The Impact of Agglomeration Externalities on Manufacturing Growth within Indonesian Locations

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To the memory of Mother and Father.

Copyright Statement

Author's Biography

Roberto earned his Bachelor and Master degree in Italy where he was awarded of various scholarships to study in Sligo (Ireland), New Paltz and New York City (USA). After his graduation in Italy and before embarking to his Ph.D. in UK, Roberto worked for several multinational enterprises based in Italy and South-East Asia, where he also cooperated with several international universities and colleges teaching numerous business modules for four years. Currently, Roberto lead his Ph.D. at the University of Huddersfield Business School, where he also had the honour and the pleasure to be the tutor for the International Business module, and supervising undergraduate and postgraduate students' dissertations for three years.

The present work has produced several conference papers and presentations within referred and ordinary sessions across Europe (including UK) as well as at the Pacific Regional Science Conference Organisation (PRSCO, biannual) in Bandung, Indonesia. Applying the current conceptual and empirical framework to Indonesia, Vietnam and Italy in order to unfold the impact of agglomeration externalities on their manufacturing expansion. During my Ph.D, I had the pleasure to be the chairman of two conference sessions, I received the possibility to attend the summer school in Poland sponsored by the European Regional Science Association (ERSA), and a conference bursary by the Regional Study Association (RSA). In addition, the present work has generated a forthcoming academic article in the Growth and Change Journal.

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Abstract

Differences in agglomeration externalities and industrial regimes between locations generate performance differentials for their localized economic activities. For more than two decades, scholars have debated which externality is dominant for growth and under which regime. The present study aims to resolve this debate by analysing the influence of agglomeration economies on the growth of five-digit manufacturing sectors and firms in Indonesia between 2000 and 2009 discriminating cities and regencies. Specialization, competition, population density, human capital, and a set of varieties are employed. This is conducted shedding the light on policy implications of economic variety sectoral decomposition functional to revitalize Indonesian manufacturing growth after the Asian Financial Crisis, which substantially hits the Indonesian economy and manufacturing. Empirical evidence reveals that Indonesian policymakers should develop initiatives to support the competitiveness of key labour-intensive industries and manufacturing transformation towards knowledge-based productions. This can be achieved through promoting key specialised clusters characterized by large sectoral interconnectivity favouring inter and intra-industry knowledge spillovers, which allow underpinning the competitiveness of clusters and overcoming the two typical drawbacks of highly specialized locations (lock-in and lack of resilience). The formation of human capital, and the development of technologically advanced industries come to light as crucial drivers to construct a more conductive innovative environment and reduce manufacturing exposure to external industry-specific shocks. Population density and industrial diversity antithetically influence manufacturing growth in cities and regencies due to their economic heterogeneities.

Key words: Agglomeration externalities, related and unrelated varieties, Indonesian economy and policy evolutions.

Jel classification: D62, O18, O25, R11

Contents

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List of Figures

List of Tables

List of Abbreviations

AFC = Asian Financial Crisis.
BPS = Badan Pusat Statistik (Indonesian Statistic Office).
Cluster GSP = Gresik-Surabaya-Pasuruan area.
Cluster JB = Jakarta-Bandung-Bekasi-Bogor area.
EEG = Evolutionary Economic Geography.
GBC = Global Financial Crisis.
H-MH = High and Medium-high Technology Intensity Industries.
ISIC= International Standard Industrial Classification of All Economic Activities.
KBLI= Klasifikasi Baku Lapangan Usaha Indonesia (Indonesian Industrial Classification).
LISA = Local Indicator of Spatial Association.
ML-L = Medium-low and Low Technology Intensity Industries.
MP3EI = The Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025.
NEG = New Economic Geography.
NOR = New Order Regime.

1 Introduction

Indonesia is one of the largest and stable economies in Asia characterized by abundant natural resources such as mineral fuels, lubricants, animal and vegetable oils, fats, and waxes. It is the first South-East Asia country to become a member of the G-20 major economies since 1999, when the forum was established (see, for instance, Hermawan, Sriyuliani, Hardjowijono, & Tanaga, 2011). Indonesia is also a co-founder member of the Association of Southeast Asian Nations (ASEAN)[1] established in 1967 for political and economic cooperation among Southeast Asian countries. Indonesia recently witnessed deep transformations in terms of industrial scale and structure, urban concentration and socio-economic conditions. These mutations were mainly dictated by the Asian Financial Crisis (AFC, 1997-1998) that hits Indonesia economy and manufacturing activities at much higher pace than other developing economies in the region highlighting the country's weaknesses to external shocks. Indonesia struggled to recover since the economic level pre-crisis is not yet reached. Despite this, it became one of the most dynamic economies in the region.

During the period beginning in 2000 and ending in 2009, Indonesian GDP grew annually between 4% and 6%, GDP per capita increased between 2% and 5%, and the population expanded between 1% and 2% (World Bank, 2015). People living within urban centres accounted for 42% in 2000 and 49% in 2009 of the total population (almost a quarter of a billion), and more than one half lived in urban areas in 2011 (World Bank, 2015). These favourable economic conditions encouraged Indonesian industries to re-focus on their domestic markets. The exportation of goods and services, as a percentage of GDP, markedly decreased from 41% in 2000 to 24% in 2009. Manufacturing exports, as a percentage of merchandise exported, decreased from 57% in 2000 to 41% in 2009 (World Bank, 2015). Exports of high technology industries declined from 16% in 2000 to 13% in 2009 of total manufacturing exports (World Bank, 2015). Despite these contractions, manufacturing experienced significant growth in terms of value added and labour productivity though employment grew at much lower rates between 2000 and 2009. This can be due to manufacturing

1. ASEAN mainly aims to enhance socio-economic growth and cooperation, regional stability and peace, mutual assistance, educational and research system, and a more effectively utilization of agriculture and industries resources and trades in the region. The country's members are: Indonesia, Malaysia, Philippines, Singapore, Thailand (co-founders), and Brunei, Cambodia, Laos PDR, Myanmar, and Vietnam.

transformations (e.g. the adoption of new technologies) in order to cope macro-economic mutations and the increasing intensity of domestic and international competitions. However after the AFC, manufacturing began to growth at lower pace than the overall economy showing a decline trajectory and a potential threat of deindustrialization emerged. The substantial importance of few labour-intensity industries within manufacturing structure exposed it to external shocks, as a result, a reduction of their competitiveness undermined the overall manufacturing growth in Indonesia.

Manufacturing plays an important role for the economic growth in Indonesia due to its high productivity and propensity to cluster generating agglomeration externalities. The localization of manufacturing has not spread all over Indonesia, but it clustered in certain locations such as the cities of Jakarta (with particular reference to its Northern and Eastern areas), Tangerang, Bandung and Surabaya, and the regencies of Tangerang, Bogor, Bekasi, and Bandung, among others. Although Java Island is characterized by the highest concentration of manufacturing within the country, Indonesia witnessed a diversification of manufacturing growth between 2000 and 2009, where less dense locations grew faster than others. These differences in economic structure and growth between Indonesian locations generated performance differentials for their localized economic activities. Numerous industries show higher performance within regencies, whereas others are more productive within cities[2], which are characterized by diverse economic configuration. Thus, some questions emerge: Why certain economic activities have higher growth in certain places and under a certain industrial regime? What are the determinants of such growth? A large body of literature has been made in order to explain these questions; theoretical and empirical literature point out that firms and workers have higher productivity within large and dense economic environments (see, for instance, Melo, Graham, & Noland, 2009; Puga, 2010; Rosenthal & Strange, 2004). This can be associated with the proximity effect of economic activities, from which rises agglomeration externalities.

However, there is a little agreement among researchers of which externalities, specialized (Glaeser, Kallal, Scheinkman, & Shleifer, 1992; Marshall, 1890), or diversified (Bairoch, 1988; Jacobs, 1969) play a predominant role for innovation and growth. The impact of agglomeration externalities can also differ across sectors and space due to their heterogeneity (see, for instance, De Groot, Poot, & Smit, 2009; Rosenthal & Strange, 2004; Van Oort, 2007). Besides this, scholars debate under which market structure innovation is optimized (see, for instance, Beaudry & Schiffauerova, 2009; De Groot et al., 2009). A more recent vein of

2. The Indonesian administrative area is divided into provinces, subdivided into regencies and cities, which are further decomposed into districts and then villages. Regencies and cities are at the same administrative level and they have their own local government, legislative body, and a wide autonomy on economic policies following the Indonesian decentralization process initiated by the Law N. 22 and 25/1999, which came into force in 2001, and subsequently amended (for a discussion, see, for instance, Firman, 2009).

literature refers to the Darwinian selection of firms as competition pushes weaker economic activities out of the market where the most efficient and innovative firms survive enhancing their performance and the relative aggregations (i.e. sectors and locations) (Combes, Duranton, Gobillon, Puga, & Roux, 2012; Duranton & Puga, 2003; Melitz, 2003). This debate has been alimented over time since scholars have found evidence to support diverse conceptualizations (see, for instance, De Groot et al., 2009; De Groot, Poot, & Smit, 2015). A potential cause of this inconclusive debate stems from the misspecification of economic variety (Boschma, Minondo, & Navarro, 2012).

This study aims to resolve this long-term academic debate testing the influence of urbanization, specialization, competition, and a set of varieties employing the economic variety sectoral decomposition as proposed by Frenken, van Oort, and Verburg (2007). This latter allows decaying general variety without any sectoral linkages into unrelated and related varieties in order to evaluate more accurately their idiosyncratic effects on growth associated with portfolio diversification (Conroy, 1974, 1975) and inter-industry knowledge spillovers (Jacobs, 1969) respectively. The Indonesian industrial classification (KBLI 2005) and the technology intensity classification (OECD, 2011) are employed to determine the cognitive proximity among sectors. These agglomeration externalities are assessed on the expansion of large and medium five-digit manufacturing sectors and firms in terms of employment, value added and labour productivity analysing separately cities and regencies between 2000 and 2009. The present study becomes particular relevant considering the current policymakers' challenges to revitalize manufacturing in Indonesia. It will be argue that the economic variety sectoral decomposition can provide valuable insights for policy design to bring back on track manufacturing. To the best of my knowledge, no similar studies have been conducted in Indonesia and the decomposition of economic variety has been applied to developed economies (see, for instance, Bishop & Gripaios, 2010; Boschma & Iammarino, 2009; Boschma, Minondo, & Navarro, 2011; Frenken et al., 2007; Quatraro, 2010). The rest of this chapter is organized as follows. In Section, 1.1, the academic and policy contributions of the present study are briefly presented. In Section 1.2, the flow of knowledge disaggregated by chapters is illustrated.

1.1 Academic and policy contributions

The present study aims to contribute to the existing theoretical and empirical literature in several areas, which stem from employing the economic variety sectoral decomposition, agglomeration externalities tested, the level of data employed, the country of analysis, and considering the heterogeneity between cities and regencies. They are addressed in order to provide recommendations to policymakers aiming to revitalize manufacturing in Indonesia. These contributions are schematically presented as follows.

More appropriate theoretical foundations and tailor-made industrial policies. Decomposing economic variety into (un)related variety based on sectoral linkages allows addressing the misspecification of Jacobian externalities contributing to resolve the long-term academic debate on which externality is more predominant for growth (see, for instance, Beaudry & Schiffauerova, 2009; De Groot et al., 2009; Feldman & Audretsch, 1999; Van der Panne, 2004). The idiosyncratic roles of inter-industry knowledge spillover (Jacobs, 1969) linked to related variety, and portfolio diversification (Conroy, 1974, 1975) associated with unrelated variety can be separately assessed. This allows discerning Jacobian externalities and portfolio diversification notions along with urbanization externalities, where this latter is connected to the market-size effect á la Krugman (1991a,1991c) rather than inter-industry knowledge spillover.

Identifying large and small sectoral cognitive proximity allows *tailor-made* industrial policies towards relatedness and diversification enhancing economic growth and resilience. Promoting key industries with large intersectoral linkages consents to reduce the risk associated with lock-in effect and lack of economic resilience, which are typical drawbacks of having a location highly specialized. Since new external knowledge can flow between interconnected economic activities with diverse but complementary know-how, which can also generate the formation of regional (un)related branches driving to new pathways of growth where the pre-existing local economic configuration can affect their genesis. In addition, identifying local degree of heterogeneous configuration provides valuable information for policy strategies to increase embedded relatedness and/or further diversification enhancing local resilience and more balanced growth. Policymakers often ignore this relationship between growth and stability for regional economic development.

Agglomeration externalities tested and their post-impact on growth. Following the seminal work of Glaeser et al. (1992), and subsequently numerous other works (see, for instance, De Vor & De Groot, 2010; Henderson, 1997, 2003), the influence of urbanization, specialization, competition and economic diversity (general varieties[3]) are assessed on manufacturing expansion within Indonesian locations. Decomposing economic variety using entropy formula as proposed by Frenken et al. (2007) permits to assess urbanization and MAR externalities along with general variety in order to compare the empirical results with previous studies' outcomes; and extending them through the disaggregation of general variety into unrelated and related varieties. Considering agglomeration externalities, the notion of path-dependency is implicitly embraced, which is often neglected by researchers (see, for instance, De Groot et al., 2009, for a review of thirty-one studies). Thus, the post-impact of agglomeration externalities is tested on manufacturing growth since its expansion is the result of prior efforts.

3. General variety term refers to Jacobian externalities computed in the old fashion without considering any distinction of sectoral interconnectedness.

Capturing micro variations on three manufacturing growth dimensions. The micro foundation of agglomeration externalities is considered employing the lowest sectoral digit level (five-digit) within the Indonesian industrial classification (KBLI 2005) and the single economic activity, which allow assessing micro variations and avoiding sectoral aggregation bias. This is often ignored by researchers (see, for instance, De Groot et al., 2009), which might cause a potential estimation bias where the most disaggregated level generates the most consistent economic theories. The influence of agglomeration externalities is tested on three dimensions of manufacturing growth in order to determine more precisely their idiosyncratic influence on manufacturing expansion. This is particular relevant in Indonesia considering that manufacturing value added and labour productivity grew faster than the numbers of employees during 2000 and 2009. Therefore considering the only employment dimension within the empirical analysis, manufacturing growth is not properly captured in Indonesia, which is further addressed taking into account value added and labour productivity.

The country development and discriminating cities and regencies. Most scholars (see, for instance, Bishop & Gripaios, 2010; Boschma & Iammarino, 2009; Boschma et al., 2011; Castaldi, Frenken, & Los, 2014; Frenken et al., 2007; Hartog, Boschma, & Sotarauta, 2012; Quatraro, 2010) tested the reconceptualization of economic variety within developed economies. The economic variety decomposition applied to Indonesian can provide valuable insights for researchers and policymakers due to its fast expanded economy and the current policymakers' challenges to revitalize manufacturing. Besides this, cities and regencies show heterogeneity in terms of area size, industrial composition, population density and availability of skilled workers determining the generation and magnitude differentials of agglomeration externalities, which lead to unlike performance of their localized economic activities.

Established manufacturing sectors show higher performance within regencies characterized by lower competition and cost of factors of production; whereas established firms and the overall manufacturing structure are more productive within Indonesian cities denoted by large local demand, heterogeneous industries, availability of skilled workers, and the localization of high and medium-high technology intensity industries. Discerning urban environments and wider geographical scales allows to take into account for their heterogeneity in terms of economic configuration and performance enhancing inference and policy relevance between these two diverse types of administrative units. Neglecting for their idiosyncratic differences analysing the entire country indiscriminately can lead to erroneous outcomes as shown in the work of Ercole and O'Neill (forthcoming). This has implications on previous study' findings (see, for instance, De Groot et al., 2009) that merely analyse agglomeration externalities at the country or regional-level since they need to be interpreted carefully.

Manufacturing decline and its revitalization. The aforementioned framework is employed to manufacturing expansion in the post-shock period. The two-year shock (AFC, 1997-1998) determined a series of changes in Indonesia such as the end of the Soeharto's authoritarian regime favouring new economic reforms, and the increasing of labour costs becoming one of the countries with the highest minimum wages in the world on average (OECD, 2012). Besides this, new trade agreements in the region increased international and domestic rivalry, with particular regard to countries (e.g. Vietnam and Cambodia) characterized by lower cost of productions in comparison of Indonesia. These mutations caused a substantial decline of manufacturing competitiveness with particular reference to labour-intensity industries, and manufacturing struggled to "bounce back". This led to manufacturing transformation towards more competitive and innovative activities, especially favouring knowledge-based productions.

Policymakers' challenges emerged aiming to support manufacturing competitiveness and its transformation where innovation and human capital come to light as key drivers to lead to a second period of industrialization in the country. It will be argued that the identification of economic relatedness and heterogeneous configuration within locations can provide valuable insights for Indonesian policymakers. Since this allows developing *ad-hoc* policies strategies in order to prioritise specialized clusters characterized by large sectoral interconnectedness and to enhance manufacturing diversification increasing economic growth and stability. These new insights can be embedded within recent Indonesian policies, which began to support key clusters focusing on critical issues for manufacturing growth such as innovation, human capital and spatial inequalities adopting location and cluster approaches, which recognize local heterogeneity and the important role-played by agglomeration externalities for local growth. In this framework conditions, the present study becomes particular relevant in Indonesia since its economy progressively moves towards a knowledge-based economy where the learning process is playing an increasing role for employment and productivity growth (Menkhoff, Evers, Wah, & Fong, 2011).

1.2 Chapters' outlines

This section is dedicated to review the main argumentations of the present work in order to provide an overview disaggregated by chapters and their interconnectivity. In Chapter 2, the main characteristics and shortcoming of the New Economic Geography are investigated in the light of its legacy of neoclassical approaches and critics moved by the Evolutionary Economic Geography. In particular, the underestimation of technological externalities and the omitted inter-industry knowledge spillovers are especially underlined. This becomes particularly relevant considering the increasing of knowledge-based economies around the world (Hanusch & Pyka, 2007; Hudson, 2001, 2005; OECD, 1996), as well as in Indonesia (Menkhoff et al., 2011), where innovation emerges as a major competitive driver for firms' profitability and survive. Following this in Chapter 3, the economic roles play by technological externalities are especially investigated focusing on the theoretical and empirical contributions of economic variety sectoral decomposition. This is conducted analysing first the limitations of highly specialized locations, and then the novelty of (un)related variety conceptualization useful to reduce industry-specific effects. It will be argued that discovering and promoting local relatedness can reduce the risk of lock-in and economic instability. In addition, determining local industrial heterogeneous degree also allows policymakers to develop initiatives towards embedded relatedness and/or further diversification. In Chapter 4, selected discrete-space indices are proposed to measure agglomeration externalities such as specialization, competition, and general variety, where this latter is decomposed into unrelated and related varieties using entropy formula as proposed by Frenken et al. (2007). These indicators will be employed in the empirical analysis in order to unfold their influence on sectoral and firms' manufacturing expansion within cities and regencies. In addition, discrete-space indicators will be also combined with selected continuous-space indices such as the global Moran's I, the Moran scatterplots and the LISA statistics in order to identify spatial patterns more accurately of large and medium manufacturing within and across Indonesian locations.

In Chapter 5, Indonesian economy and manufacturing evolutions are explored investigating the diverse policies during different country's phases. In particular, two main points are highlighted in order to address the present study. First, the Asian Financial Crisis had a substantial negative impact on Indonesian economy and manufacturing highlighting the country's weaknesses to external shocks. Second, the slow pace of economic recovery associated with the decline of manufacturing encouraged policymakers to develop more sophisticated initiatives based on location and cluster approaches focusing on critical issues for manufacturing growth such as innovation, human capital and spatial inequalities. Although, Indonesian Government is greatly engaged to pursue economic and manufacturing growth, it emerges that more efforts are required in order to enhance innovative environment, qualified job creation, and the localization of technologically advanced industries. Currently, few labour-intensive industries represent the large majority of manufacturing configuration in the country restraining knowledge spillovers, human capital formation, and economic resilience. The lack of manufacturing diversification emerged as a structural issue and a reduction of labour-intensive industries competitiveness undermined the overall manufacturing growth favouring industrial composition change towards higher degree of technology intensity industries. In Chapter 6, the rise and fall of large and medium manufacturing sectors are investigated between 2000 and 2009. Low technology intensity industries substantially decreased their importance, and higher technology intensity sectors increased their manufacturing contributions. Supporting this transformation towards more knowledge-based productions is highly recommended in Indonesia, which increases industrial diversification, balanced growth, productivity, innovation, and the formation of human capital. However currently, manufacturing growth in Indonesia cannot be achieved without revitalizing labour-intensive industries due to their predominant localization. Thus, it is also advisable to develop public policies underpinning the competitiveness of tradition sectors. In addition, agents' localization differences on average between cities and regencies are investigated, which generate performance differentials of their localized economic activities via their diverse magnitude of agglomeration externalities. This highlights the necessity to empirically discriminate these two diverse types of administrative units in order to avoid spurious inference analysing indiscriminately the entire country.

In Chapter 7, the influence of agglomeration externalities is investigated on average annual employment, value added and labour productivity growth of established sectors and firms between 2000 and 2009. Population density and human capital show antithetic effects between cities and regencies, which can be due to their diverse urbanization tendencies and industrial compositions. Specialized clusters are negatively associated with sectoral and firms' growth with particular regard to regencies, which are highly specialized. As a result, established manufacturing activities benefit from an increase of heterogeneous industrial configuration within regencies, which reduces industry-specific negative effects. The preponderant role of manufacturing relatedness in general, and in particular of high and medium-high technology intensity related industries emerged indiscriminately by locations. In Chapter 8, the influence of agglomeration externalities is further investigated on the overall manufacturing structure for five-digit sectors and firms during 2000 and 2009. This is extended disaggregating it by technology intensity degrees and two-digit sectors. Specialization emerged as a preponderant source for the overall manufacturing development. Related variety computed based on the Indonesian industrial classification is beneficial for sectoral industrial structure growth with particular regard to cities. A divergent impact of high and medium-high, and medium-low and low technology intensity related industries emerged. Disaggregating manufacturing structure based on technology intensity industries and two-digit sectors, it is observed that economic activities take advantage due to an increase of their technological relatedness. Unrelated variety shows an opposite effect between cities and regencies due to their diverse level of economic density. In this context, human capital comes to light as a predominant driver for manufacturing revitalization regardless to the type of locations and sectors.

In Chapter 9, spatial inequality is investigated highlighting the persistent present of two agglomeration bells around large economic centres in Java. The notion of specialisation and relatedness is combined through the identification of key embedded specialised clusters. Since specialisation and relatedness can be seen as complementary sources to enhance localisation externalities as argued by Jacobs (1969), and the competitive advantages of clusters as supported by Porter (1990), which can reduce the risk of lock-in and local resilience. Thus, policymakers should combine the notion of specialisation and relatedness in a unified policy framework to design more effective public initiatives. The industrial configuration of Eastern Jakarta is used as a case study to unfold the role of key embedded specialised clusters on growth useful to design effective policy for its future industrial development. It is also argued that the current industrial changes towards knowledge-based productions within large economic centres can lead to manufacturing transformation and revitalisation in the country. Since the substantial development of high and medium-high technology intensity industries in Eastern Jakarta (among other dense places) can affect the industrial development across locations, with particular reference to the two agglomeration bells in Java generating spatial snowball effects. Finally in Chapter 10, empirical outcomes are reconciled in the light of their policy implications aiming to revitalise manufacturing in Indonesia. It emerged that Indonesian policymakers should address the following initiatives. 1) Supporting key embedded specialized clusters favouring inter and intra-industry knowledge spillovers. 2) Encouraging population growth and industrial diversity within regencies reducing the negative impact of industry-specific effects; and discouraging them within cities decreasing the risk of over congestion. 3) Underpinning the development of human capital, and the genesis and growth of technologically advanced industries, which can increase manufacturing resilience, further formation of skilled workers, and innovation capabilities, which can be also beneficial for their unrelated activities. 4) Enhancing domestic and international competitiveness of Indonesian manufacturing through favouring sectoral rivalry, which lead to selection of firms making their aggregation more efficient and productive. 5) Developing regional policies in Java Island exploiting spatial industrial development across locations, especially promoting growth of high and medium-high technology intensity industries, which can lead to manufacturing transformation and development across locations.

In Figure 1.1, the structure and key concepts of the present study disaggregated by chapters are illustrated.

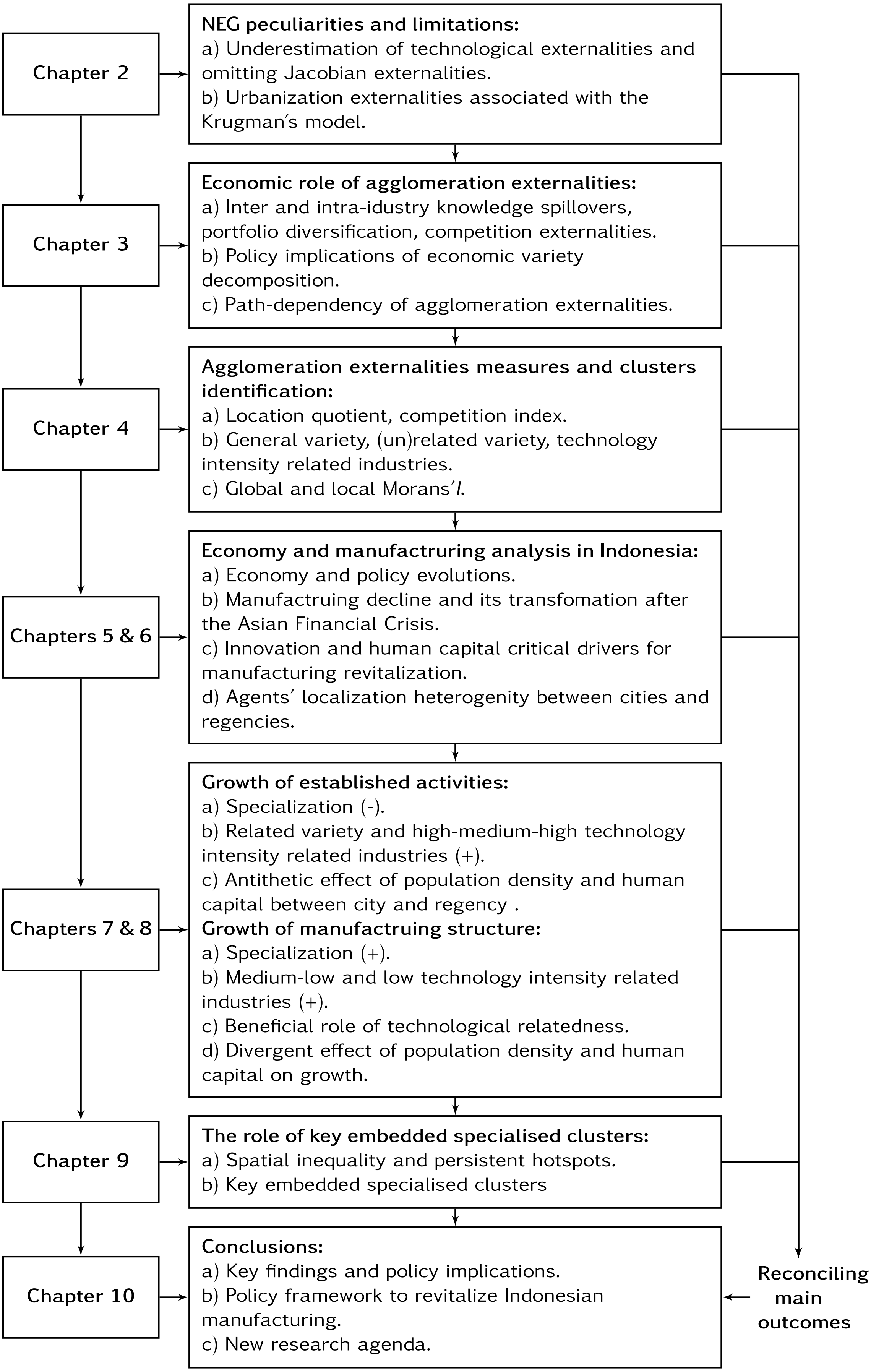

Figure 1.1: Structure and key contents of the present study.

Notes: The signs between brackets reported for Chapter 7 and Chapter 8 denote the observed influence of the relative agglomeration sources on the explained variable.

2 New Economic Geography's peculiarities and limitations

2.1 Introduction

For several centuries, there has been a tendency towards urban concentration across the world due to migratory flows from rural to urban areas. Urbanization consistently grew between 1950 and 2011, and it will continue to do so in all regions (United Nations, 2012). For the first time in history more people around the world live in urban centres than in rural areas. In 2011 from Table 1 in the report of United Nations (2012), 3.63 of 6.97 billion people lived in urban areas (slightly above 52%) and by 2050 they project 6.25 of 9.31 billion (slightly above 67%), so population will grow by around 34% and urbanization by 72%. Different nations have experienced urbanization process at different times; developed countries had a faster urbanization before 1950, and developing nations after this date (United Nations, 2012). In 2011 inhabitants living in urban centres in developed regions accounted for around 80% of the population, whereas, Asia and Africa are expected to reach the point where half of their population lives in urban areas by 2020 and 2035 respectively (United Nations, 2012). This tendency of concentration of inhabitants within urban centres can be associated with the maximization of their socio-economic utilities.

Empirical evidence (see, for instance, UN-HABITAT, 2010) demonstrates that there is a significant correlation between urbanization and economic development since GDP per capita, firm and workers concentration tend to increase simultaneously in more urbanized countries, regions and cities. China is a recent example of these linkages, where increased urbanization has fostered socio-economic conditions contributing to poverty reduction as well as improved welfare and an improved standard of living (UN-HABITAT, 2012). The concentration of agents in urban areas may create integrated urban regions forming clusters of cities, for instance, around one or more hub such as Metro Manila, Jakarta, Delhi, or Karachi (Laquian, 2005); or alternatively in the absence of a major hub city, where large and medium-sized cities form an integrated urban region such as in Guangzhou, Shenzhen, Hong Kong and Macau within the People's Republic of China (Yeh, Yok-shiu, Tunney, & Nien, 2002).

Urbanization and industrialization are unavoidable consequences of the development process of nations, regions, and cities, though different locations make the urban transition at different stages of their country's development, and with various urban and economic growth patterns (Wheaton & Shishido, 1981; Williamson, 1965). It is, however, possible to find countries where high levels of urbanization fail to generate urban economic development, such as in African nations, including: Madagascar, Niger, Senegal and Zambia, among others (Kessides, 2006). In these cases where urbanization and development have not gone hand in hand, dense urban concentration has generated high unemployment rates, congestion, poverty, low welfare, and poor infrastructures, among other negative consequences (see, for instance, Boadi, Kuitunen, Raheem, & Hanninen, 2005; Fay & Opal, 2000). In particular, local authorities have failed to address suitable policies to support urban concentration and industrial growth creating unsustainable urban development (Boadi et al., 2005).

Given the tendency of agents to concentrate within certain locations and the importance of space, academic attention to economic geography has been increasing over time. Numerous scholars (see, for instance, Christaller, 1933; Isard & Vietorisz, 1959; Krugman, 1991a; Nelson & Winter, 1982; Von Thünen, 1826; Weber, 1909) have investigated reasons for economic agglomeration, what kind of economic activities are concentrated and where they are located. The current predominant framework within the theoretical and empirical economic geography literatures refer to New Economic Geography (NEG) initiated by Krugman (1991a, 1991c), though recently numerous aspects of the approach has been criticised (see, for instance, Boschma & Frenken, 2006; Garretsen & Martin, 2010; Martin & Sunley, 1996). It has been mainly criticised for its legacy of neoclassical approaches and the way to treat technological externalities as a secondary dynamic, where the only Marshallian externality has been considered omitting the important driver of knowledge spillovers across sectors. In order to overcome this limitations, a new conceptualization emerged denominated Evolutionary Economic Geography (EEG), which can be tracked on the seminal contribution by Nelson and Winter (1982). Afterwards, numerous evolutionary studies of economic geography has been elaborated (see, for instance, Boschma & Lambooy, 1999; Boschma & Wenting, 2007; Brenner, 2004; Essletzbichler & Rigby, 2005; Klepper, 2002; Rigby & Essletzbichler, 1997; Swann & Prevezer, 1996), though EEG framework is still under development (Martin, 2003). However, there is no doubt that NEG greatly influenced the agglomeration theories and brought new insights to the study of economic geography. In particular, Krugman (1991a, 1991c) had the merit to combine transportation costs, increasing firms return to scale, and imperfect competition within the full general equilibrium where supply and demand are endogenized (Garretsen & Martin, 2010).

In the study of economic agglomeration, it is essential to determine under which conditions an agglomeration site formed, why certain places grow faster than others, and what factors determine the dispersion of economic activities. This can be explained by the uneven distribution of the "first nature" and "second nature" as argued by Cronon (1991). The former refers to natural endowments such as climate, topography, raw materials, and communication ways, among other factors; and the latter represents the outcomes generated by human behaviours. NEG and EEG substantially differ on the determinants of agglomeration generation and growth. NEG considers pecuniary externalities as the main agglomeration drivers and technological externalities as a secondary dynamic. EEG assumes that technological externalities are the preponderant sources of economic concentration where pecuniary externalities arise as a secondary dynamic due to an increase in competition. Although NEG and EEG consider the initial space as neutral[4], they do not dismiss the importance of first nature advantages to explain economic agglomerations, since often clusters are created around natural endowments (e.g. access to the sea, natural resources) to reduce firms' transportation costs and exploit pre-existing sources.

Natural endowments are distributed unevenly among places generating irregular spatial distribution explaining why certain industries cluster in specific places (Cronon, 1991; Ottaviano & Thisse, 2004). Examples of the influence of natural endowments are the localization of wine producers in California, France, Italy and Australia, and the steel industry near the Great Lakes region in the USA with easy access to iron ore and coal. Ellison and Glaeser (1999) argue that the presence of natural competitive advantages within a location can explain half of geographical colocalization. The mobility of workers and growth of the city can be connected to first nature advantages as argued by Black and Henderson (2003), where natural communications (e.g. ocean) and produced communications (e.g. railroad) play a paramount role on it facilitating the flow of trade with other locations as stated by Beeson, DeJong, and Troesken (2001). Roos (2005), and Rosenthal and Strange (2001, 2004) find evidence that first nature and agglomeration economies are both determinant sources for economic clustering. Since economic agglomeration asymmetry is not determined solely by a sites' first nature characteristics as many clusters are less natural resource dependent such as Chicago, which became the central city of the America heartland without any natural competitive advantage (Cronon, 1991; Krugman, 1993). Thus, the second nature needs to be taken into account in order to explain the formation and development of economic agglomerations, which modifies the first nature by a multitude of individual actions. Based on Starrett's work (1978) on the spatial impossibility theorem[5], Fujita (1986) observes that in order to take into account spatial agglomeration formation and growth as an endogenous phenomenon three characteristics are fundamental: externalities from non-market interactions made by agents (technological externalities) where the distance among firms

4. NEG and EEG assume the neutral space condition since they argue that economic agglomeration and consequently regional development can also occur without any natural endowment differences. However, they differ in the final assumptions, where NEG assumes that the interaction of agglomeration forces restores the symmetric initial condition, and EEG embraces the Schumpeterian notion of temporary convergence and divergence of the system and between places, which is considered recursive.

5. Starrett (1978) refers to spatial impossibility theorem as the incompatible combined notions of agents' concentration with competitive equilibrium, which is supported by neoclassical economists. Since, interaction among agents generates some kinds of market imperfection making the space inhomogeneous, and agents' localization decisions are based on geographical differences.

plays a prominent role; imperfect market competition, which is an essential condition for the increasing of firms returns to scale (pecuniary externalities); and the heterogeneity of space (natural endowments), which contributes to explain the formation of the central business district (CBD) in a given location.

This chapter explores the main NEG's characteristics considering the comments made by critics in order to shed light on its limitations[6]. Particular emphasis will be placed on the underestimation of technological externalities and the omission of a crucial driver of inter-industry knowledge spillover. In Section 2.2, the main NEG's features are investigated discussing them based on the recent critics moved by the EEG scholars. In Section 2.3, the determinants of agglomeration formation and development under the NEG framework are discussed. The conclusions are provided in Section 2.4.

2.2 The main characteristics and critics of the New Economic Geography

Von Thünen (1826) introduced the theory of agricultural location, designing a framework to optimize land-use for the maximization of farmers' net profits and consequently his land rents. This was the first early attempt for the theory of location anticipating other future studies of spatial economics (Samuelson, 1983). He investigated agglomeration and dispersion forces, which force individuals and economics activities to move in or out certain places. The pioneering work of Von Thünen (1826) anticipated the Marshallian forces (1890) adopted by Krugman (1991a, 1991c) such as the market-size effect and thick labour market. Von Thünen investigated pecuniary externalities as drivers of agglomerations thought he did not considered pure external (dis)economies. Pecuniary externalities are external to firms' production activities and generated by product market interactions mediated by the price mechanism (Scitovsky, 1954). They are associated with increasing return at the firm level under imperfect competition where a decision by an agent affects the market price and consequently other agents' decisions (Fujita, Krugman, & Venables, 1999; Scitovsky, 1954). However, neoclassical economists assume pure competition, thus, a constant return to scale is implicitly considered.

Pecuniary externalities are the central forces of the NEG approach in order to explain under neutral space conditions the causes of economic formation and development of nations, regions and cities. The first NEG's conceptualization was presented in Krugman (1991a, 1991c), which considered the question of how agglomerations are formed and under what conditions they are (un)stable. Krugman pointed out that concentration of firms can take place through the

6. This chapter has been constructed in a similar conceptual fashion of several scholars' works combined (see, for instance, Boschma & Frenken, 2006; Garretsen & Martin, 2010; Martin & Sunley, 1996), which criticize the NEG approach. Part of the present theoretical framework is included in Ercole (2012).

constant interplay of increasing returns to scale at the firm level, transportation costs and factor mobility (Krugman, 1991a, 1991c). The NEG's formulation and orientation subsequently have been extended by important works of several authors such as Fujita (1988), Krugman (1995), Krugman and Venables (1995) and Venables (1996). NEG greatly influenced agglomeration theories and brought new insights to the study of economic geography although several of NEG's ingredients are borrowed from the early location and agglomeration theories, which have been unified and reinterpreted in the NEG framework. NEG introduces little that is new in comparison with the past theories though NEG overcomes their limitations (Fujita, 2000, 2011) such as endogenous growth rather than exogenous growth, imperfect market competition rather than perfect market competition, full equilibrium rather than partial equilibrium, and non-monecentric models rather than moncentric models.

Several aspects of NEG framework have been criticised by EEG scholars (see, for instance, Boschma & Frenken, 2006; Garretsen & Martin, 2010; Martin & Sunley, 1996) as follows. 1) The full general equilibrium and the multiple equilibrium do not reflect the dynamic nature of the real economy; 2) the utility maximization and "representative agents" do not consider the context where the decision is made and the diversity of agents; 3) monopolistic and oligopolistic market structures reflect few real market situations; and 4) technological externalities are considered as secondary dynamic and omitting Jacobian externalities (Jacobs, 1969). In the rest of this section the main ingredients of the New Economic Geography are critically investigated in the light of neoclassical theories and these recent critics moved by the Evolutionary Economic Geography, which are schematically synthesized in Figure 2.1.

Imperfect market competition and increasing firms returns to scale. NEG, as explained in Krugman (1991a, 1991c), assumes that firms choose a location within large imperfectly competitive markets in order to increase their returns to scale and minimize their transportation costs. The imperfect market competition is the necessary condition in order to preserve the assumption of increasing firms' returns to scale. NEG mainly adopts monopolistic and oligopolistic competition (Fujita & Thisse, Fujita & Krugman, 2004; 2002); in contrast with neoclassical approaches, which embrace the perfect market competition and as a consequence constant returns to scale is assumed. However, pure competition is an idealised market, and monopolistic and oligopolistic markets reflect only few real competition structures. By contrast, EEG considers monopolistic competition based on the Schumpeterian notion of "creative destruction", which reflects more realistic markets in terms of dynamics and structures. EEG assumes that firms' innovation capabilities are the main cause of increasing returns to scale due to the development of new products and processes, which lead to temporary monopolies (Grossman & Helpman, 1991). However neoclassical theory, NEG and EEG agree that tough competition fosters convergence among economic activities and locations since fierce rivalry erodes firms' profitability.

Utility maximization by agents and representative agents. Another concept borrowed from neoclassical theories by NEG is that agents seek and choose a given location to maximize their utilities and profits assuming the homogeneity of agents ("representative agents"). Numerous scholars (see, for instance, Amin & Thrift, 2000; Boschma & Frenken, 2006; Garretsen & Martin, 2010; Hanusch & Pyka, 2007; Martin & Sunley, 1996) criticise this approach since it does not deal with space. The assumption of "representative agents" does not take into account the spatial heterogeneity of locations and the geographical diversity of agents' competencies and capabilities. Indeed, agents' decisions should be considered bounded in their rationality rather than just maximization of utility a-context, since agents' decision processes are highly affected by the context where local institutions play an important role on it, as supported by the EEG (see, for instance, Boschma & Frenken, 2006).

"Iceberg" transportation costs. NEG mainly adopts the "iceberg" transportation costs, which was originally introduced by Samuelson (1954). Transportation costs are computed as a constant percentage of the Free-On Board (FOB) price between two locations, and any increase in the price of transported products implies a proportional increase in the shipment costs (Krugman, 1998). In other words, they are calculated as a constant fraction of the value of shipped goods, which increases proportionally with the distance covered. In the early theory, the transportation costs is a critical factor and their computation can undermine the constant elasticity of demand, which is preserved using "iceberg" transportation costs (Krugman, 1998). However, several researchers (see, for instance, Ottaviano, Tabuchi, & Thisse, 2002) have criticized the "iceberg" transportation costs, in particular, they argued that it is inapplicable in many real situations. Thus, alternative ways to calculate shipment costs have been developed within the NEG framework (see, for instance, Ottaviano et al., 2002).

The full general equilibrium through endogenous growth and multiple equilibria. The full general equilibrium model adopted by NEG assumes that all market processes and firms' returns are generated endogenously fostering external economies of agglomeration (Krugman, 1991a, 1991c). This was an important contribution by the New Economic Geography in comparison with earlier theories, which partially considered the equilibrium of the system (Krugman, 1998). Since they did not include all economic factors endogenously such as geographical distribution of population, demand and supply. NEG assumes a neutral initial stage where the persistent interaction of agglomeration forces generates a core-periphery configuration. Afterwards, the full general equilibrium and multiple equilibria emerge within and between places restoring the symmetric initial condition due to invisible-hand dynamic processes of agents' localization decisions, which are oriented towards utility and profit maximization.

EEG criticizes the general equilibrium mechanism as a static equilibrium, which does not reflect the dynamic nature of the real economy (Boschma &

Frenken, 2006) since the system is likely to be in a temporary equilibrium and disequilibrium. EEG assumes that the system is out-of-equilibrium embracing the Schumpeterian notion of market competition. Temporary convergence and divergence are generated due to endogenous firms' innovation behaviours causing the dynamic distribution of economic activities in space and time (Boschma & Martin, 2010). Firms, through innovation, can have disproportional profitability generating uneven distribution of economic activities, whereas the erosion of profits due to increasing of price competition is considered as a second dynamic, which leads to a short-run economic convergence causing smart selection of organizational routines (Boschma & Frenken, 2006). This process of temporary economic balance and imbalance due to firms' innovation behaviours is considered recursive.

The non-monocentric urban models. NEG adopts the non-monocentric urban models (see, for instance, Fujita & Ogawa, 1982; H Ogawa & Fujita, 1980; H. Ogawa & Fujita, 1989) overcoming the limitations of the monocentric urban models (see, for instance, Alonso, 1964; Mills, 1967, 1972; Muth, 1969) employed by the early agglomeration theories. Alonso (1964) introduced for the first time the monocentric urban model reinterpreting the Thünen's framework (Fujita, 2000, 2011), and afterwards it has been extended by several authors (Fujita, 1989; Mills, 1967, 1972; Muth, 1969). The monocentric urban model assumes the existence of a unique market in the city, which is considered the central business district (CBD), and all workers live in the surrounding areas supposing to commute to the CBD. This has been criticized for the assumption that the CBD is formed and grown exogenously.

All economic forces need to be considered endogenous in order to explain the genesis and patterns of CBD (Fujita, 2011; Mori, 2006) and to achieve the multiple equilibria between CBDs. In order to overcome this shortcoming, several economists have elaborated non-monocentric urban models, which are built based on a polycentric approach where the formation of the entire local spatial structure of the economy is endogenously determined assuming the market imperfection. The non-monocentric urban model was introduced for the first time by Fujita and Ogawa (1982) and subsequently it has been extended by several scholars (see, for instance, H Ogawa & Fujita, 1980; H. Ogawa & Fujita, 1989). They demonstrate that market interactions alone under imperfect competition can explain the spatial agglomeration of economic activities between CDBs. These conceptualizations along with the notion of non-monocentric urban models have been embraced by NEG as critical elements of its framework.

Economic (de)agglomeration forces. Pecuniary externalities are considered the main determinants of spatial convergence and divergence of economic activities where technological externalities arise as a consequence of market interactions. Krugman (1991a) justifies the limited importance attributed to knowledge spillovers in NEG since they are difficult to measure given their intangible nature. EEG scholars (Boschma & Frenken, 2006; Garretsen & Martin, 2010; Martin & Sunley, 1996) strongly criticise the assumption of secondary dynamic of technological externalities and taking into account the only Marshallian externalities omitting the important driver of knowledge spillovers across sectors. Krugman (1991a, 1991c) identifies several centripetal forces, which favour concentration of agents; and centrifugal forces, which discourage such proximity. Centripetal forces are the typical Marshallian's sources (Marshall, 1890): market size effects through linkages, thick labour markets and pure external economies. Centrifugal forces are: immobile factors of production (e.g. lands, natural resources, and people in international context), land rents due to high demand and pure external diseconomies (e.g. congestion).

Krugman and Venables (1995) and Venables (1996) argue that vertical linkages between upstream and downstream industries under imperfect competition can have the same agglomeration role as the migratory inflow of workers á la Krugman (1991a, 1991c). If industries are vertically connected within input-output configuration, downstream markets determine the market size for intermediate products, shaping the size of upstream industries. Many downstream firms generate a large market for intermediate goods (backward linkages) favouring suppliers' localization. A large upstream market allows downstream industries to have lower transportation and inputs costs (forward linkages) leading to further delocalization of firms. Within a dense proximity of industries, firms would pay higher salaries due to competition for labour and this leads to further workers immigration due to wage differentials between locations. If the increase of firms' returns to scale within a large market supports higher wages, firms are still encouraged to drive their business within the location; otherwise, dispersion of economic activities is favoured towards other sites with lower salaries and higher firms' return to scale[7].

Circular cumulative causation model. In order to connect and describe the persistent interaction of pro-concentration and anti-concentration forces in a path-dependence way, NEG embraces the circular cumulative causation model. It was introduced for the first time in Myrdal (1957), while Hirschman (1958) included the backward and forward linkages within the model. Afterwards, the circular cumulative causation model has been adapted and applied to a variety of academic fields. It is a multi-causal approach and the idea underling it is that the persistent and accumulative variations of forces produce several changes in the environment. NEG assumes that economic localization is favoured if concentration sources are stronger than dispersion forces within a location; otherwise deconcentration sources force footloose firms and dwellers towards other places considered more economically attractive. The persistent interplay of pro-concentration and anti-concentration forces can generate a threshold-effect

7. Agglomeration forces linked through the path-dependence mechanism as assumed by NEG are synthesise in Figure 2.2.

of economic agglomeration when a critical level is overcame generating spatial economic balance or imbalance (see, for instance, Durlauf & Johnson, 1995).

The capital accumulation in a given location fosters external economies and historical accidents self-enforcing agents' expectations, though this latter may arise in the absence of past accidents (Krugman, 1991b). The cause and effect relationship between past and future events may create convergence of agents' expectations, which lead to economic agglomeration or dispersion. Self-fulfilling and overlapping expectations occur when agents move in or out of a particular place based on their positive or negative expectations that a specific event will take place (Baldwin, Forslid, Martin, Ottaviano, & Robertnicoud, 2003) such as the level of rents and market expansion. The strength of agglomeration economies and convergence of agents' expectations might also lead to location hysteresis, which is related to a shock in the region and this might cause a catastrophic agglomeration (Baldwin et al., 2003). Temporary shocks might lead to permanent changes in the agglomeration landscape, which might be not reversible. This could be conducted to the effect of the Asian Financial Crisis (1997-1998) in Indonesia, which hardly hits its economy leading to the decline of manufacturing agglomeration causing its composition transformation. The changes in economic and competitive paradigms due to a two-year shock generated selection of manufacturing activities. Since the less competitive and innovative firms and sectors are pushed out from the market or substantially reduced their economic contributions, whereas the more competitive and technologically advanced ones survived and evolved (see Chapter 5 and Chapter 6). The mutation of agglomeration landscape encouraged Indonesian policymakers to underpin the new manufacturing growth pathway where human capital and knowledge spillovers emerge as pillar factors in leading manufacturing revitalization and its transformation in the country (see Chapter 7 and Chapter 8).

2.3 Agglomeration formation and development under NEG

Urbanization economies were introduced by Hoover (1937) discerning them from localization externalities. The former is internal to the city and external to the industry fostering the output of all firms within a location, which increase the dimensions of the overall economy. The latter is internal to a given industry and external to the firms increasing the outputs of localized economic activities with the same industry. As argued by numerous scholars (see, for instance, Frenken, van Oort, & Verburg, 2007; Harrison, Kelley, & Gant, 1997; Henderson, 1986; Van Oort, Burger, Knoben, & Raspe, 2012), urbanization externalities are more associated with the local demand effect á la Krugman (1991a, 1991c). However, Henderson (1986) argues that local demand does not explain fully why firms from different industries want to locate in close proximity to each other underpinning the preponderant role of knowledge spillovers within the same sector.

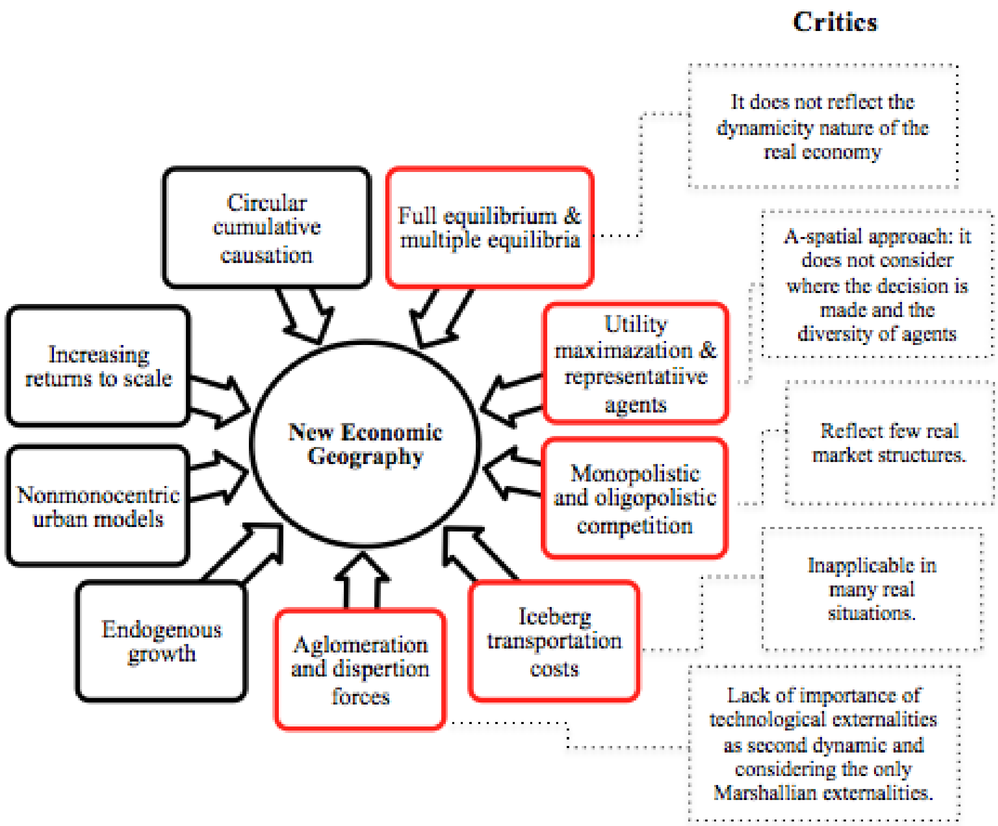

Figure 2.1: The main NEG's peculiarities and critics.

Krugman's framework (1991a, 1991c) begins with the migration inflows of workers due to wage differentials between locations, albeit workers are less mobile in the international context due to the difficulty for companies to recruit them. The inflows of labour enlarge local demand increasing firms return to scale (backward linkages, demand side). The market size effect through linkages generates a "snowball" mechanism increasing labour market pool, and the concentration of downstream firms, which increase the demand size of intermediate products and services. As a result, upstream industries are encouraged to move into the location fostering input-output vertical linkages with positive implications on firms' returns to scale, and intra-industry knowledge spillovers emerge as a secondary dynamic. The proximity of agents decreases input and transportation costs, and market prices (forward linkages, cost side). This increases productivity and profitability with positive repercussion to nominal wages. The rise in workers' salaries and lower product prices increase real wages supporting firms' productions of diversified goods in order to satisfy large heterogeneity customers' needs. Product differentiation fosters further economic agglomeration as enterprises can avoid price competition (Fujita & Thisse, 2002), and workers are encouraged to be in the place with availability of jobs, high salaries, reduced market prices and large product varieties. As aforementioned, input-output configuration can have the same agglomeration role as the migratory inflow of workers (Krugman & Venables, 1995; Venables, 1996), which also arises knowledge spillovers, albeit NEG considers only the Marshallian externalities

(Marshall, 1890) neglecting the role of Jacobian externalities (Jacobs, 1969).

Fugal sources make locations less competitive in attracting agents (e.g. high levels of rents and local congestion) generating a negative path-dependence mechanism. When a location becomes densely concentrated, factor market competition and product market competition arise the negative forward linkages (Fujita & Thisse, 2002; Krugman, 1991a, 1991c; Puga & Venables, 1998). Firms are encouraged to be in a location until when the benefits related to the increasing firms' returns to scale overcome the drawbacks related to the raise of nominal wages and the overall production costs. Agglomeration and dispersion forces are connected through the circular cumulative causation, which highlights the possibility of forecasting a given event raising agents' expectations convergence. They can play as well as a role in self-enforce economic agglomeration or dispersion fulfilling or overlapping a particular location based on agents' prediction (Baldwin et al., 2003). The interaction between agglomeration forces and agents' expectations might also generate location hysteresis, which might lead to catastrophic agglomeration (Baldwin et al., 2003). Figure 2.2 synthesizes the path-dependence mechanism of these agglomeration forces.

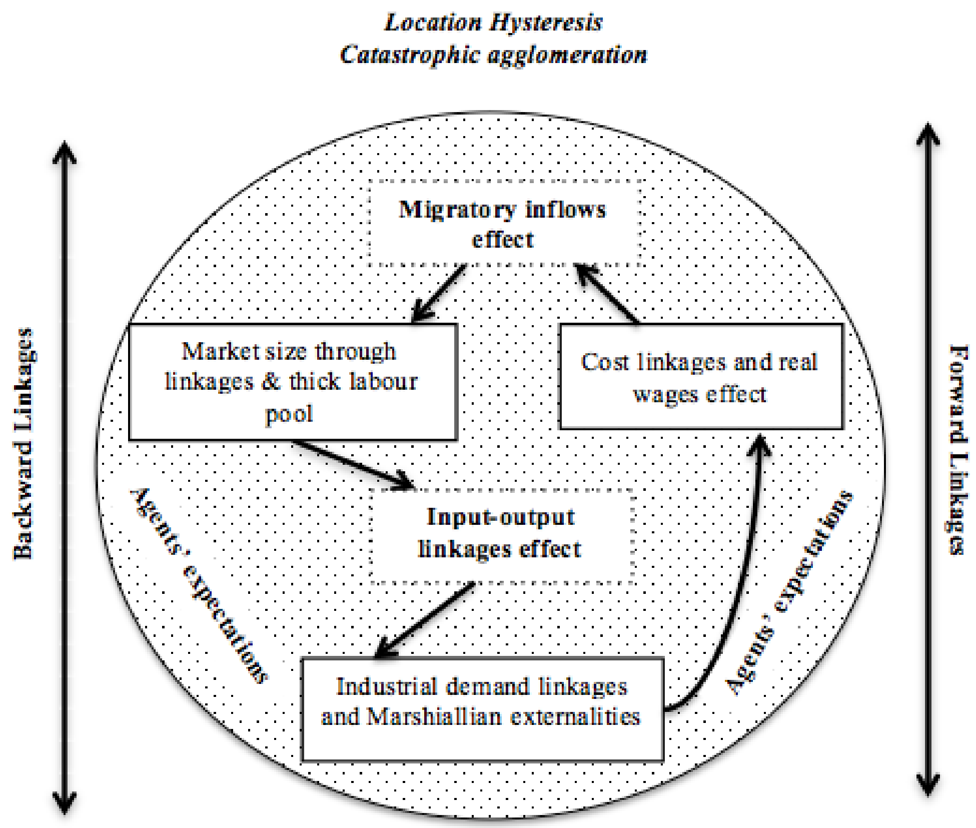

Figure 2.2: The main NEG's agglomeration forces linked through the circular cumulative causation.

NEG assumes a core-periphery configuration in the first stage due to the persistent interaction of agglomeration forces, and then a mechanism of self-organization is generated restoring full general equilibrium within the system and multiple equilibria among locations. An evident example of the core-periphery configuration can be found in Italy, where the historical internal mobility from Southern to Centre-northern regions has generated a large socio-economic asymmetry within the country (Piras, 2012). The migratory flows have fostered the growth of the Centre-northern area, what has become known as the "Third Italy", generating a core-periphery configuration in a dualistic relationship "North-South". Although this phenomenon began on the end of the War World II, significant socio-economic differences are still in place between these two macro Italian regions. Therefore, the mechanism of self-organization as theorized by Krugman (1991a, 1991c) did not occur in Italy. This conceptualization is under academic debate since it does not reflect the dynamic nature of the real economy (Boschma & Frenken, 2006; Boschma & Martin, 2010).

2.4 Conclusions

In this chapter, the main ingredients and limitations of the New Economic Geography have been investigated in the light of its legacy of neoclassical approaches and critics moved by Evolutionary Economic Geography. It is no in doubt that NEG greatly influenced the agglomeration theories and brought new insights within the economic geography; though important limitations have been highlighted, therefore, a question emerges: Do we need to rethink or overcome NEG framework? This question is currently under academic debate; this chapter suggested that NEG framework should be reconsidered in order to explain consistently and coherently the varieties of agglomerations genesis and development. In particular considering the increasing importance of knowledge-based economies around the world (Hanusch & Pyka, 2007; Hudson, 2001, 2005; OECD, 1996), where innovation emerges as a major competitive driver for firms' profitability. In this context, EEG can represent a potential alternative, evolutionary studies are taking ground among researchers though its theoretical framework stills under development.

This chapter highlighted an important drawback of NEG framework referring to the underestimation of technological externalities, which are considered as a secondary dynamic and omitting knowledge spillovers across sectors. The following chapter embraces the conceptualization that technological externalities are the pillar determinants for economic growth in the light of the recent contribution of economic varieties decomposition proposed by Frenken et al. (2007), which provides new theoretical and policy insights for researchers and policymakers.

3 The role of agglomeration externalities on economic growth

3.1 Introduction

In the previous chapter, the limitations of the New Economic Geography have been highlighted. In particular, it has been argued that Krugman (1991a, 1991c), in his seminal works, attributed little importance to technological externalities and without taking into account inter-industry knowledge transmission missing an important building block within the puzzle of regional and urban development. This assumes important connotations considering the recent increase of knowledge-based economies around the world (Hanusch & Pyka, 2007; Hudson, 2001, 2005; OECD, 1996), which arises the necessity to take into account innovation as a crucial driver for economic growth of nations, regions, sectors, and firms . The present study embraces this notion where knowledge spillovers stand behind the generation of innovation, which allows firms to have disproportional profitability, as argued by EEG scholars.

Although, there is a general agreement among researchers that knowledge generation and spill over play an important role in regional innovation and growth (Karlsson & Manduchi, 2001), for more than two decades, scholars debate on the following matters. If the creation and diffusion of knowledge between actors is a function of distance (Bathelt, Malmberg, & Maskell, 2004; Rallet & Torre, 1999), which technological externality is more important for location growth and under which market structure innovation is optimized (see, for instance, Beaudry & Schiffauerova, 2009; De Groot, Poot, & Smit, 2009; Feldman & Audretsch, 1999; Van der Panne, 2004). Which type of industries are more responsive to which externality (see, for instance, Boschma & Frenken, 2009; Neffke, Henning, Boschma, Lundquist, & Olander, 2011). Several authors (De Groot et al., 2009; Puga, 2010; Rosenthal & Strange, 2004; Van Oort, 2007) also argue that the effects of agglomeration economies differ across sectors, space and time. This debate increased over time since researchers have found evidence to support different theoretical conceptualizations (see, for instance, De Groot et al., 2009; De Groot, Poot, & Smit, 2015). A potential source of this inconclusive debate may stem from the diverse types of sectors and level of analysis, different stage of industry life cycle examined (Bishop & Gripaios, 2010; Neffke, Henning, Boschma, et al., 2011; Paci & Usai, 1999; Van Oort, 2004), methodologies employed and the misspecification of economic variety (Boschma, Minondo, & Navarro, 2012). With regard to this latter, economic variety decomposition based on sectoral linkages addresses the misspecification of Jacobian externalities, which can contribute to resolve the aforementioned long-term academic debate.

Agglomeration economies can be categorized into four main forces explaining knowledge spillovers and economic agglomerations formation and evolution in different ways as follows. 1) Firms are encouraged to operate in proximity within the same industry due to intra-industry knowledge spillovers (Glaeser, Kallal, Scheinkman, & Shleifer, 1992). 2) Firms take advantage of locating their activities close to complementary industries exploiting inter-industry knowledge spillovers (Jacobs, 1969). 3) Economic localization occurs regardless of the nature of established industries since benefits arise from a dense and heterogeneous environment within a location, in terms of population, R&D centres and business services among other "pull" forces, which foster the outputs of all firms localized in the area (Hoover, 1937)[8]. 4) Knowledge transmission and economic growth is influenced by the degree of competition (Glaeser et al., 1992; Jacobs, 1969; Porter, 1990), which can be also associated with the notion of Darwinian selection and adaptation of ecologic system (Combes, Duranton, Gobillon, Puga, & Roux, 2012; Duranton & Puga, 2003; Melitz, 2003; Melitz & Ottaviano, 2008). Agglomeration externalities can be generated through industrial configuration of inter and intra-industry establishments and/or large market size generating a mechanism of economic path-dependency.

There is no doubt that economic proximity arises agents' benefits, which can be associated with sharing facilities and infrastructures, availability of a large and skilled labour pool, large and heterogeneous suppliers, gaining from external economies, better matching between agents, and learning through knowledge exchange due to interactions between agents (Duranton & Puga, 2003). However, agents' concentration increases agglomeration costs such as pollution and congestion, among others. The trade-off between agglomeration benefits and costs makes a location more or less competitive in attracting economic activities and dwellers. A large body of theoretical and empirical literature has been made in order to investigate why firms and workers prefer to be within highly concentrated places albeit this increases their costs (see, for instance, Melo, Graham, & Noland, 2009; Puga, 2010; Rosenthal & Strange, 2004). Empirical evidence shows that firms and workers have higher performance within a large and dense economic environment and this can be associated with the proximity effect of economic activities, from which arises agglomeration externalities (see, for instance, Duranton & Puga, 2003; Melo et al., 2009; Puga, 2010; Rosenthal & Strange, 2004).

This chapter is devoted to establish a conceptual relationship between the types of agglomeration externalities and their economic roles in the light of recent

8. Often, urbanization externalities are improperly associated with Jacobian externalities due to the misspecification of inter-industry knowledge spillovers. The present study clearly distinguishes them, where the former is conducted to the Krugman's conceptualization referring to Chapter 2, and the latter is linked to the notion of related variety since knowledge is likely to be transmitted between connected activities rather then disconnected ones.

contribution by Frenken et al. (2007), which distinguishes variety based on sectoral linkages into related and unrelated varieties. Four main contributions are identified stemming from this decomposition as follows. First, the idiosyncratic role played by inter-industry knowledge spillover (Jacobs, 1969) and portfolio diversification (Conroy, 1974, 1975) effects can be separately evaluated addressing the misspecification of Jacobian externalities. Second, (un)linked variety and urbanization externalities can be conducted to more appropriate theoretical foundations; where Jacobian externalities are associated with the role played by related variety, urbanization externalities are linked to the market-size effect through linkages á la Krugman (1991a, 1991c), and unrelated variety is connected to the portfolio diversification. Third, discovering economic relatedness allows policymakers to develop *ad hoc* initiatives to promote key industries with large intersectoral linkages, which permits to reduce the risk of lock-in effect and lack of resilience (typical drawbacks of having a location highly specialized). Fourth, the identification of local economic embeddedness and heterogeneous configuration degrees allows more accurate policy strategies to examine and pursue economic growth and diversification.

The rest of this chapter is organized as follows. In Section 3.2, the economic role of technological externalities are explored in the light of decomposition of economic varieties based on linked sectors distinguishing related and unrelated varieties. This brings new important implications for policy design, which are also investigated. In Section 3.3, the effect of competition externalities on knowledge spillovers is explored, which can be also associated with smart selection and adaptation of ecologic system. In Section 3.4, the dynamic mechanism of economic development is proposed highlighting the inter-relation of agglomeration externalities, which shape agents' proximity configuration within locations. Finally, conclusions are provided in Section 3.5.

3.2 Technological externalities

Technological externalities are associated with nonmarket interactions where the activity of a single firm directly affects the production function of other economic agents (Scitovsky, 1954). The first conceptualization of technological externalities goes back to Marshall (1890), who argues that knowledge is a production input diffused freely in the atmosphere due to the dynamic interactions between economic agents within specialized clusters, and it does not require market mechanisms to make it available to users. Afterwards, this conceptualization has been extended by numerous authors (see, for instance, Glaeser et al., 1992; Jacobs, 1969). Neoclassical economists assume that knowledge is a public good, and thus, it is not profitable; though the taxonomy of knowledge is complex by nature, often local and tacit, which is not available to all agents and it does not occur automatically ("in the air") (Breschi & Lissoni, 2003; Capello, 1999). However, knowledge can be explicit (documented and codified, such as patent documents, scientific and technical literatures), which can be transferred easily to others. Thus, some aspects of public good can be also found since more than one firm can use an idea at the same time (non-rivalry) and it is difficult to exclude specific firms to exploit it (non-excludability).

Knowledge creation and spill over stand behind innovation, which is not only generated at the firm level but often at the meso level through sectoral linkages. Know-how transmission can occur in many different ways such as imitations, spin-off, social networks, labour mobility, and collaborative networks (Boschma & Frenken, 2006). An essential condition of knowledge flow is the dissimilarity of agents' know-how otherwise lock-in effect can be generated where the distance still plays an important role on it. Since ideas are easier to be transfer among firms in proximity rather than far way (Jaffe et al., 1993), though this can occur between economic activities detached from the regional context due to recent technological progress (Breschi & Lissoni, 2001). Schumpeter (1912, 1942) is one of the first scholar to stress the importance of innovation for economic growth. The Schumpeterian growth model incorporates the technological process as an endogenous introduction of product and/or process innovations by economic agents in order to maximize their utilities and profits. This is the result of the persistent and dynamic interactions between economic activities enhancing their competences and capabilities to innovate through knowledge exchange. This generates a temporary firms' disproportional profitability self-enforcing location attractiveness of new entrants increasing the diversification of knowledge.

This section aims to investigate this crucial role of technological externalities for economic growth in the light of the contribution of economic varieties decomposition, which provides new insights for researchers and policymakers. This is addressed as follows. In Section 3.2.1, Marshall-Arrow-Romer (MAR) model (Glaeser et al., 1992) is explored highlighting the limitations of highly specialized locations. In Section 3.2.2, the contribution of economic varieties decomposition is examined investigating separetely Jacobian externalities (Jacobs, 1969) and portfolio diversification (Conroy, 1974, 1975) effects, and new relevant insights for *tailor-made* policies are also discussed.

3.2.1 Knowledge exchange within specialized clusters and its shortcomings

Marshall (1890) examined pecuniary and technological externalities in order to explain the formation and development of economic agglomerations, and he theorized the concept of external economies in the production process within specialized clusters. Marshall (1890) argued that agglomeration externalities encourage firms to produce in proximity to other enterprises within the same industry. Since a specialized economic cluster allows enhancing network of relationships, firms' innovation capabilities, labour pool and specialized workers, and reducing agents' transaction and coordination costs. Afterwards, Glaeser et al. (1992) formalized and extended the Marshallian externalities combining the works of Arrow (1962) and Romer (1986), into what has become known as the Marshall-Arrow-Romer (MAR) model. The MAR model assumes that knowledge spillovers are predominantly industry-specific as intra-industry linkages foster innovation and growth within locations. There are numerous empirical examples of industrial specialization, for instance, the software industry in California's Silicon Valley in the United States and Bangalore in India, automotive manufacturing in Detroit in the United States, biotechnology industry in Cambridge in the United Kingdom, and the ceramic tile and textile manufacturing in Sassuolo and Prato respectively in Italy.

Although it is expected higher economic performance within specialized places and this has been supported by numerous empirical evidence (see, for instance, De Groot et al., 2009, 2015), two important drawbacks are associated with highly specialized locations: lock-in effect and lack of economic resilience. Lock-in effect can be generated in the long run due to the reduction of know-how complementarity within the same industry. Knowledge transfer over time increases the cognitive proximity between firms reducing their diverse expertise causing a less effective learning process (Boschma, 2005; Nooteboom, 2000). However, the presence of strong knowledge bases and tight external linkages within an industrial cluster allow to overcome the risks associated with lock-in effect, since new external knowledge can spill over within a specialized cluster (Giuliani & Bell, 2005; Graf, 2011), what is called knowledge gatekeepers.

With regard to economic resilience, a location characterised by a high level of specialization is less protected to external industry-specific demand and supply shocks, and technological paradigm shifting due to a lack of portfolio diversification. As argued by Porter (1990), institutional organizations need to create the environmental conditions necessary to sustain the genesis and development of diversified agglomerations, since the future success of a cluster is unpredictable. Even, Marshall (1890) did not dismiss the benefits for a location from having some degrees of industrial diversification in order to increase its economic resilience. It will be argued that the identification of relatedness allows reducing these risks associated with highly specialized locations by promoting key clusters characterized by large sectoral interconnectedness.

3.2.2 The contributions and challenges of economic variety decomposition

Jacobian externalities are commonly measured as general variety without differentiating sectoral linkages though it incorporates two idiosyncratic economic effects: inter-industry knowledge spillovers (Jacobs, 1969) and portfolio diversification (Conroy, 1974, 1975). Recently, Frenken et al. (2007) suggest disaggregating general variety into related and unrelated varieties based on sectoral interconnectedness in order to measure more accurately their idiosyncratic economic roles. This decomposition stems from the conceptualization that related variety is more associated with the role of Jacobian externalities and unrelated variety is more linked to portfolio diversification effect. In the rest of this section, these two effects are separately investigated highlighting their implications for policy design.

3.2.2.1 Knowledge transmission across sectors

In contrast with the MAR model, Jacobs (1969) argued that the creation and diffusion of knowledge are more relevant between complementary industries rather than within the same industry, since innovation generated by an industry can be applied to other related industries. This also drives localization economies. Knowledge is expected to spill over between related industries with some degree of cognitive proximity rather than unrelated industries with large degrees of cognitive distance (Boschma & Iammarino, 2009; Frenken et al., 2007; Nooteboom, 2000). However when the cognitive proximity is too high among agents (specialization) can generate lock-in effect as the relevance of the learning process becomes less effective due to the similarity of agents' expertise (Boschma, 2005; Nooteboom, 2000). Porter (1990, 2003) is one of the first scholar to recognize the importance of related industries to enhance the competitive advantage of clusters.

Following the recent work of Frenken et al. (2007) in the Netherlands, several empirical studies have been conducted investigating the role played by related and unrelated varieties on innovation, employment and productivity growth in developed economies. Bishop and Gripaios (2010) in Great Britain, Boschma and Iammarino (2009) and Quatraro (2010) in Italy, Boschma et al. (2012) in Spain, Quatraro (2011) in France, Hartog, Boschma, and Sotarauta (2012) in Finland, and Castaldi, Frenken, and Los (2014) in US. These scholars found evidence that related variety fosters regional expansion albeit their approaches widely vary in terms of, for instance, geographical scales, measures of relatedness, periods covered, control variables employed and the country of analysis. In addition, several authors (Boschma, Minondo, & Navarro, 2013; Hidalgo, Klinger, Barabasi, & Hausmann, 2007; Neffke, Henning, & Boschma, 2011) have demonstrated that related variety generates incremental and radical innovations via spin-off, recombination and accumulation of complementary competences, and assets increasing diversification through the creation of regional (un)related branching.

The learning process between interconnected industries is more intense than unrelated activities, which is expected to generate the emergence of new industries and technologies. Knowledge transmission between linked sectors enhances their innovation capabilities favouring the establishments of new relatedness. This can also generate changes, which can be adopted by unrelated industries creating regional unlinked branches guiding to new directions of growth and new market opportunities enhancing local expansion and diversification. However, the genesis of new activities is likely to be related to the pre-existing local industrial structure rather than disconnected to the established configuration. Since linkages between economic activities are facilitated and knowledge transmission is favoured, which increase sectors and firms' survival within a regional embedded space. For instance, Klepper and Simons (2000) use a case-study in the television receiver industry in US demonstrating the creation of new regional related branching. Neffke, Henning, and Boschma (2011) find evidence in Swedish regions that a new industry is likely to establish its activities in a region where other industries are technologically related, and an existing industry is likely to exit in absence of technologically relatedness within a region. Boschma and Wenting (2007), and Klepper (2007) demonstrate that related branching process also increases firms' survival chances. These studies highlight the positive role of regional related industries on growth and diversification. A well-known example is the case of the Emilia-Romagna region in Italy where the regional engineering knowledge-based favoured the proliferation and expansion of related industries for the production of irradiation, electromedical and electrotherapeutic equipment and luxury car in Modena, manufacture of agricultural and forestry machinery in Reggio nell'Emilia and Modena, and ceramic tile in Sassuolo, among other cognitive proximity clusters (see, for instance, Ercole, 2013).

In addition, the persistent presence of related industries in a location generates regional knowledge-based related-skills, which can contribute to reduce the impact of economic shocks and downturns through absorbing the negative industry-specific fluctuations of demand and/or regenerating the industrial structure into new pathways of growth. For instance, Pittsburgh witnessed a rapid economic recovery due to its strong steelmaking skills supported by related businesses (i.e. steelmaking equipment, engineering services, high-tech devices, and basic refractory brick) (Treado, 2010); and Boston experienced an economic restructuring over the long period of time due to its complementary expertise (Glaeser, 2005). This phenomenon of diversification through economic relatedness recently emerged within the theoretical and empirical literature as a new address of study for local growth and stability. Figure 3.1 schematically illustrates the diversification role of related varieties through knowledge recombination and accumulation between interconnected clusters, which generate new (un)linked branches affecting location resilience and growth.

3.2.2.2 Portfolio diversification effect

The decomposition of economic varieties based on sectoral linkages allows identifying the degree of heterogeneous configuration within a location, which is associated with the portfolio diversification effect. Economic diversity increases location stability protecting from external industry-specific demand and supply shocks, and technological paradigm shifting (Essletzbichler, 2007; Frenken et al., 2007). This also reduces regional economic volatility since a heterogeneous configuration can have a more balanced growth where given

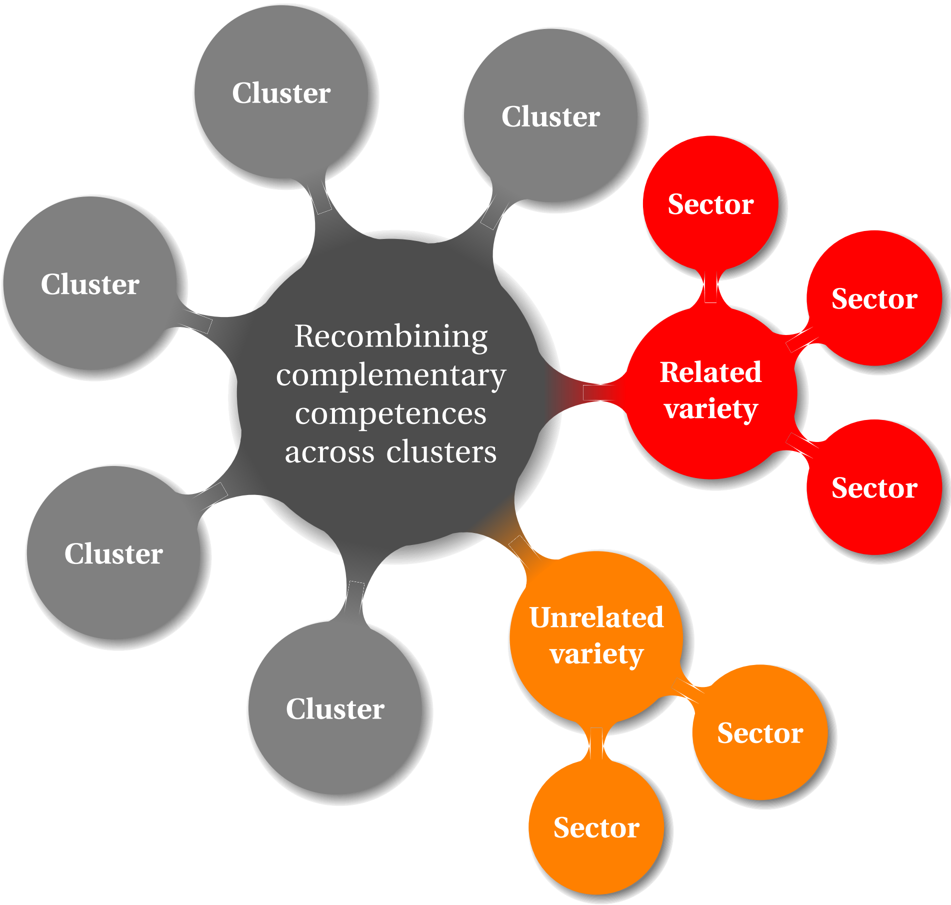

Figure 3.1: The diversification process of complementary competences accumulation and recombination into new and related pathways of growth.

sectors perform better than others. The portfolio diversification effect was originally conceptualized and adopted as a strategy to reduce the risk of financial assets through diversification (see, for instance, Markowitz, 1959). Afterwards, Conroy (1974, 1975) suggests a portfolio-theoretic approach to regional economic diversity and diversification in order to reduce the risk of regional instability associated with high degree of specialization in a location. An example is Detroit, which is the most populous city in the state of Michigan and highly specialized in automotive industry. Although this facilitated the city's growth due to localization economies, Detroit recently experienced an economic downturn due to a significant reduction of global automotive demand, which generated socio-economic instability with unemployment rate of 20% (E. Hill et al., 2012). This was due to the negative industry-specific effect, which could not be absorbed by other industries due to low degree of portfolio diversification within the city.

The relationship between regional stability and performance has been investigated for quite long time by numerous authors (see, for instance, Malizia & Ke, 1993; McLaughlin, 1930; Tress, 1938; Wagner & Deller, 1998), and they find evidence that a location with more economic diversity experienced in more economic stability. The process of economic diversification within a location can be seen as a dynamic mechanism of production, consumption and trade pattern changes (Schuh & Barghouti, 1988) where the degree of heterogeneous configuration can be associated with the scale and diversity of local demand. However, economic diversity does not mean absence of specialization but the presence of multiple specializations within a location (Malizia & Ke, 1993) where their establishment is not purely random but a certain degree of coherence can exist between related established sectors (Neffke, Henning, & Boschma, 2011). As aforementioned, existing industrial configuration within a location is likely to be related to the past composition generating the future local structure (Neffke, Henning, & Boschma, 2011) where regional interconnected activities increase the probability to survive of new industries and firms (Boschma & Wenting, 2007; Klepper, 2007). Nevertheless, knowledge flow is not precluded for unrelated variety as demonstrated by Castaldi et al. (2014). These scholars investigate the influence of (semi-)related and unrelated varieties on patents in US and they find evidence that the combination of unrelated knowledge can produces radical innovations generating technological "breakthroughs". This study add a novelty in comparison of the original work of Frenken et al. (2007), which neglects the flow of knowledge between unrelated economic activities, which is rare but it can not be excluded.

3.2.2.3 Policy implications of economic variety sectoral decomposition

There is no doubt that knowledge transmission within a cluster foster firms' innovation capability and growth, which has been supported by numerous empirical evidence (see, for instance, De Groot et al., 2009, 2015). However, two important constraints of growth emerge within highly specialized locations: lock-in effect and lack of economic resilience. Reconceptualising economic variety based on sectoral linkages can overcome these two drawbacks by discovering and promoting key specialized clusters characterized by large inter-sectoral linkages. New external knowledge can flow between interconnected economic activities with diverse but complementary know-how reducing the risk of similarity of their expertise. The promotion of related variety can also increase location diversification through the formation of regional (un)related branches generating new local growth pathways (Boschma et al., 2013; Hidalgo et al., 2007; Neffke, Henning, & Boschma, 2011).

Policymakers should select and promote a cluster not only based on the value that it can create by itself, but it should be assessed in a broader local prospective based on its contribution to other linked sectors stimulating local growth and diversification. This reduces the risk of a cluster's failure since related and supportive businesses are crucial elements for the competitiveness of a specialised agglomeration as argued by Porter (1990). However, policymakers should avoid investing in industries that are not actually (or potentially) embedded within their regional context (linked with other sectors); and they should stay away from supporting stagnant and decline clusters (even if they are regional embedded) that show non-temporary competitive weaknesses and/or an enduring reduction of their demand due to their technological paradigms and customers' preferences changes. The assessment of a cluster's potentiality represents a policymakers' challenge since its future success is unpredictable, and the complexity of forecasting is augmented due to the regional embeddedness considerations. This discovery process requires a heedful evaluation of the impact of a cluster on regional structure growth and a careful monitoring during the policies implementation in order to assess their impact on cluster's evolution and its local contribution.

Policymakers recognize the importance of promoting key related sectors in order to enhance local growth, though the definition and identification of cognitive proximity linkages between sectors, and how the promotion of industries with certain large inter-linkages impacts locations, sectors and firms' growth represent further policymakers' challenges in order to develop *ad-hoc* regional policies. As argued by Siegel, Johnson, and Alwang (1995), the identification of sectoral interconnectedness should be based in terms of explicit economic relationships as type of sector and sectoral interaction based on, for instance, production process and inputs, technology used, and sharing the same infrastructures, among others. Examples of public policies in promoting key industrial clusters can be found in the State of Texas through the Industrial Cluster Initiative, which aims to increase the strength of log-term competitiveness of primarily technology-based industries (Office of the Governor of Texas, 2004). The findings of the Culliton Report are supported in Ireland, which recommend the promotion and the development of clusters and their related industries in order to increase the national competitive advantage in the view of Porter (Doyle & Connell, 2007). From 2004, Indonesian policies (i.e. The National Long Term Development Plan 2005–2025, and the Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025) began to prioritize key industries based on cluster and regional approaches recognizing the importance of local specificity of agents' localization and agglomeration externalities as contributors to growth (see Chapter 5).

Based on these recent Indonesian policies, it will be argued that decomposing economic varieties based on sectoral linkages can provide valuable insights for policy design in order to revitalize manufacturing activities in Indonesia. This becomes particular relevant considering that its economy progressively moves towards a knowledge-based economy (Menkhoff, Evers, Wah, & Fong, 2011), especially, manufacturing activities witnessed a significant growth of high and medium-high technology intensity industries between 2000 and 2009 (see Chapter 5 and Chapter 6). In this context, learning process plays an increasing role for productivity and employment growth in Indonesia. The identification of relatedness with Indonesian locations allows policymakers to develop *ad hoc* strategies enhancing knowledge spillover and diversification underpinning manufacturing and location growth. Scholars have commonly focus their attention on the impact of relatedness on regional economic development, and policymakers largely ignore the relationship between growth and stability

(Baldwin & Brown, 2004). It will be also argued that the determination of local degree of heterogeneous configuration provides as well useful information to design *tailor-made* policy strategies to increase embedded relatedness and/or further diversification.

3.3 Competition externalities

The MAR model (Glaeser et al., 1992) and Jacobs (Jacobs, 1969) also differ for the effect of local rivalry on knowledge spillovers and growth. The MAR model supports the Schumpeterian idea that local monopolies better facilitate innovations, since the flow of ideas is restricted to others maximizing firm's innovation capability; whereas tough competitions reduce firms' returns on innovation due to the high risks of idea leakages to others discouraging their budget allocation on R&D. This is in contrast with the view of Jacobs (1969) and Porter (1990), which assumes that local competitions rather than monopolies encourage firms to innovate and speeds up technology adoption in order to cope rivalry. Combes (2000) argues that high competition incentives firms to increase their R&D spending in order to survive, albeit firms are discouraged to further outlays in R&D if the pace of innovation occurs too fast making the returns on R&D investments too low (Schumpeter, 1912, 1942).

In addition, a more recent vein of literature associate to the level of competition refers to the Darwinian selection and adaptation of ecologic system. A dense economic proximity with the same sector increases competition for labour, land, and capital leading to smart selection and adaptation of firms making the aggregation more efficient and productive. The economic landscape dynamically and continuously transforms and adapts itself where fierce rivalry pushes weaker firms out from the market where the most efficient and innovative economic activities survive enhancing their single performance and the relative aggregations (i.e. sectors and locations) (Combes et al., 2012; Duranton & Puga, 2003; Melitz, 2003; Melitz & Ottaviano, 2008). Competition can also lead to smart adaptation where economic activities switch their productions to sectors considered more profitable.

3.4 Path-dependency mechanism of agglomeration externalities

The persistent interplay of agglomeration forces triggers a path-dependency mechanism, which generates the level of industrialization and urbanization, and the degree of competition and congestion within locations as illustrated in Figure 3.2. Urbanization externalities are associated with the Krugman's model (see Chapter 2), which favours the concentration of heterogeneous industries due to the increasing firms returns to scale and the diverse customer' needs within a large local market. Economic diversity raises location resilience due to the portfolio diversification effect where its configuration is likely to be linked to the past structure generating the establishment of multiple specializations and their supportive relatedness, which underpins the competitive advantage and growth of localized clusters.

However, the industrial scale effect can have the same impact as the market size (Krugman & Venables, 1995; Sveikauskas, Gowdy, & Funk, 1988; Venables, 1996), and this has important implications for industrial patterns configuration within and across places, where firms' localization decisions stem from industrial size rather than demand size. Intra-industry knowledge spillovers are traditionally associated with the flow of know-how among localized firms within the same sector, which favours the establishment of complementary activities. Specialized and interconnected sectors within a location enhance technological externalities increasing firms' innovation capabilities generating disproportional profitability. This encourages further economic localization and mobility of workers enlarging intermediate and final local demand characterized by diverse customers' needs, which contribute to the establishment of heterogeneous industries that are likely to be embedded with a certain local economic shell. However, the persistent and dynamic interaction of these forces often occurs simultaneously where a net line of demarcation among them cannot be clearly identified.

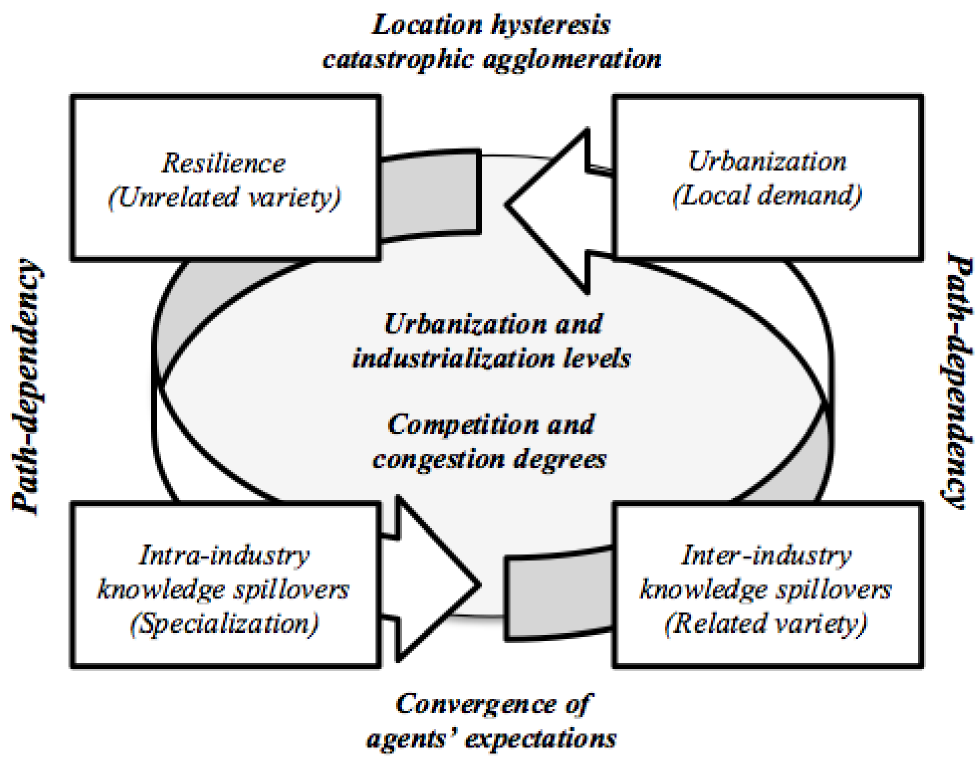

Figure 3.2: The path-dependency mechanism of economic configuration.

Given the taxonomy of path-dependency mechanism, the convergence of agents' expectations is also necessary to take into account. The historical cumulative mechanism of cause and effect relationship leads to positive or negative agents' expectations that a certain event might occur self-enforcing local concentration or dispersion of economic activities and dwellers (Baldwin et al., 2003). Location hysteresis might be generated due to the accumulative interaction of agglomeration forces and convergence of agents' expectations, which might lead to shocks and catastrophic agglomerations. The scale of agents' localization determines the degree of local industrial structure and urban size impacting the level of competition. However, a dense location leads to negative agglomeration externalities and agents' expectations (e.g. raising costs of factors of production, market prices, and pollution), and the trade-off between costs and benefits of agglomeration makes a location more or less competitive to attract agents.

3.5 Conclusions

This chapter was devoted to conceptually investigate the economic role played by agglomeration externalities within locations, which are considered inter-related dependent and dynamic. In addition, the reconceptualization of economic varieties based on sectoral linkages was also examined shedding the light on its valuable insights for researchers and policymakers. Economic variety decomposition allows assessing the idiosyncratic role played by inter-industry knowledge spillover and portfolio diversification, conducting economic (un)linked variety and urbanization externalities to more appropriate theoretical foundations. Overall, the identification of local relatedness and heterogeneous configuration degrees allows *tailor-made* policies towards economic growth and diversification. In particular, promoting clusters characterized by large interconnectedness allows reducing the risks of lock-in effect and lack of resilience, which are typical drawbacks of highly specialized locations.

Two main policymakers' challenges are identified for the discovery process of key interconnected clusters. First, the difficulties to assess the potentiality of a cluster, which is increased due to the evaluation complexity of its impact on location structure. However, policymakers should avoid promoting industries that are not actually (or potentially) connected to the regional shell, and they should stay away from supporting stagnant and decline clusters (even if they are regional embedded) that show non-temporary changes in their competitive paradigms and customers' preferences. Second, a further problematic issue refers to the definition and identification of cognitive proximity linkages between sectors in order to design *ad-hoc* regional policies. The theoretical foundation presented in this chapter will be employed in the empirical analysis in order to unfold the relationship between the type of agglomeration externalities and manufacturing growth within Indonesian locations between 2000 and 2009. The next chapter is devoted to explore and describe several indicators to measure agglomeration externalities and detect spatial clustering.

4 Measuring agglomeration externalities and clustering identification

4.1 Introduction

In the previous chapter, the economic role played by agglomeration externalities were explored in the light of recent reconceptualization of economic variety decomposition based on sectoral linkages, which bring new insights for policy design. Following the conceptual analysis, this chapter is devoted to propose and examine selected indicators to measure agglomeration externalities such as location quotient as a proxy for the MAR externalities (Glaeser et al., 1992), sectoral rivalry index to assess the effect of competition externalities (Porter, 1990), and entropy formula to decompose general variety[9] without any sectoral linkages into (un)linked sectors as proposed by Frenken et al. (2007). Related variety is associated with the role of Jacobian externalities (Jacobs, 1969) and unrelated variety is conducted to the portfolio diversification effect (Conroy, 1974, 1975). The Indonesian industrial classification (KBLI 2005) and the technology intensity classification (OECD, 2011) have been employed to determine the cognitive proximity among sectors. This chapter also aims to propose a composite measure in order to detect spatial agglomeration patterns to identify spatial configuration of large and medium manufacturing concentration within and across Indonesian locations between 2000 and 2009.

Agglomeration measures can be classified into two main approaches: discrete-space and continuous-space. The former refers to indicators built based on the assumption of discrete "states" hypothesis (Krugman, 1991c) considering locations independent and equidistant. The latter is based on spatial dependency between locations where political borders and distance function are commonly employed as proximity variables. However, there is little agreement among researchers on which indicator and approach capture more appropriately spatial clustering. Most of geographic concentration indices are built based on discrete-space models (see, for instance, Brülhart & Torstensson, 1996; Ellison & Glaeser, 1997; Kim, 1995; Krugman, 1991a; Maurel & Sédillot, 1999; Midelfart-Knarvik, Overman, Redding, & Venables, 2002), which does not allow a proper identification of spatial patterns since they are based on an isolated state assumption. Thus, several scholars (see, for instance, Anselin, 1995; Arbia & Espa, 1996; Arbia & Piras, 2007; Duranton & Overman, 2002; Feser & Sweeney,

9. General variety term is used to indicate the Jacobian externalities measured in old fashion without any sectoral linkages.

2000; Marcon & Puech, 2003) have elaborated continuous-space approaches since geographic space has to be considered continuous due to the spatial sprawl and interaction between economic agglomerations in proximity, which avoid an underestimation of spatial concentration (Guillain & Le Gallo, 2007; Quah, 2002).

These two diverse approaches provide different but complementary information, thus, several authors (see, for instance, Arbia, 2001; Guillain & Le Gallo, 2007; Sohn, 2004) proposed to combine them in order to detect more effectively economic spatial patterns. For instance, Guillain and Le Gallo (2007) suggest an hybrid model combining the locational Gini index, the Moran's I coefficients of global spatial autocorrelation, the Moran I scatterplots and LISA statistics to measure the degree of spatial localization in Paris and its surrounding in 1999. Following this, a composite measure is proposed combining discrete-space indicators for measuring agglomeration externalities with continue-space statistics such as global Moran's I coefficients, the Moran's I scatterplots, and the local Moran's I statistics in order to detect spatial patterns more accurately in Indonesia. The rest of this chapter is organized as follows[10]. In Section 4.2, discrete-space statistics are investigated such as location quotient, competition index, and entropy statistic for general variety useful to decompose it into (un)linked variety. In Section 4.3, the continuous-space approach is examined with particular reference to the spatial autocorrelation notion, the spatial weight matrix, and several spatial indicators such as the global Moran's I, and the local indicator of spatial association (LISA) statistics. Conclusions are provided in Section 4.4.

4.2 Agglomeration externalities measures

Several discrete-space indicators are investigated to measure agglomeration externalities within locations, which will be employed in the empirical analysis in order to unfold their influence on manufacturing growth at the sectoral and firm levels analysing separately Indonesia cities and regencies. In addition, they will be combined with selected continuous-space statistics in order to detect agglomeration patters more effectively. This section is organized as follows. In Section 4.2.1, the location quotient is examined as a proxy for localization externalities. In Section 4.2.2, the competition index is investigated as a proxy for competition externalities. In Section 4.2.3, the entropy formula for general variety is proposed, which allows decaying variety into related and unrelated varieties.

4.2.1 Location quotient index

The location quotient (LQ) was introduced for the first time by Florence (1939) and afterwards it has been applied in a variety of academic fields. LQ measures

10. Part of the present framework has been also applied in Italy in order to unfold the localization patterns of employment at three-digit level of manufacturing industries within and across provinces in 2007, see Ercole (2013).

the locational ratio of a certain variable of interest (e.g. employment, output, among others variables) in relation to a certain scale (e.g. sector, and region) within a focal region with respect to the aggregation of the same variable in a larger area. *LQ* is computed based on employment as defined by Kim (1995):

$$LQ_{r,i} = \frac{E_{r,i}/\sum_{i=1}^{N} E_{r,i}}{\sum_{r=1}^{R} E_{r,i}/\sum_{i=1}^{N}\sum_{r=1}^{R} E_{r,i}} \tag{4.1}$$

where $E_{r,i}$ represents the annual average of total workers per working day of five-digit sector r (=1,2,...,R) within a location i (=1,2,...,N). The numerator represents the share of five-digit employment in a location, and the denominator denotes the share of sectoral employment in the whole country. Generally, scholars assume that a location is relatively specialized when $LQ_{r,i}> 1$, since this denotes overrepresentation of industrial employment r within a location in comparison to its aggregation in the country. Whereas, $LQ_{r,i}< 1$ indicates sectoral underrepresentation within a location. However, there is not agreement among researchers when *LQ*'s value denotes a specialized cluster within a location (Martin and Sunley, 2003; O'Donoghue & Gleave, 2004). Some authors assume a cut-off value of LQ = 1.25 (Miller et al., 2001) while other scholar higher (see for instance, Isaksen, 1996; Malmberg & Maskell, 2002) in order to increase its statistic significance (O'Donoghue & Gleave, 2004). In order to overcome this dispute, O'Donoghue and Gleave (2004) propose an alternative *LQ* index and they suggest a derive methodology in order to assess when *LQ* is significantly high.

The location quotient measures the relative sectoral specialization within a location and it has an important advantage allowing comparison between its coefficients with regard to a certain time and over time across locations. Identifying sectoral specialization provide useful information to policymakers in order to design *ad hoc* initiatives favouring certain clusters towards a more specialization and/or promoting less specialized sectors that show growth potential increasing diversification. In addition, measuring the degree of specialization over time allows to monitor the effectiveness of policies on cluster's growth. The location quotient is employed in the empirical analysis as a proxy for intra-industry externalities (Glaeser et al., 1992), assuming sectoral specialization within a location when its value overcomes 1. Since this shows higher localization of a certain sector within a location in comparison with its localization at the national level.

4.2.2 Competition index

The degree of sectoral competition within a location is computed to assess the relationship between rivalry degree and manufacturing growth with Indonesian locations. The effect of competition intensity often refers to Porter externalities (Porter, 1990) within the literature (see, for instance, Beaudry & Schiffauerova, 2009; De Groot et al., 2009; De Vor & De Groot, 2010). However, there is not agreement among scholars (see, for instance, Glaeser et al., 1992; Jacobs, 1969; Porter, 1990) with regard to the impact of competition degree on knowledge transmission and economic expansion (see Section 3.3). There are numerous indicators to measure local competition, the most common refers to the Herfindahl-Hirschman Index (HHI) (Herfindahl, 1950; A.O. Hirschman, 1945)[11], which is used to assess the concentration ratio of a certain variable within a location. However, HHI index has two important shortcomings. It is sensitive to the number of observations, which is emphasized by the square and HHI does not take into account any estimator weight (e.g. geographical size) making the comparison between HHI's values less significant. However, several versions of HHI index overcome these limitations using the area size and the absolute value (see, for instance, Ellison & Glaeser, 1997). The competition index is adopted in the fashion employed by several scholars (see, for instance, De Vor & De Groot, 2010; Glaeser et al., 1992), which allows comparison between observed values coefficients in a certain time and over time across locations. It is defined as the ratio of the number of establishments per employee in a sector r within a location i with respect to the ratio of number of firms per employee of the same industry at the national level. Formally, the competition index can be defined as follows:

$$COMP_{r,i} = \frac{F_{r,i}/E_{r,i}}{\sum_{r=1}^{R} F_{r,i}/\sum_{r=1}^{R} E_{r,i}} \tag{4.2}$$

where $F_{r,i}$ denotes the number of firms within five-digit sector r in location i. A value greater than 1 denotes higher sectoral competition within a location i in comparison of the same five-digit sector r at the national level, whereas a value lower than 1 indicates underrepresentation. This indicator provides information with regard to the relative sectoral competition within a location, which can be useful to create specific policies favouring more or less intra-industry competition at the local and national levels. In addition, measuring sectoral competition over time allows overseeing the influence of policies on cluster rivalry.

4.2.3 Economic varieties decomposition

The general variety computed without any sectoral linkages incorporates two different economic roles: location resilience degree to external industry-specific shocks and inter-industry knowledge spillovers. In order to measure these two idiosyncratic economic effects, Frenken et al. (2007) propose entropy measure to decompose general variety into sectoral interconnectedness. The first conceptualization of entropy was elaborated by Boltzmann (1877), and

11. HHI index can be written as: $\sum_{i=1}^{N} p_i^2$, where p_i is the rate of a certain variable in region i, whereas N is the number of observations. For instance, p_i might be associated with the plants' output rate, market share, employment, and sells, among other variables within a location i, where N might represents the number of firms observed. There is no concentration if $p_1 = p_2 = p_i$ then $HHI = \frac{1}{N}$, whilst there is full concentration in only one region if $HHI = 1$. Therefore, it assumes values between $\frac{1}{N} \leq HHI \leq 1$.

Shannon (1948) developed its probabilistic interpretation. Whereas, the first economic application of entropy measure goes back to Henri Theil (1967, 1972), who applied it in the information theory, and afterwards numerous researchers employed entropy statistics within numerous economic fields such as industrial concentration, regional diversification, income inequality, among others (Frenken, 2007).

The entropy can be considered as a measure of uncertainty or probability that a certain event occurs. It has an attractive and superior advantage in comparison with other statistics (e.g. HHI index) due to the decomposition analysis, which allows aggregation and disaggregation of the entropy formula through its property of additivity (Theil, 1972). This makes the entropy statistics a preferable measure since it allows decomposing general variety into related and unrelated varieties with a single statistic (the decomposition demonstration is reported in Appendix 4.A) without causing necessarily multicollinearity within regression analysis. Due to the novelty provided by related variety conceptualization for regional economic development, scholars (see, for instance, Boschma et al., 2013; Neffke, Henning, & Boschma, 2011) focused on constructing relatedness measures often neglecting the relevance for policy design of the identification of unlinked sectors within a location, which can provides as well valuable information to increase embedded relatedness and/or diversification. This is allowed by the entropy decomposition formula identifying linked and unlinked sectors within a location deriving them from the disaggregation of local varieties. The entropy formula is employed in order to measure general variety for traditional Jacobian externalities without taking into account any sectoral linkages, which can be expressed as the sum of entropy at the five-digit level by weighting the share values (p_r) by their respective probability ($1/p_r$) given as:

$$VARIETY_i = \sum_{g=1}^{N} p_r log_2 \left(\frac{1}{p_r} \right) \tag{4.3}$$

where p_r represents the five-digit sector share of employment with a location i (=1,2,3,...N) and g (=1,2,3...G) denotes the two-digit industry. The logarithm base 2 is used for the entropy expressing the information in “bits” (Shannon, 1948), which has been adopted by scholars (see, for instance, Frenken et al., 2007) for the economic variety decomposition. $VARIETY_i$ denotes the degree of location diversity in its economic composition, where higher value corresponds to higher economic diversification and vice versa. It can assume value between 0 and $log_2(N)$ (Theil, 1972, pp. 8-10). Given the property of additivity of the entropy measure, $VARIETY_i$ can be decomposed as the sum of the between-group entropy referring to unrelated variety (UV_i) and the average within-group entropy denoting related variety (RV_i) (see for the decomposition theorem, Theil,

1972) as follows:

$$VARIETY_i = \underbrace{\sum_{g=1}^{G} P_g log_2 \left(\frac{1}{p_g}\right)}_{UV_i} + \underbrace{\sum_{g=1}^{G} P_g \left(\sum_{r \in S_g} \frac{p_r}{p_g} log_2 \frac{1}{p_r/P_g}\right)}_{RV_i} \tag{4.4}$$

The between-group entropy computed for unrelated variety (UV_i) can be defined as the weighted sum of entropy at the two-digit level (S_g) within a location i, where P_g is the sum of two-digit shares, in which r falls exclusively within a two-digit sector S_g within a location i, as follows:

$$P_g = \sum_{r \in S_g} p_r$$

The higher value of UV_i denotes higher diversification at two-digit level increasing location resilience, and vice versa. The related variety (RV_i) can be defined as the five-digit sectors weighted sum of the entropy within each two-digit industry, which is the average within group entropy. Higher value of RV_i indicates a higher degree of sectoral interconnectedness within the two-digit industry in a location, and vice versa. Related varieties is associated with the inter-industry knowledge spillover since it is more likely to flow among related economic activities than unrelated industries, and this latter is associated with portfolio diversification.

Frenken et al. (2007) decompose general variety based on the industrial classification, which measures ex-ante the similarity in the production and processes without capturing other possible elements that make two sectors interconnected such as technology, same regulatory framework, and the use of the same infrastructure, among others sectoral interconnectedness. Thus, an alternative decomposition of relatedness has been adopted based on manufacturing classification of technology intensity industries proposed by OECD (2011), which is based on the relationship between R&D expenditure, and value added and production within manufacturing industries. Hartog et al. (2012) use a similar methodology in order to compute their high-tech related variety and low- and medium-tech related varieties. Therefore, UV_i and RV_i are computed based on the Indonesian industrial classification (KBLI 2005, which is based on ISIC Rev. 3) and RV_i is further decomposed based on technology intensity industries classification (OECD 2011).

Although OECD (2011) classifies technology intensity manufacturing industries in four classes: high, medium-high, medium-low, and low; two clusters are constructed merging high with medium-high technology intensity industries, and medium-low with low technology intensity industries. As a result, two indicators of relatedness are computed: $RVHMH_i$ and $RVMLL_i$ respectively. The former is likely to generate more frequently incremental and radical changes due to higher degree of technology utilized. The latter is denoted by lower degree of technology industries characterized by more labour intense activities, where innovation is not the principal component of their competition; albeit the diffusion and the creation of innovation cannot be excluded for these industries but less frequently generated. These indices can be useful to unfold whether related variety with different degrees of technology intensity influence five-digit sectors and firms' growth within Indonesia regencies and cities.

4.3 Detecting spatial clustering

The discrete-space indices do not capture accurately spatial agglomeration patterns since they consider the unit as isolated (a-spatial) neglecting the role-played by nearby territories, which may cause an underestimation of agglomeration concentration (Guillain & Le Gallo, 2007). In particular, geographical data analysis arises two important effects: spatial dependence and spatial heterogeneity (Anselin, 1993). The former refers to the first low of geography and it is often associated with autocorrelation, whereas the latter denotes the differences among observations in terms of spatial structure. In order to assess these two effects, it is necessary to use a combination of spatial measures and complementary techniques in order to allow the identification of patters in terms of their spatial distribution, association, spatial instability (non-stationary) and atypical observations (outliers) (see, for instance, Anselin, 1993; Arbia, 2001; Guillain & Le Gallo, 2007; Lafourcade & Mion, 2007).

Thus, discrete-space measures can be implemented by continuous-space statistics in order to capture spatial economic agglomeration distribution in a more meaningful way. However the continuous-space approach is not free of limitations, in particular, an important shortcoming refers to what is called the modifiable areal unit problem (MAUP) due to scale effect and zoning effect. The former is related to potential diverse results using different scale, and the latter is associated with different outcomes due to regrouping zones at a given scale. The rest of this section is organized as follows. In Section 4.3.1, the conceptualization of spatial autocorrelation is explored. In Section 4.3.2, the weight matrix is examined with particular regard to the definition of the queen contiguity matrix. In Section 4.3.3, the global Moran's I of spatial autocorrelation is investigated. Finally in Section 4.3.4 the local indicator of spatial association (LISA) is analysed in the light of its complementary information, which allows identifying agglomeration patters more precisely.

4.3.1 Spatial autocorrelation

The essential concept of spatial analysis is the presence of geographic dependency between observations. Cliff and Ord (1969) introduce for the first time the term of spatial autocorrelation since often a variable tends to cluster in space. In order to enhance the regional development understanding, these authors point out the importance of studying spatial interaction and dynamism between locations rather than just within locations. Spatial dependence between units refers to the first law of geography underpinning the notion of "everything is related to everything else but near things are more related than distant things" (Tobler, 1970, p. 3). The spatial autocorrelation can be defined as the coincidence between value similarity and location similarity (Anselin, 2001). A positive spatial autocorrelation indicates a spatial clustering of high or low values, whereas a negative spatial autocorrelation is characterized by a location surrounded by neighbourhoods with very dissimilar values. Spatial autocorrelation is the correlation within variables across space, and it is a clear distinct concept from autocorrelation indicating correlations within variables a-space, and correlation statistics denoting the relationships between variables (Getis, 2007). Mathematically, spatial autocorrelation can be defined as follows:

$$corr(y_i, y_j) = E(y_i, y_j) - E(y_i)E(y_j) \neq 0 \tag{4.5}$$

where y_i and y_j are random variables indexed by locations i and j ($i \neq j$). The spatial autocorrelation measures the spatial distribution degree of clusters identifying random, concentration and dispersion patterns of a certain variable. If a location shows a spatial dependence due to spatial interaction of its neighbours, this can be written as:

$$y_i = f(y_j), i = 1, 2, ...N \tag{4.6}$$

where the value of y_i in the location is a function of the value of its neighbour j. An essential part of spatial analysis is the specification of spatial linkages between locations, which recall the notion of spatial weight matrix (W) representing the strength of spatial interactions between locations.

4.3.2 Spatial weight matrix

The spatial weight matrix can be defined as a symmetric binary contiguity matrix based on topological information of geo-referenced data using adjacency or distance function (Anselin, 1988). The spatial weight element w_{ij} within W can be defined by two different criteria referring to adjacency and distance. This research employs the former approach constructing the Queen contiguity matrix where 1 denotes when location j is adjacent to location i, 0 otherwise. The diagonal elements of the spatial weight matrix for convention is set to zero since it correspondents to the location itself. The spatial weight matrix can be also constructed in a standardized form where the sum of all raw elements is equal to one with an exception of locations with no neighbours such as islands, which are excluded in spatial analysis in order to avoid estimation bias. The row-standardization transformation is often preferred since it generates a relative weighting scheme of a single location with different numbers of neighbours. This reduces a potential bias due to sampling design or an imposed aggregation of observations. The raw-standardization matrix can be constructed by dividing each element within a row by the sum of the elements in the row. This can be written as follows:

Given a spatial weight matrix (W):

$$W = \begin{pmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \end{pmatrix} \tag{4.7}$$

The raw-standardization spatial weight matrix $(\widetilde{W})$ can be constructed as:

$$\widetilde{W} = \begin{pmatrix} 0 & \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{3} & 0 & \frac{1}{3} & \frac{1}{3} \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix} \tag{4.8}$$

where the single element of the raw-standardization matrix $(\widetilde{w}_{ij})$ can be written as:

$$\widetilde{w}_{ij} = w_{ij} / \sum_{j=1}^{N} w_{ij}$$

The spatial lag (W_y) matrix can be constructed by multiply the vector of observations y_i with $\widetilde{W}$ as:

$$W_y = \begin{pmatrix} 0 & \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{3} & 0 & \frac{1}{3} & \frac{1}{3} \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix} \cdot \begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{pmatrix} = \begin{pmatrix} \frac{1}{2}(y_2 + y_4) \\ \frac{1}{3}(y_1 + y_3 + y_4) \\ \frac{1}{2}(y_1 + y_2) \\ \frac{1}{2}(y_2 + y_3) \end{pmatrix} \tag{4.9}$$

It is notable that this produces a vector of the average value of y_i over the neighbours of each region. The Queen contiguity combines the Bishop and Rook contiguity matrix conceptualization (see, for instance, LeSage, 1998), and it adopts a less stringent definition of polygon contiguity where the shared border can be as small as a point. The Queen contiguity matrix is employed since even when a location shares a small part of its border with a neighbour denotes proximity increasing the likelihood of potential spatial economic interaction and sprawling. The Queen contiguity matrix can be built using different order of contiguity where the first-order contiguity matrix refers to locations that share a common border with a focal location; the second-order contiguity matrix denotes locations that share borders with the first-order neighbours; and so on with the higher orders. The first-order raw-standardized Queen contiguity matrix is employed where a location j is considered a neighbour of location i when it share in any direction (vertical, horizontal, and vertex) a common border without any restriction of border's length. Figure 4.1 illustrates the Queen contiguity matrix definition.

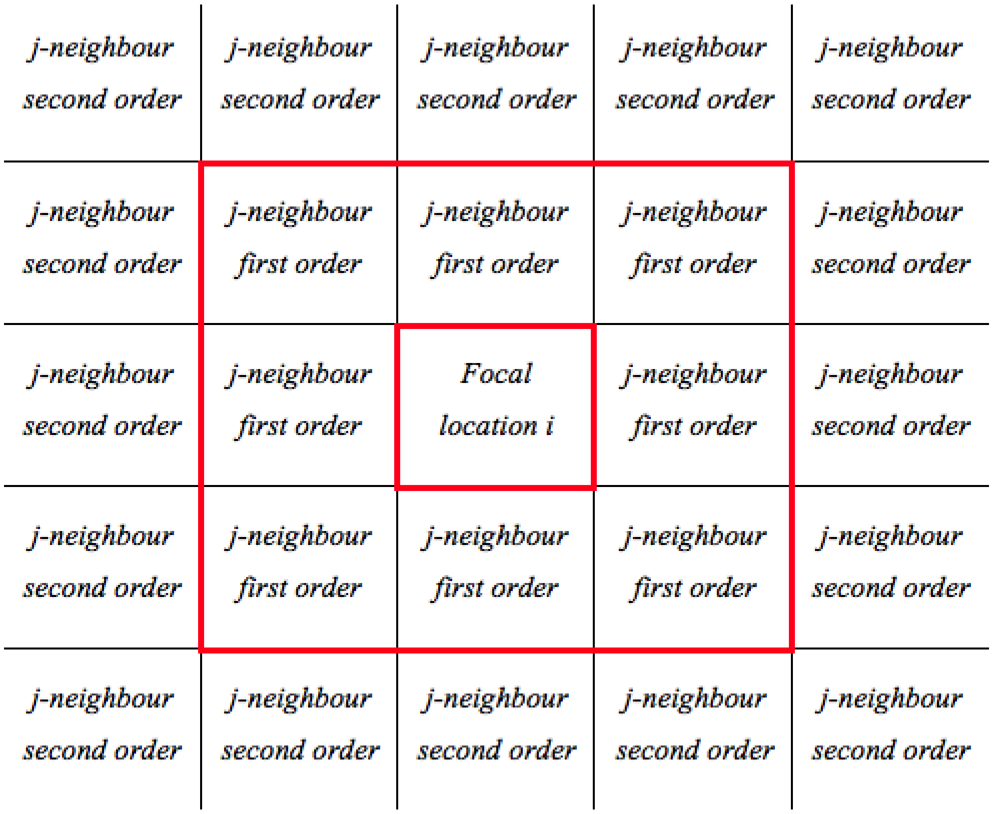

Figure 4.1: The Queen contiguity conceptualization

4.3.3 Global Moran's I index of spatial dependence

The essential element of adopting spatial analysis techniques is the presence of spatial dependency among observations; otherwise traditional a-spatial statistics and models have to be used. There are several indicators in the literature to measure space dependency, the most used indicators refer to the Getis and Ord statistics of local spatial association (Getis & Ord, 1992; Ord & Getis, 1995) and the Moran's I coefficients[12] of spatial autocorrelation (Moran, 1948, 1950). The Getis-Ord statistics only allow 2-ways associations of the units observed: high and low value clusters. Whereas, the Moran's I combining with the Moran scatterplots and the local Moran's I allow a better detection of spatial agglomeration values into four associations assessing also their statistical significance (Anselin, 1993; Arbia,

12. The Moran's I term will be used to indicate the Global Moran's I, whereas local Moran's I is indicated with the full-length denomination.

2001; Guillain & Le Gallo, 2007; Sohn, 2004). The Moran's I coefficients measure the degree of linear spatial association between a vector of observed values and a weighted average of the neighbouring values or spatial lag (Cliff & Ord, 1981; Moran, 1948, 1950). It measures the similarity between two locations i and j by multiply the deviation of x_i and x_j from the global mean $\bar{x}$, and the product is weighted by their spatial proximity matrix of w_{ij}. The global Moran's I can be defined as follows:

$$I = \frac{N}{S_0} \frac{\sum_{i=1}^{N} \sum_{j=1}^{N} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{N} (x_i - \bar{x})^2} \tag{4.10}$$

where $S_0 = \sum_{i=1}^{N} \sum_{j=1}^{N} w_{ij}$, and w_{ij} denotes an elements of the weight matrix W indicating the spatial connection of region i to the region j $(i \neq j)$. N is the number observations, x_i and x_j are the observed values for the region i and j respectively with the mean $\bar{x}$. The equation includes the deviation of the variable of interest with respect to the mean $(x_{i(j)} - \bar{x})$. The expected value of Moran's I under the null hypothesis (absence of correlation, randomization) is given by $E(I) = -1/(n-1)$; whereas, $I{>}E(I)$ denotes a positive spatial autocorrelation in the observations due to similar x_i and x_j values; and $I{<}E(I)$ indicates a negative spatial autocorrelation among locations due to dissimilar values. The Moran's I coefficients can vary between ±1, where values close to + 1 denotes clustering and near to - 1 indicate dispersion. When the spatial weights matrix is row-standardized where the sum of all elements in each row is equal to 1 then $S_0 = N$, the Moran's I can be rewritten as:

$$I = \frac{\sum_{i=1}^{N} \sum_{j=1}^{N} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{N} (x_i - \bar{x})^2} \tag{4.11}$$

The Moran's I encapsulates in a single value the magnitude of spatial autocorrelation, and the permutation significance test can be used rather than the $z-score$ in order to relax the assumption of normality. Statistical significance is assessed in order to allow rejecting or accepting the null hypothesis of absence of autocorrelation (or randomness). The Moran's I coefficient is a global measure and it allows the identification of an overall spatial pattern within a single value detecting three different type of spatial distribution: random, cluster and dispersion. However when the spatial autocorrelation is predominant, the Moran's I index may not identify properly the delimitation of agglomeration. The indicator can detect high-value and low-value clustering with a positive and negative global autocorrelation, the Moran's I can not distinguish them if these two agglomeration values coexist (Zhang & Lin, 2007). In order to overcome this shortcoming, tools of exploratory spatial data analysis (ESDA) can be used to identify local spatial associations and to test their statistical significance. In particular, the Moran scatterplots and the local indicator of spatial association (LISA) can be combined in order to detect high-value clusters, low-value clusters and negative autocorrelations. These have been applied, for instance, to investigate local spatial patterns of regional income differences in the European Union (Le Gallo & Ertur, 2003), economic agglomeration in Paris and its surroundings (Guillain & Le Gallo, 2007), among several other studies.

4.3.4 Local spatial autocorrelation

The Moran's I coefficients can be implemented by the Moran scatterplots (Anselin, 1996, 2002), which is a graphic representation of the global Moran's I and the slope of the regression line represents the Moran's I value useful to visualize the strength of the overall spatial autocorrelation. The Moran scatterplots allow the classification of 4 different spatial associations: high-low (HL) and low-high (LH) indicating dissimilar values of x_i (negative autocorrelation); high-high (HH, hotspot) and low-low (LL, coldspot) denoting similar values of x_i (positive spatial autocorrelation). The first term of the association (H or L) indicates the variable of the observed unit, whereas the second term denotes the value of its surroundings (or spatial lag). The Moran scatterplots allow a better detection of spatial agglomeration values rather than using Getis-Ord statistics (see, for instance, Feser & Sweeney, 2002), which only imply 2-ways split of the units observed: high and low value clusters. However, the Moran scatterplots do not allow the assessment of statistical significance of spatial associations, therefore local indicator of spatial association (LISA) needs to be employed (Anselin, 1995). LISA statistics allow the decomposition of the global Moran's I through the local Moran's I, which measures the spatial autocorrelation for each individual location. It is designed to test whether the distribution of values around a specific location deviates from spatial randomness (null hypothesis). The local Moran's I gives indication of the existence of significant spatial clustering of similar values within the dataset and testing the null hypothesis of absence of local spatial association (Anselin, 1995). The local Moran's I statistics for an observation i can be defined as (Anselin, 1995):

$$I_i = z_i \sum_{j=1}^{N} w_{ij} z_j \tag{4.12}$$

where $z_{i(j)}$ denotes the standardized values in deviations from the mean as $x_{i(j)} - \bar{x}$ with $j \neq i$. When the spatial weight matrix is raw-standardized, $S_0 = N$, the local Moran's I can be rewritten (Anselin, 1995) as:

$$I_i = (z_i/m_2) \sum_{j=1}^{N} w_{ij} z_j \tag{4.13}$$

where $m_2 = \sum_{i=1}^{N} z_i^2/N$, and the randomization hypothesis is equal to $E(I_i) = -w_i/(n-1)$ where w_i is the sum of the raw elements ($\sum_{j=1}^{N} w_{ij}$). As in the global Moran's I, the permutation test can be used to assess the statistical significant of local Moran's I relaxing the assumption of the Gaussian distribution. Figure 4.2

shows four different types of spatial associations with respect to a focal location and its neighbours. Similar values denote clustering (HH – hotspots, and LL - coldspots, quadrant 1 and 2 respectively) whereas dissimilar values indicate outliers (HL and LH, quadrant 3 and 4 respectively).

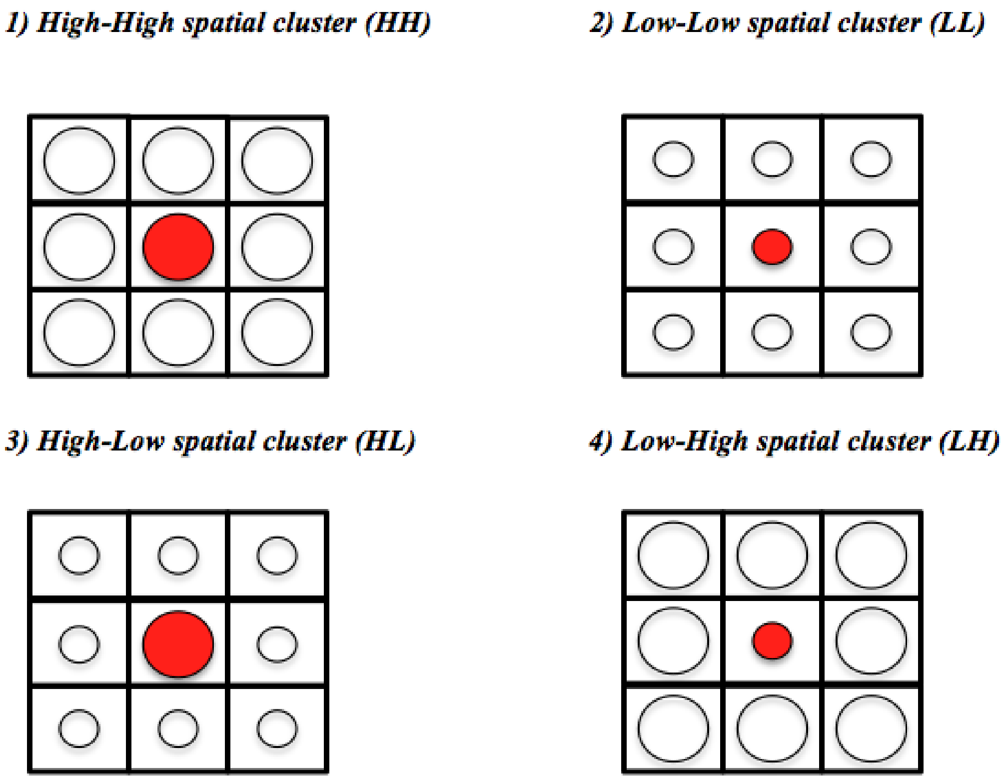

Figure 4.2: The four spatial associations of LISA statistics.
Notes: The focal location is represented by the red circle and its neighbours are denoted by the white circles. The dimension of circles indicates the size of location's value.

4.4 Conclusions

This chapter was devoted to examine selected discrete-space indices to measure agglomeration externalities within Indonesian locations with particular emphasis to economic varieties decomposition based on sectoral linkages. These measures will be employed in the empirical analysis in order to unfold their influence on sectoral and firms' manufacturing growth analysing separately Indonesia cities and regencies. In addition, the discrete-space indicators will be combined with continuous-space indices employing the global Moran's I, the Moran scatterplots and the LISA statistics in order to detect more effectively spatial agglomeration patterns of large and medium manufacturing within and across Indonesian locations.

From the next chapter the empirical analysis begins investigating the Indonesian economy and manufacturing evolutions highlighting the development of diverse policies in different country's stages. A declining trend of manufacturing activities after the Asian Financial Crisis emerges, which represent policymakers' challenge in order to bring back on track manufacturing activities and supporting its transformation towards more knowledge-based productions. In this context, innovation capabilities and the formation of adequate human capital are considered essential drivers to revitalize and underpin manufacturing growth. It will be argued that the decomposition of economic varieties based on sectoral linkages can provide useful insights to develop *tailor-made* industrial policies in order to lead to a second period of industrialization in Indonesia.

Appendix

4.A Appendix: The entropy decomposition theorem.

The demonstration of entropy statistics decomposition (Theil, 1972) is given by:

$$
\begin{aligned}
VARIETY_i &= \sum_{g=1}^{G} p_r log_2\left(\frac{1}{p_r}\right) \\
&= \sum_{g=1}^{G}\sum_{r\in S_g} p_r log_2\left(\frac{1}{p_r}\right) \\
&= \sum_{g=1}^{G} P_g \sum_{r\in S_g} \frac{p_r}{P_g}\left(log_2\left(\frac{1}{P_g}\right) + log_2\left(\frac{P_g}{p_r}\right)\right) \\
&= \sum_{g=1}^{G} P_g \left(\sum_{r\in S_g} \frac{p_r}{P_g}\right) log_2\left(\frac{1}{P_g}\right) + \sum_{g=1}^{G} P_g \left(\sum_{r\in S_g} \frac{p_r}{P_g} \log_2\left(\frac{P_g}{p_r}\right)\right) \\
&= \underbrace{\sum_{g=1}^{G} P_g log_2\left(\frac{1}{p_g}\right)}_{UV_i} + \underbrace{\sum_{g=1}^{G} P_g \left(\sum_{r\in S_g} \frac{p_r}{p_g} log_2 \frac{1}{p_r/P_g}\right)}_{RV_i}
\end{aligned}
$$

Therefore, $VARIETY_i$ can be rewritten as the sum of the between-group entropy indicating unrelated variety and the average within-group entropy denoting related variety.

5 Economic and policy transformations, and manufacturing revitalization challenges

5.1 Introduction

Indonesia is one of the largest and stable economies in Asia. Characterized by high growth potential where the country is well-positioned geographically, abundant natural resources (e.g. mineral fuels, lubricants, animal and vegetable oils, fats, and waxes), dense and large domestic market (250 million people) and more than one half lived in urban areas in 2011 (OECD/ Asian Development Bank, 2015; World Bank, 2015). These favourable conditions contributed to shape the country's economy in the last 50 years. Two major turning points can be identified that substantially change the country: 1) The crisis in 1965, which favoured the establishment of the New Order Regime (NOR) in 1966, and 2) the Asian Financial Crisis (AFC) in 1997-1998, which caused the end of the Soeharto's regime in charge for 32 year. These two important crises forced policymakers to develop remarkable economic and industrial reforms to regenerate growth and resilience.

During 1967 and 1996, Indonesia economy witnessed a structural change switching from an agrarian economy to an industrialized nation due to the successful policies under the Soeharto's regime, which was underpinned by the favourable macroeconomic conditions (i.e. oil price boom 1973-1980). Manufacturing was highly boosted during the export-oriented strategy between 1982 and 1996. Subsequently, the AFC significantly hits the Indonesian economy, and aftermath manufacturing has seen a substantial deceleration of its contribution within the country's economy showing a potential threat of deindustrialization (Tijaja & Faisal, 2014). The industrial composition is prevalently characterised by labour-intensive industries and a reduction of their competitiveness (e.g. the raise of labour costs, lack of skilled workers, the inadequacy of sophistication of goods and innovation capabilities) undermined the overall manufacturing growth. This has generated a sectoral composition change where the more competitive and technology advanced sectors increased their economic contributions within the country and numerous labour-intensive industries decreased it. This opened a new manufacturing's phase and policymakers' challenges in order to bring back on track manufacturing growth. From 2004, Indonesian policymakers began to develop more innovative and refine initiatives (i.e. The National Long Term Development Plan 2005–2025 and the Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025) in order to revitalize manufacturing and more in general the whole economy. These recent policies focus on critical issues for manufacturing growth (e.g. infrastructures, spatial inequality, human capital and innovation) embracing location and cluster prospective encouraging the formation of agglomerations. This recognizes the important role of agglomeration externalities in leading to a second period of industrialization in Indonesia.

Although Indonesian Government is greatly engaged in order to support manufacturing growth, it emerges that more efforts are required. Indonesian Government should increase and favour public and private expenditures on research and development activities, and the number of researchers employed in order to enhance the country's innovation environment. This can support the competitive advantage of manufacturing industries and the localization of more technological advanced industries increasing industrial diversification. However, the scarcity of these latter industries stands behind the shortage of qualified jobs. The country's industrial composition is mainly characterised by labour-intensive industries, which prevalently require low-qualified workers, thus, they are not able to create and absorb significant human capital. Increasing efforts in innovation capability and human capital formation are vital to regain manufacturing competitiveness of traditional sectors and support manufacturing transformation towards more knowledge-based productions, which increase manufacturing diversification and resilience to shocks. This becomes particular relevant considering that the country aims to become a high-income nation, the world's 10th economy by 2025, and the 6th largest economy by 2050 as targeted by the Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025 (MP3EI). Although the economy stills far from growing by 7-9% per year in order to achieve these ambitious goals (Naudé, 2013), manufacturing revitalization can highly contribute on it due to its high productivity.

This chapter aims to investigate the economic and manufacturing evolutions in Indonesia and policy interventions by different country's stages. Since the current condition of manufacturing is related to the past evolutions, thus, it is necessary to review the historical economic and manufacturing mutations in order to understand the present manufacturing circumstances. This chapter is organized as follows. In Section 5.2, economic and policy evolutions in Indonesia are investigated by different country's stages highlighting the structural change within the Indonesia economy and the recent deceleration of manufacturing activities. In Section 5.3, manufacturing trajectory is examined in the light of its composition change. In Section 5.4, manufacturing challenges are critically investigated in terms of innovation, human capital and urbanization, which are considered crucial elements for the regeneration of manufacturing activities in Indonesia. Finally, conclusions are provided in Section 5.5.

5.2 Indonesian economy and policy evolutions

Policies for industrial structure modernization effectively started when the NOR came into power in 1966 under the President Soeharto in charge until 1998. The establishment of the NOR was favoured by the political instability and economic crisis in 1965-1966 where the inflation reached more than 1,000% and the country was internationally isolated (H. Hill, 1996). Policymakers recognized the importance of economic and political reforms to stabilize the country's macroeconomic environment; thus, numerous changes were made in order to build the foundations for the future economic growth. In 1969, the country' economy was stabilized and the inflation rate was brought down to 15%.

Indonesian economy favourably responded to the NOR's reforms until the AFC in 1997. For three decades (1967-1996), the country enjoyed a rapid economic and manufacturing growth transforming its economy from mainly based on agriculture to manufacturing activities where exportations played a key role on it (Jacob, 2005). The oil price boom (began in 1973 until the 1980s) underpinned the economic transformation and growth, albeit this period was accompanied by an inward-oriented strategy. The end of the oil boom led to a series of reforms rethinking the protectionism strategy towards an outward-oriented approach, which highly boosted manufacturing. Subsequently, the AFC (1997-1998) hits the country harder than other Asian economies highlighting Indonesia's economy weaknesses to external shocks. This forced further industrial policy evolutions adopting a medium and long-term visions based on cluster and location approaches in order to enhance economic stability and resilience. Although the Indonesian economy has not been fully recovered since it is far away to reach the economic level of pre-AFC, the country became one of the fastest and stable growing economies in the last decade within the region.

In the rest of this section, the country's economic mutations are briefly explored, which led to diverse policy interventions in Indonesia transforming its economy and industrial structure[13]. It is organized as follows. Section 5.2.1 the NOR period is investigated divided it into three phases: rehabilitation and stabilisation (1967–1972), intervention and protectionism (1973–1981), rationalization and export orientation (1982–1996). Section 5.2.2 the impact of the AFC (1997-1998) is examined. Finally, the period after the AFC is explored decaying it into two phases: recovery period (1999-2003), and the adoption of regional and industrial cluster policies (2004–onwards).

5.2.1 The New Order Regime (1966-1998)

This period was particular relevant for the Indonesian economy and manufacturing since the current economic structure mainly stems from the

13. This section is mainly relied on the works of Aswicahyono and Feridhanusetyawan (2004), Aswicahyono, Hill, and Narjoko (2010), H. Hill (1996), Jacob (2005), J. D. Lewis (1994), Naudé (2013), Rock (2003) and Tijaja and Faisal (2014).

efforts during the Soeharto's regime. Policies shifted from a more open market in order to give a positive impulse to the economic crisis in 1965, to an inward-oriented strategy in the early 1970s supported by the easy growth due to the oil price boom. For then, adopting an export-orientated approach in the early 1980s as a reaction of the drastic reduction of oil price, which compromised the country growth and an open market was preferable. In the rest of this section, these three different phases are investigated.

5.2.1.1 Rehabilitation and stabilisation (1967–1972)

This phase was a turning point for the Indonesian economy and industrial development policies due to the severe political and economic crises in the 1960s characterized by high inflation rate, fiscal deficit, and the failing of GDP per capita (J. D. Lewis, 1994; Rock, 2003). The economy was mainly based on agriculture with more than 50% of the GDP whereas manufacturing's share was just 10% of the country's GDP (Figure 5.4). The New Order came into power in 1966 with numerous challenges to face and its policy interventions began in 1967. NOR intervened with various reforms such as reducing importation and exportation restrictions, liberalisation of investment, and adopting orthodox monetary and fiscal policies (Jacob, 2005) in order to stabilize the economy and increase industrialization. Two important laws had a significant impact on the country development such as the Law No. 1/1967 and the Law No. 6/1968, which favoured foreign direct investments and domestic business respectively (Aswicahyono & Feridhanusetyawan, 2004).

The economy favourably reacted. The GDP grew more than 8% on average between 1968 and 1972 from just 1% in 1967 and the GDP per capita followed this positive trend (Figure 5.2). Importations and exportations substantially increased by 19% and 13% on average respectively between 1967 and 1972 (Figure 5.2). The inflation was reduced from more than 1,100% in 1966 to 15% in 1969, and it progressively decreased up to 7% in 1972 (Figure 5.3). A trajectory of industrialization began, the industry's value added[14] increased from 12% in 1966 to 25% in 1972 as a percentage of the GDP, albeit manufacturing was slightly affected. Indeed, a negative trend of an economy based on agriculture commenced, its GDP share significantly decreased from more than 50% in 1966 to less than 40% in 1972 (Figure 5.4).

5.2.1.2 Intervention and protectionism (1973-1981)

The oil price boom started in 1973, which financed and supported the economic and industrial development and manufacturing slightly began to increase its economic weight. Following the favourable economic conditions generated by the exponential increase of oil price between 1973 and 1980, the Indonesian government reduced its openness implementing an import substitution strategy

14. Industry includes mining and quarrying (including oil production), manufacturing, construction, and public utilities (electricity, gas, and water).

and inward orientation favouring domestic businesses, restricting FDIs, and raising barriers to importations. This led to a new phase of protectionism with strong government interventions through industrial policies, providing subsidies and financial support to state-owned enterprises. At the time, the state-owned enterprises played an important role for industrial development in the country, which accounted for a quarter of non-oil manufacturing value added during 1974–1975 (J. D. Lewis, 1994). The GDP continued to growth in the range between 6% and 9% between 1973 and 1981 (Figure 5.1), albeit the inflation began to run due to the increase of oil price reaching 40% in 1974 for then dropped around 10% in 1978 (Figure 5.3).

Following the drastic reduction of oil price in 1982, the GDP grew by just 1% (Figure 5.1). Importations growth fell from more than 30% in 1973 to 10% in 1980, and exportations growth dropped from 20% in 1973 to 5% in 1980 (Figure 5.2). In 1981, a divergence tendency of importation and exportation growth emerged due to the end of oil price boom and the depreciation of rupiah, which favoured importations (+35%) and discouraged exportations (-18%) (Figure 5.2). The structural change progressively continued where agriculture fell from less than 40% (1972) to around 25% (1982), and industry increased from less than 30% (1972) to 40% (1982) as a share of the country's GDP. Manufacturing began its positive trajectory (Figure 5.4). During the oil boom, the oil production sector contributed with almost 70% of the national revenues making the Indonesian economy highly dependent of natural resources and less resilience to external shocks. Thus when the oil price began to fail in the early 1980s (the price dropped by two-thirds in just 6 months in 1986), this had negative repercussions on the overall economy; and the Indonesian government started to rethink the protectionism approach addressing new policies based on free-market and more open economy in the mid-1980.

5.2.1.3 Rationalization and export orientation (1982–1996)

Important initiatives were taken during 1985 and 1992 to facilitate importations and exportations. Importation costs and clearing time were reduced, the average nominal tariff declined from 22.0% to 9.0%. In addition, a set of reforms was taken to boost the country's exportations as an industrialisation strategy, which began in 1986. The country's competitiveness was favoured by new macroeconomic policies such as more stringent monetary and fiscal policies, reforms of the financial and banking sectors, devaluating the rupiah by around 28% in 1983 and 45% in 1986 (H. Hill, 1996).

In 1982, the GDP growth was just 1% and the new initiatives positively affected the GDP expansion, which increased by 7% on average between 1983 and 1996 (Figure 5.1). Exportations grew by 8% on average in the same period of time (Figure 5.2) contributing substantially to manufacturing growth (Figure 5.4). This fostered the diversification of exportation from simple consumer goods and basic resources processing to manufacturing goods characterized by a more technological sophistication (Aswicahyono et al., 2010). The FDIs increased by 3% in 1996 as a GDP share (Figure 5.2). The Indonesian structural change continued with particular reference to manufacturing activities, which highly benefited from a more open market. Manufacturing increased from 12% in 1982 to 26% in 1996 as a share of GDP surpassing for the first time agriculture activities (Figure 5.4). The inflation was under control with rates below 10% (Figure 5.3). Indonesia became a middle-income country in 1996 albeit just for a short period time until the AFC, which badly hits the country's economy. The middle-income status was re-obtained following the recovery period.

5.2.2 The Asian Financial Crisis (1997–1998)

The AFC began with the collapse of the Thai Bath in 1997 triggering a deep economic and financial crisis since 1965. The AFC hits Indonesia more than other developing economies in the region. The Indonesian GDP growth decreased by 13% in 1998, whereas developing economies in the region and the world's economy grew by around 2% (Figure 5.1). Importations and exportations dramatically fell by 40% and 30% respectively in 1999 (Figure 5.2). The rupiah has been highly depreciated from Rp2,500 to Rp17,500 per US dollar (Aswicahyono et al., 2010), which generated high inflation rate of around 60% in 1998 (Figure 5.3). This inevitably created a period of deindustrialization where many firms shut their activities down increasing unemployment rate. This economic and financial turmoil caused the resignation of Soeharto's authoritarian regime in May 1998 after 32 years opening a new country's phase.

The AFC highlighted serious structural weaknesses of Indonesian economy characterized by high dependency on raw materials and intermediate products imported with particular reference to high capital and technological intensive industries (Naudé, 2013). However, large and medium scale manufacturing showed more resilience to the crisis with a relatively low impact on production and employment rates, which declined by less than 10% and 3% respectively (Dhanani, 2000). In addition, the industrial concentration of large and medium manufacturing was not significantly affected and the level of exportations was at similar level pre-crisis (Dhanani, 2000).

5.2.3 Following the Asian Financial Crisis (1999-onwards)

The period after the AFC was particularly difficult where the country was characterized by a weak economy. Numerous economic reforms were lunched such as privatisation, deregulation, and decentralization to empower local authorities. However the country struggled to fully recover, thus from 2004, the Indonesian Government began to adopt a regional and industrial cluster approaches in order to revitalize the economy and manufacturing. In this Section, these two country's phases after the AFC shock are explored.

5.2.3.1 Recovery (1999-2003)

The government requested the technical assistance and financial support of the International Monetary Fund (IMF) in order to cope the economic crisis. It imposed further liberalizations as part of the deal in exchange for loan. The government signed a series of Letters of Intent (LOI) containing also a section for deregulation and privatisation in order to rethink the country's industrial structure and its composition. The state-owned enterprises largely characterized the economy, albeit they were often inefficient with negative repercussions of the country development. The government targeted the overall economy without to address specific policies to revitalize manufacturing industries to bring them out of the economic crisis. An important initiative was taken with regard to the decentralization process starting in 2001 in order to empower local authorities to allocate and manage their financial sources and industrial policies based on their local needs. Although the decentralization had the intent to increase local and country efficiency, it generated a large regional fragmentation increasing bureaucracy. In addition, the large discretionary gave to local authorities, with particular reference to regencies and cities, also generated inefficiency due to scarce local competencies and high level of corruption with negative repercussions in attracting FDIs and boosting domestic businesses (Firman, 2009).

The GDP growth began to have a positive sign in 1999 with less than 1% and then it grew by 4% on average between 2000 and 2003 (Figure 5.1). Importations and exportations started to grow though with volatile rates, and FDI inflows slightly recovered (Figure 5.2). The inflation fell under 4% in 2000 for then fluctuating between 11% and 6% between 2000 and 2003 (Figure 5.3). The industry reached 45% and manufacturing around 30% as a share of the GDP, whereas agriculture continued to decrease its economic weight reaching 15%. Despite this, industry created much lower jobs with around 20% (of which 12% within manufacturing) than agricultural activities with more than 40% of the total employment (Figure 5.4). Although the recovery performance varied across sectors where export-oriented firms were able to recover faster than others, Indonesia struggled to bring back the economy on growth after the AFC. This could be mainly attributed to the excessive regulatory policies, the rising of labour costs and other labour market rigidities (Aswicahyono, Hill, & Narjoko, 2013; Staff of the World Bank, 2012), which negatively influenced the economic competitiveness. In particular in the pre-crisis period, the wages growth was supported by the Indonesian economic expansion and the trade unions were heavily controlled by the Soeharto's authoritarian regime. After the AFC and the resignation of NOR, pro-labour pressures emerged obtaining regulated minimal wages creating a divergence between salaries and productivity where the former increased at higher pace than the latter due to the weak economy.

5.2.3.2 Regional and industrial cluster policies (2004–onwards)

The Indonesian Government began to prioritise industries based on industrial cluster and regional approaches to cope with the difficulties of economic recovery. Four crucial inter-related documents with a medium and long-term visions were released targeting manufacturing and the whole economy[15]. The National Long Term Development Plan 2005–2025 (Rencana Pembangunan Jangka Panjang Nasional–RPJPN) aims to improve efficiency, modernization, and productivity in the primary sector (including mining), promoting local and international competitiveness, more balanced economic development with particular reference to less developed locations outside Java Island. This plan also recognizes the importance of transportation, communication, energy, and technology as drivers for the country development. A further important document refers to the National Medium Term Development Plan 2004–2009 (Rencana Pembangunan Jangkan Menengah Nasional–RPJMN), which identified 10[16] specific clusters based on the following criteria: creation of employment, meeting domestic needs, processing domestic natural resources including agricultural resources, and having export potential. The RPJPN is implemented through the five years plan of RPJMN, which allows a more consistent formulation and adaptation of strategy and budget allocation based on economic mutations.

The National Industrial Policy was lunched by the Presidential Regulation No. 28 in 2008 and Regulation of the Minister of Industry 41/M-IND/PER/3/2010 providing specific policies for the country's industrial development (with particular reference to non-oil and gas industries). It prioritizes the development of agro-based activities, transportation, information technology and telecommunication equipment industries. A more recent important document refers to The Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025 (MP3EI), which was released in 2011. It aims to increase economic balance, sustainable economic growth and prosperity focusing on sensitive country's issues such as infrastructure development, human capital, poverty reduction, among others (Coordinating Ministry for Economic Affairs, Republic of Indonesia Ministry of National Development Planning, & National Development Planning Agency, 2011). The MP3EI sets the ambitious targets to become a high-income nation, the world's 10th economy by 2025, and the 6th largest economy by 2050. The MP3EI also combines cluster and regional approaches setting six strategic economic corridors (Figure 5.5) enhancing inter-regional connectivity and transactions, with particular reference to less-developed areas. The construction of six economic corridors aims to valorised regional competitive advantages developing specialized centres of production (Coordinating Ministry for

15. Only selected Indonesian policies are investigated useful to unfold the major policy orientation and interventions in the country.

16. The ten clusters are: food and beverage industry, marine resource processing, textiles and garments industry, footwear industry, oil palm industry, wood-products industry (including rattan and bamboo), rubber and rubber products industry, pulp and paper industry, electric machinery and electronics industry, and petrochemicals industry.

Economic Affairs et al., 2011). The MP3EI is an integral part of the national development scheme and it does not aim to substitute the RPJPN and the RPJMN.

Although these policies interventions did not fully generated yet their effects on the economy, Indonesia started to grow with higher rates than the recovery period albeit manufacturing reduced its contribution. The GDP and GDP per capita grew by around 6% and 4% respectively on average between 2004 and 2013, and FDI inflows slightly increased its economic relevance reaching 3% in 2013 thought it stills a small fraction of the whole economy (Figure 5.2). The inflation rate was relatively under control with 7% on average between 2004 and 2013 (Figure 5.3). Industry's value added and employment continued to have positive trends though manufacturing activities seem to be embarked in a descendent trajectory, as shown by the reduction of their value added share and practicably a flat trend for job creation (Figure 5.4). Indeed, value added and job creation within agriculture persistently slowed down (Figure 5.4). It is relevant to observe that the Global Financial Crisis (GFC, 2008-2009) moderately affected the economy (Figure 5.2) with lower impact than other economies (Figure 5.1). Since the country's financial sector remained broadly intact and the exchange rate depreciated only moderately, though export-oriented firms suffered more caused by their international exposition (Aswicahyono et al., 2010). In fact, importations and exportations growth decreased by 15% and 9% respectively in 2009 (Figure 5.1).

Starting from 1960 where the economy was mainly based on agricultural activities, nowadays, the Indonesian economy is highly dependent on the contribution of industry and service sectors. In particular, this latter constantly contributed to the GDP between 30% and 40% during 1961 and 2013 generating much higher jobs than industry. Recently, the employment within service sector overcomes agricultural employment accounting for more than 40% of the total employment. Instead, industry has the highest contribution of the country's GDP though it has the lowest job creation (Figure 5.4).

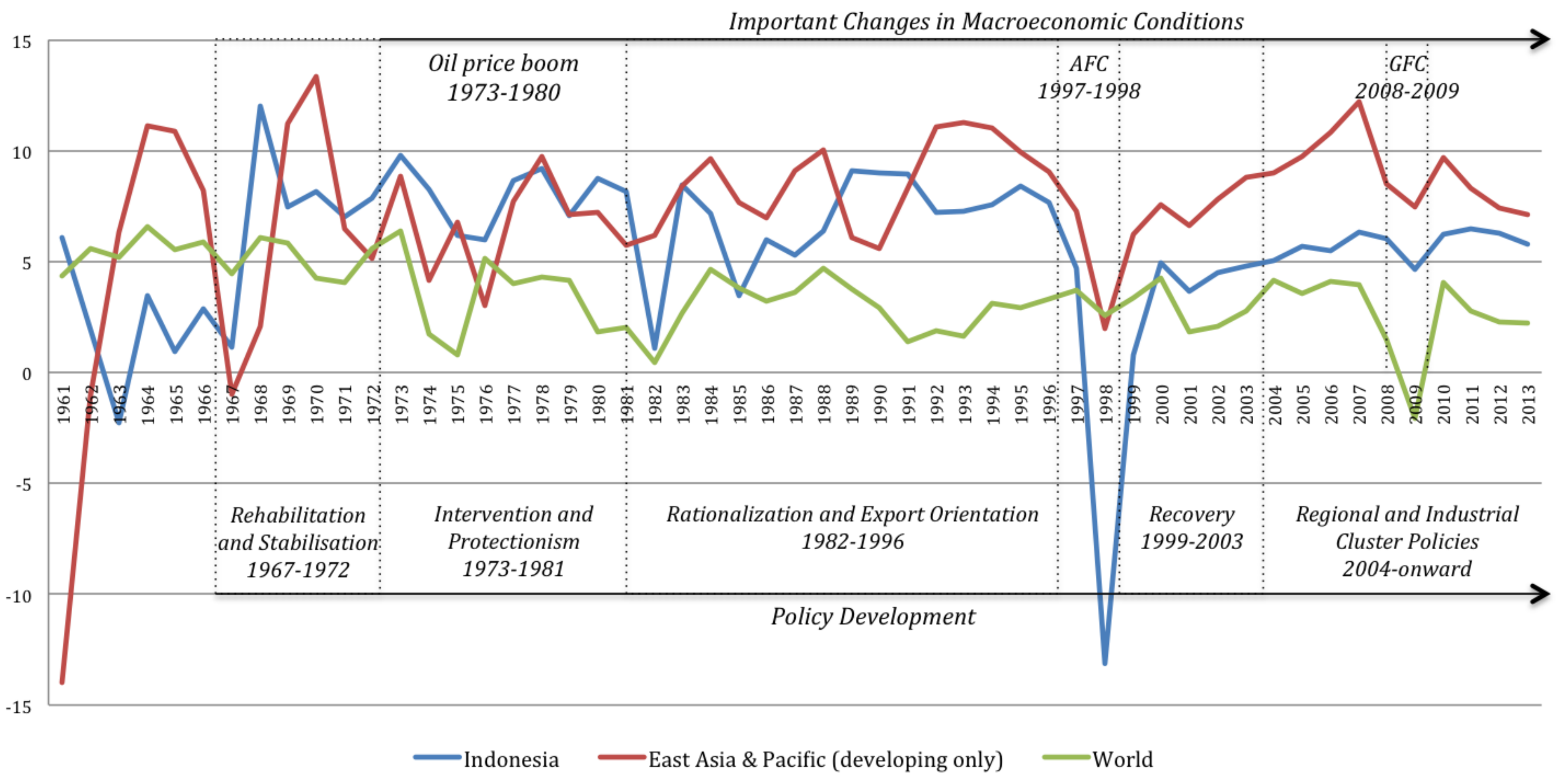

Figure 5.1: The annual GDP growth in Indonesia, East Asia & Pacific (developing only), and the world's economy by Indonesian economic phases and policy interventions during 1961 and 2013.

Source: World Development Indicators (World Bank, 2015). Notes: East Asia & Pacific (developing only) includes developing countries within Indonesian region: American Samoa, Cambodia, China, Fiji, Indonesia, Kiribati, South Korea, Lao PDR, Malaysia, Marshall Islands, Micronesia Fed. Sts. Mongolia, Myanmar, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Thailand, Timor-Leste, Tonga, Tuvalu, Vanuatu, Vietnam.

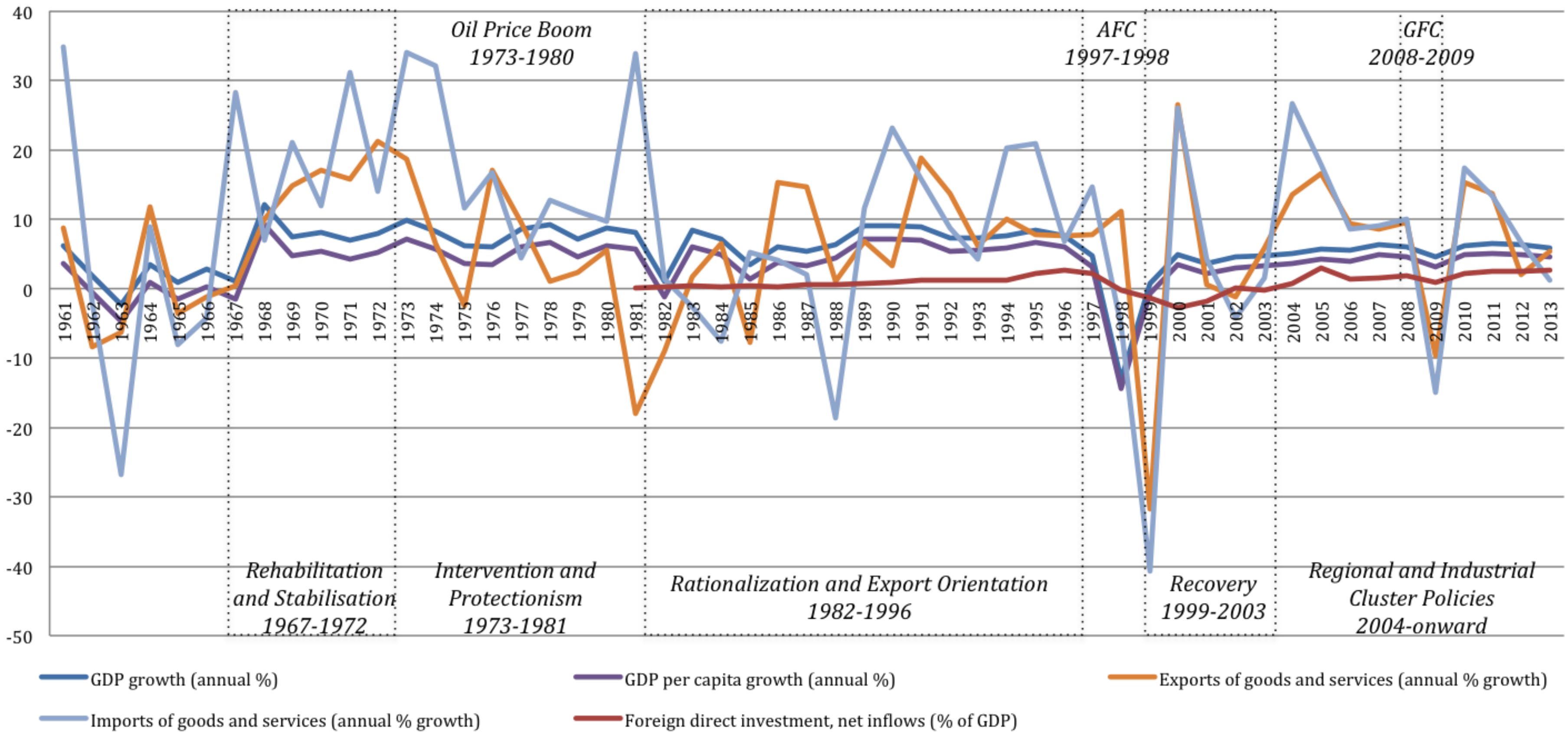

Figure 5.2: The annual percentage growth of GDP, GDP per capita, export and import of goods and services, and FDI inflows in Indonesia between 1961 and 2013.

Source: World Development Indicators (World Bank, 2015). Notes: the data of FDI net inflows is available from 1981, which represents the differences between new investment inflows less disinvestment from foreign investors divided by the country' GDP.

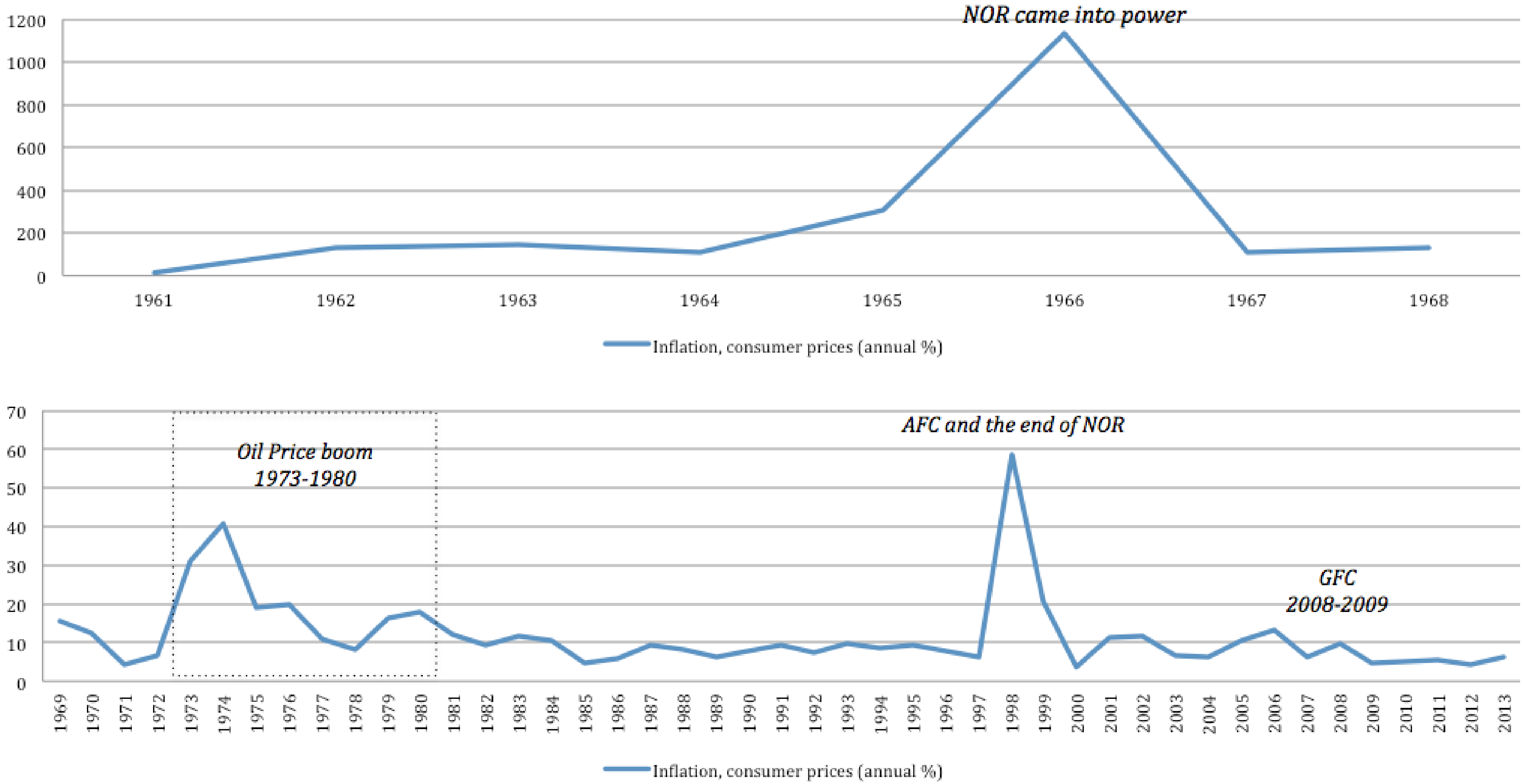

Figure 5.3: The inflation rate variations in Indonesia between 1961 and 2013.

Source: World Development Indicators (World Bank, 2015). Notes: The inflation rates are reported based on the consumer price index.

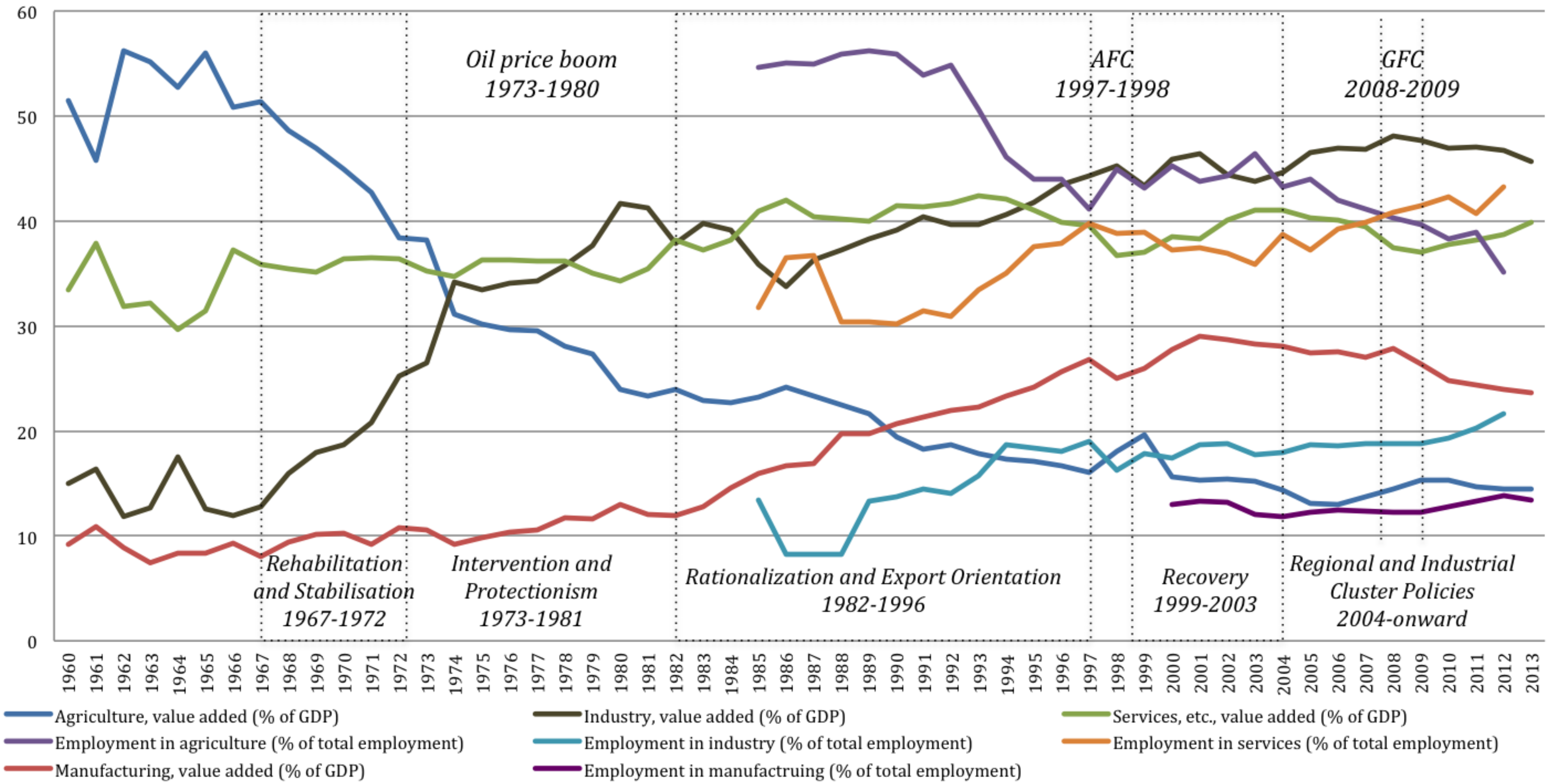

Figure 5.4: The structural change in the Indonesian economy between 1960 and 2013: Value added and employment as a percentage of GDP and total employment respectively of agriculture, industry, service and manufacturing.

Sources: All data are from the World Development Indicators (World Bank, 2015) with an exception of manufacturing employment, which is computed by the author based on BPS' data (Badan Pusat Statistik, 2015). Notes: Industry denotes the aggregation of mining and quarrying (including oil production), manufacturing, construction, and public utilities (electricity, gas, and water). Manufacturing refers to industries belonging to ISIC divisions 15-37. Service includes value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. The Employment data of main sectors are available from 1985 and manufacturing employment is available from 2000.

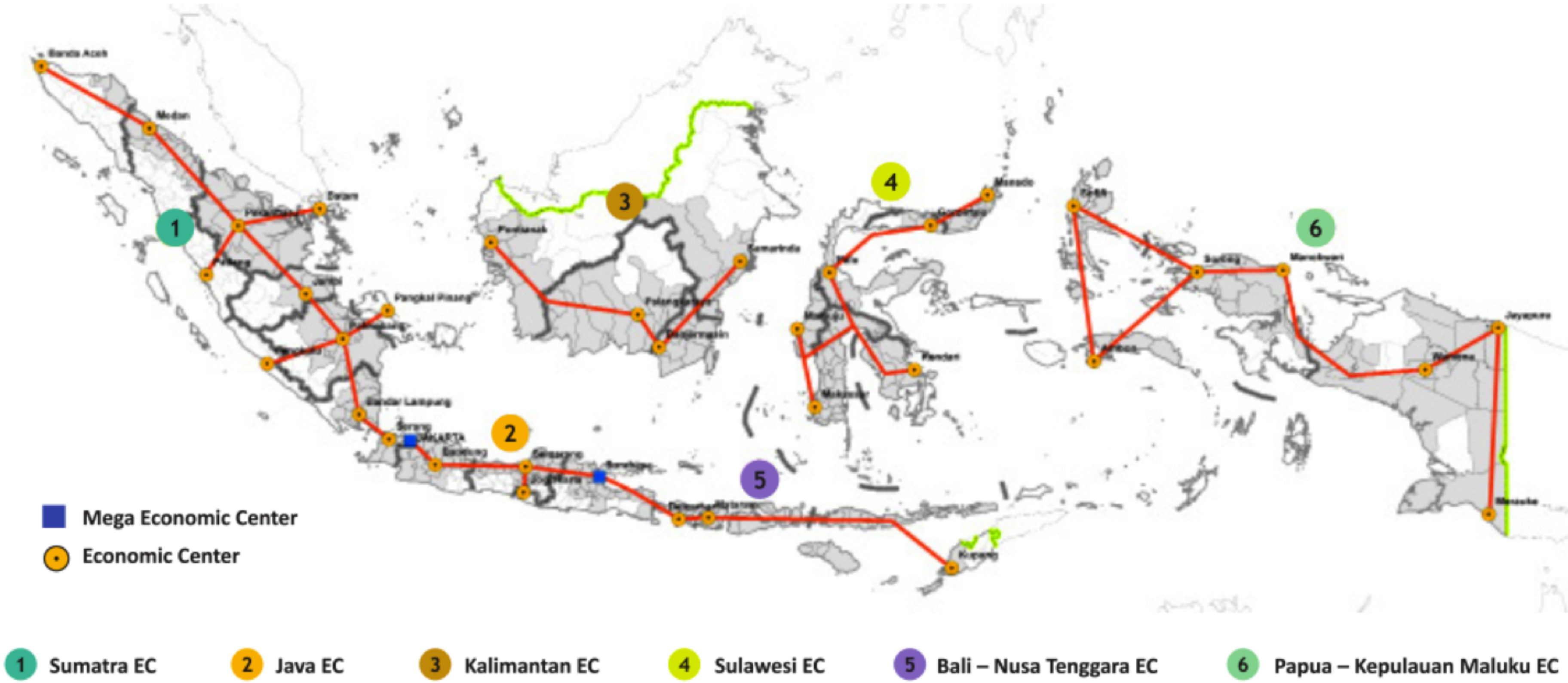

Figure 5.5: The map of six Indonesian economic corridors set by the Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025.

Source: Coordinating Ministry for Economic Affairs et al. (2011). Notes: the six economic corridors (ECs) are developed based on specific location characteristics valorising their competitive advantages aiming to establish specialized centres of production as follows: Sumatra Economic Corridor as a centre for production and processing of natural resources and nation's energy reserves, Java Economic Corridor as a driver for national industry and service provision, Kalimantan Economic Corridor as a centre for production and processing of national mining and energy reserves, Sulawesi Economic Corridor as a centre for production and processing of national agricultural, plantation, fishery, oil & gas, and mining, Bali and Nusa Tenggara Economic Corridor as a gateway for tourism and national food support, Papua and Kepulauan Maluku Economic Corridor as a centre for development of food, fisheries, energy, and national mining.

5.3 The rise and fall of manufacturing and the beginning of its transformation

Indonesia witnessed important transformations on its economic structure switching from an agriculture-based economy to a more industrialized nation. However after the AFC, manufacturing activities seem to be embarked in a deindustrialization pathway encouraging policymakers to developed various policies based on regional and cluster approaches in order to revitalize manufacturing. The reduction of competitiveness of traditional sectors led to a composition change, where the most competitive and innovative sectors increased their contributions and the less efficient ones reduced it. The establishment and growth of manufacturing in Indonesia is desirable since it is a driving force behind the economic growth, per capita income, living standard, quality of jobs, and poverty alleviation due to its high productivity (Naudé, 2013), though manufacturing does not generate as much as employment. Manufacturing activities contribute to economic diversity increasing economic resilience to external shocks. In addition, manufacturing tends to cluster generating externalities between economic agents favouring knowledge spillovers within and across industries. Input-output linkages can have the same effect as the market size enlarging industrialization and urbanization. In developing countries, manufacturing is playing a crucial role on growth and it was the most important source in advanced economies during 1950 and 1973 (World Bank, 2015). In the rest of this section, manufacturing evolution is investigated highlighting the contribution change by major sectors within manufacturing.

5.3.1 Manufacturing transformation

Between 1967 and 1996, manufacturing increased its economic share by almost 15% and its growth always exceeded the GDP growth (Figure 5.6). The AFC was a turning point for the country's economy and manufacturing though the crisis moderately hits manufacturing sectors in comparison of the whole economy. The GDP growth decreased by more than 4% and manufacturing growth dropped by 3% on average during the AFC (Figure 5.6). As aforementioned, manufacturing substantially increased its economic share during the export-oriented strategy between 1982 and 1996 where exportations played a key role on it. It is relevant to notice that manufacturing exportations substantially increased from just 5% on average between 1973 and 1981 to almost 55% on average between 1999 and 2003 as a share of merchandise exports (Figure 5.6). This generated a temporary convergence between exportations and importations until the recovery period, and from 2004, their divergence trajectory re-emerged (Figure 5.6). This inevitably intensifies the country's dependency on importations increasing its vulnerability to external shocks. In the past, exportations played an important role on manufacturing growth and their decline contributed to the process of shrinking its economic contribution where manufacturing began to growth with lower pace than the country's GDP (Figure 5.6).

The decline of manufacturing could be due to the excessive regulatory policies, the rising cost of labour and other labour market rigidities (Aswicahyono et al., 2013; Staff of the World Bank, 2012). The salaries within manufacturing increased by more than 70% between 1997 and 2013[17] (Badan Pusat Statistik, 2014) where Indonesia has one of the highest minimum wages in the world on average, although they varies across provinces (OECD, 2012). The raise of labour costs was partially caused by the minimum salaries achieved after the AFC reducing the country's competitiveness. The Indonesian manufacturing industrial structure is characterized by labour intensive industries and the increase of wages undermined their competitiveness and the overall manufacturing growth. This fostered the composition change (Figure 5.7) where high and medium-high technology intensity industries[18] increased their economic contribution between 1990 and 2009. In particular, chemicals[19], and machinery and transport equipment[20] increased their value added share by 8 % and 10% respectively. However just recently, chemicals activities had an exponential increase of their shares. Whereas, food, beverages, and tobacco[21], and textiles and clothing[22] industries decreased their manufacturing contribution by 5% and 4% respectively between 1990 and 2009.

This tendency can be interpreted as an initial sign of manufacturing landscape change towards higher degrees of technology intensity industries, which can reinvigorate the whole manufacturing growth due to their innovation propensity. It also enhances industrial diversification and resilience since the country stills dominated by labour-intensity industries. However, manufacturing growth cannot be achieved without revitalizing labour-intensity industries due to their predominant localization in the country. Thus, these industries need to build an alternative and more durable competitive advantages rather than just rely on cost of labour such as enhancing their sophistication and quality of goods, and innovation capabilities. In this context, knowledge spillover and human capital can play an essential role on it and they can support manufacturing transformation towards knowledge-based productions. In the next section, innovation environment and human capital formation in Indonesia are investigated, which are considered the major drivers (or constrains) for the current manufacturing revitalization. Urbanization trajectory is also explored since it can provide new manufacturing opportunities due to the generation of new urban centres and agglomeration externalities.

17. The data refers to production workers in manufacturing below supervisory level.
18. It is based on OECD's classification (2011), which has been widely employed within the present work.
19. Chemicals correspond to ISIC division 24.
20. Machinery and transport equipment denote ISIC divisions 29, 30, 32, 34, and 35.
21. Food, beverages, and tobacco indicate ISIC divisions 15 and 16.
22. Textiles and clothing represent ISIC divisions 17-19.

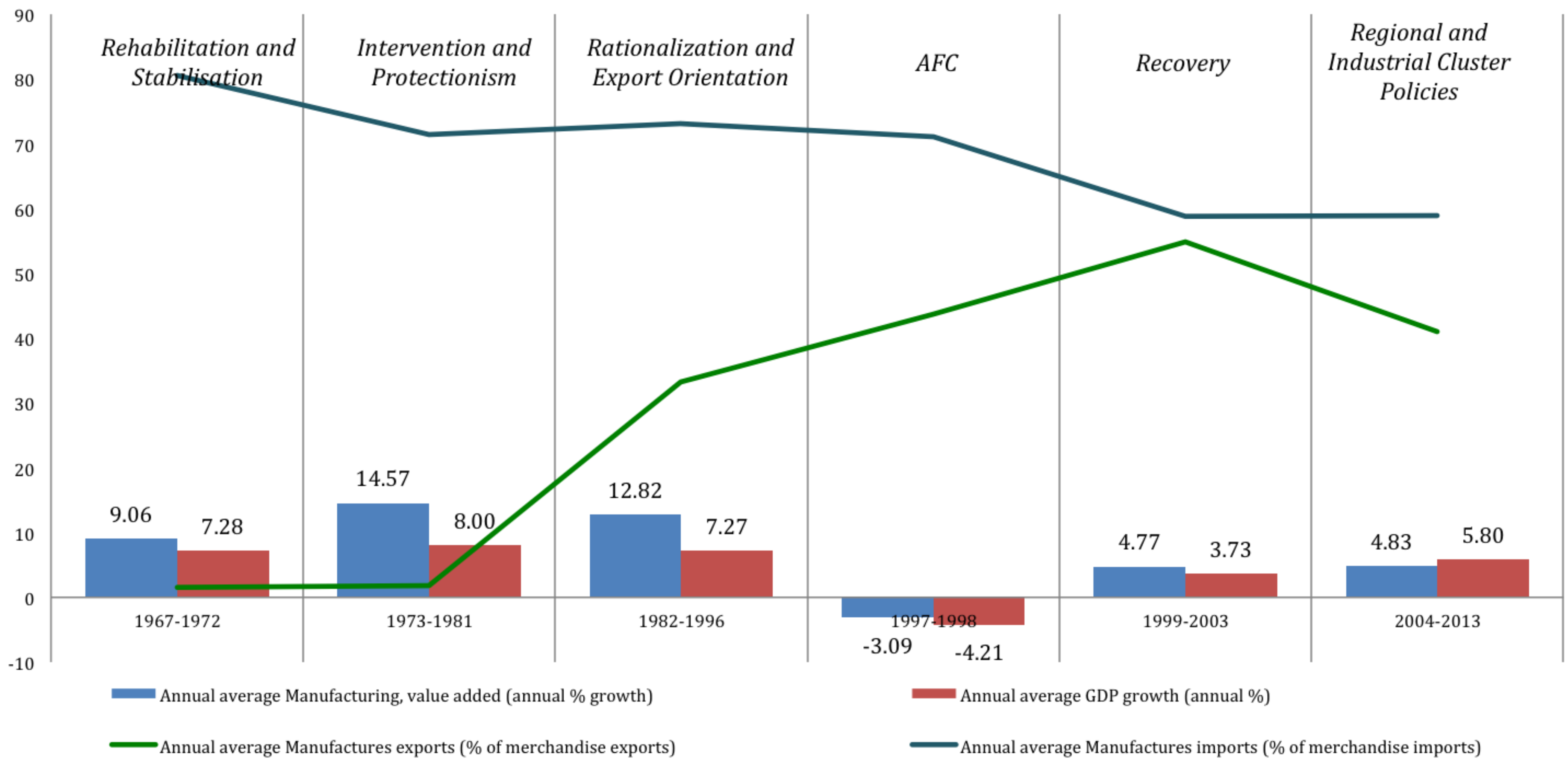

Figure 5.6: Annual average of manufacturing value added and GDP growth, and manufacturing import and export as a percentage of merchandise by the country' stages between 1967 and 2013.

Source: Author's compilation based on World Development Indicators (World Bank, 2015). Notes: Manufacturing growth refers to industries belonging to ISIC divisions 15-37. Manufactures import and export include sections 5 (chemicals), 6 (basic manufactures), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured goods), excluding division 68 (non-ferrous metals) based on the Standard International Trade Classification (SITC). The GBC is not reported since it does not significantly affect manufacturing, which has been incorporated in 2004-2013 period.

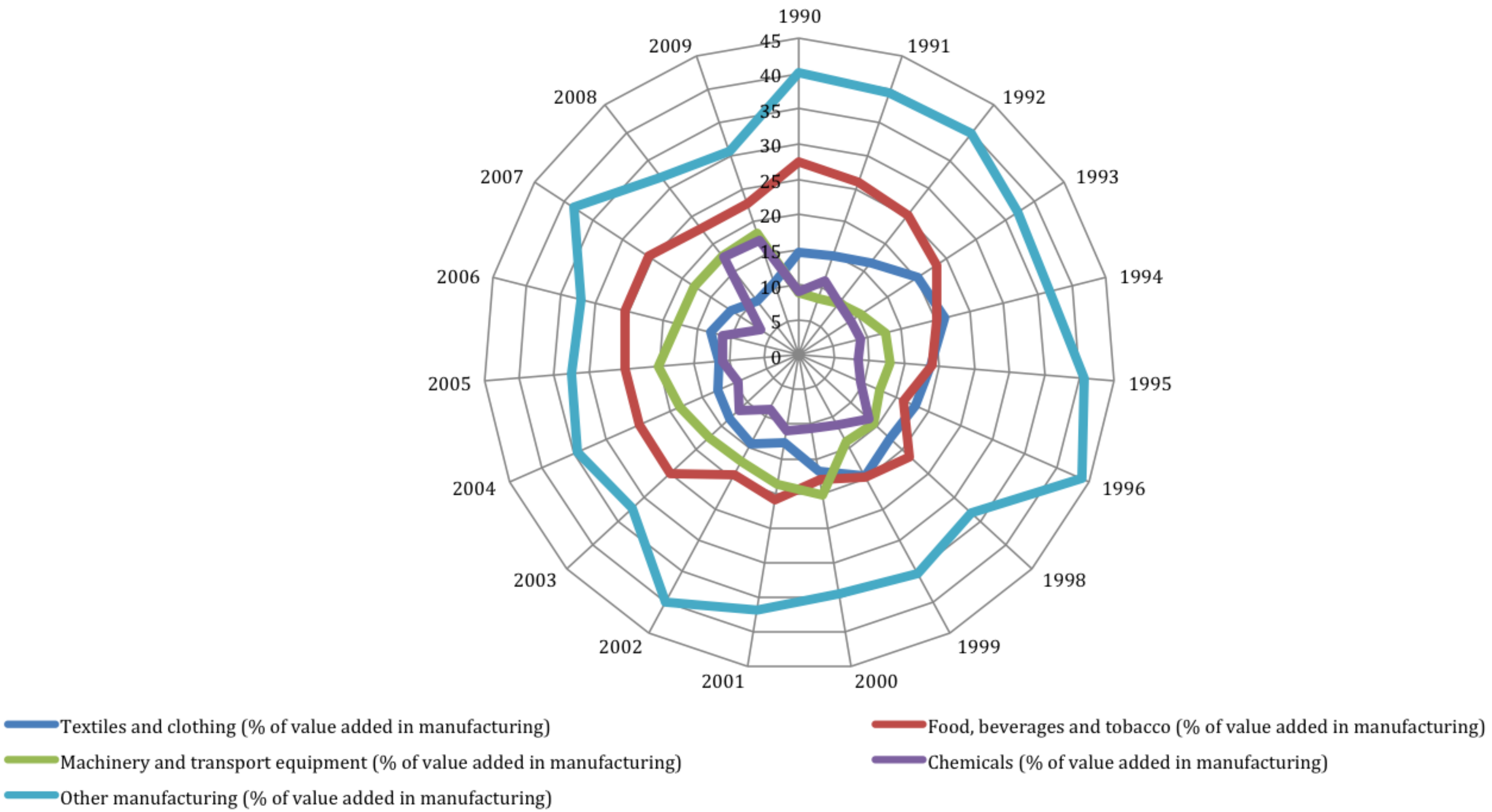

Figure 5.7: The contribution of major manufacturing industries as a percentage of total manufacturing value added in Indonesia between 1990 and 2009.

Source: World Development Indicators (World Bank, 2015). Notes: The data is available from 1990 to 2009 and it is missing in 1997. Machinery and transport equipment correspond to ISIC divisions 29, 30, 32, 34, and 35. Food, beverages, and tobacco correspond to ISIC divisions 15 and 16. Chemicals correspond to ISIC division 24. Textiles and clothing correspond to ISIC divisions 17-19.Other manufacturing, a residual, covers wood and related products (ISIC division 20), paper and related products (ISIC divisions 21 and 22), petroleum and related products (ISIC division 23), basic metals and mineral products (ISIC division 27), fabricated metal products and professional goods (ISIC division 28), and other industries (ISIC divisions 25, 26, 31, 33, 36, and 37).

5.4 The current manufacturing challenges

After the AFC, manufacturing activities decelerated since they lost their competitiveness with particular reference to traditional sectors (mainly labour intensity) that highly contributed to the past country' growth (e.g. textile and clothing, see Figure 5.7). This has generated a manufacturing transformation, with particular reference towards more knowledge-based productions. Underpinning manufacturing competitiveness and transformation should be pursued through building more durable competitive advantages based on knowledge creation and diffusion where skilled labour is a crucial component in this process. Manufacturing expansion plays an important part for the Indonesian economy due to its high productivity and its propensity to cluster favouring the generation of agglomeration externalities. It is necessary to notice that the spatial distribution of agents in Indonesia is highly imbalanced where the localization is concentrated in Java Island, which is denoted by large cities. However, spatial inequality is gradually reduced since less agglomerated places grew faster than more developed locations generating new manufacturing opportunities through the creation of new urban centres. Recently, Indonesian policymakers have moved in these directions embracing regional and cluster approaches, which recognize the importance of locations and industrial agglomerations as contributors to growth. They also favoured a re-balancing of the spatial economic distribution between locations. For instance, the MP3EI includes actions to foster industrial development, connectivity between locations, human capital formation, knowledge exchanges, innovation capabilities, and reduce economic inequality.

The rest of this section is organized as follows. In Section 5.4.1, the innovation environment within the country is explored in order to assess the potentiality (or constrain) of knowledge creation and diffusion. In Section 5.4.2, the trend of human capital formation is examined, which is a critical element for innovation and manufacturing revitalization. In Section 5.4.3, urbanization trajectory is investigated, which can represents new opportunities for manufacturing activities.

5.4.1 Innovation environment

Quite recently, there has been a rediscovery of the central importance of innovation as a driver of economic growth and productivity of nations, regions, sectors, and firms (Hanusch & Pyka, 2007). In particular, this was favoured by the increase of knowledge-based economies around the world (Hudson, 2001, 2005; OECD, 1996). Although, Indonesian industrial policies take into account innovation as an important driver for manufacturing development, the country seems to have a weak innovation environment on various measures compared with other emerging countries in the region (OECD, 2010). In particular, R&D expenditures are just less than 0.1% as GDP's share in 2000 and practicably unchanged in 2009 and researchers employed within R&D decreased from 215 to

90 per million people between 2000 and 2009 in Indonesia (Figure 5.8). Other developing economies in the region have a much higher R&D expenditures and researchers employed and they doubled their spending and professionals between 2000 and 2009 (Figure 5.8).

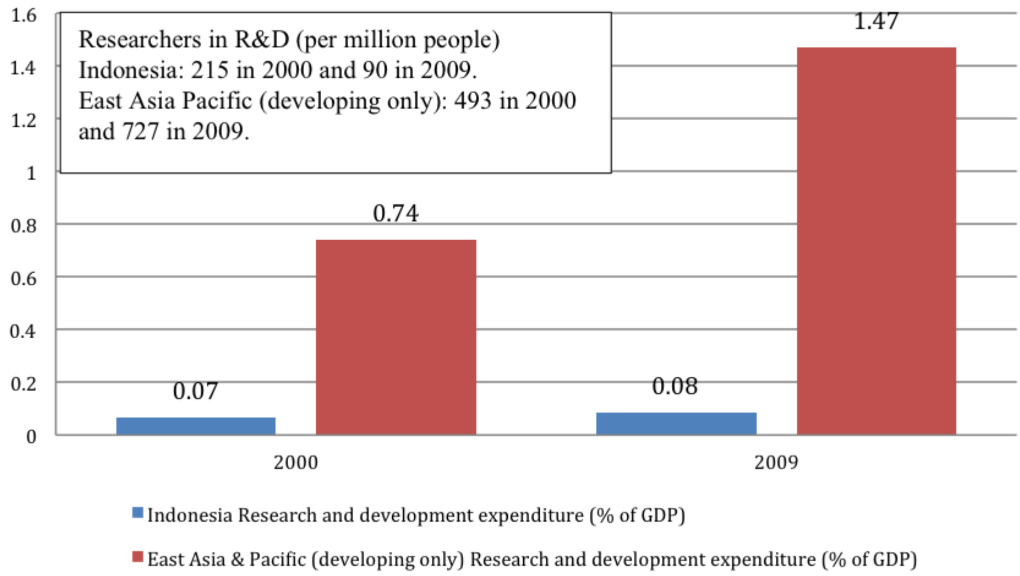

Figure 5.8: Research and development expenditure in Indonesia and East Asia and Pacific (developing only) as a percentage of GDP in 2000 and 2009.
Source: World Development Indicators (World Bank, 2015). Notes: Expenditures for research and development includes public and private covering basic research, applied research, and experimental development. Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned (postgraduate PhD students engaged in R&D are included).

In addition, it is relevant to observe that the large majority of patent's applications are from non-residents though a positive trend of patents by residents can be noted (Figure 5.9). Residents almost doubled on average their patent's applications from the recovery period to the adoption of regional and cluster policies. Innovation and technological capability accumulations are essential elements for the industrial catch-up (Lucas, 2008) where FDIs play an important role on it. However, the lack of Governmental efforts to research and development constrained innovation generation and diffusion, which negatively affected the localization and exportation of high-technology activities. High-technology goods experienced a substantial reduction of exportations from 17% in 2005 to 7% in 2012 as a percentage of manufacturing exports (Figure 5.10). High-technology exports are highly boosted during the export-oriented strategy, and they drastically decreased from 2005 (Figure 5.10).

Regaining manufacturing competitiveness in Indonesia cannot be pursue without the construction of a conductive innovative environment to facilitate the generation and diffusion of innovations. This could be achieved by increasing government efforts on R&D, encouraging FDI inflows, and the localization and exportation of more technological advanced industries. These factors are essential drivers for the current manufacturing revitalization in order to boost capabilities to innovate and differentiate the industrial structure, which is currently based on labour-intensive industries making manufacturing vulnerable to external shock.

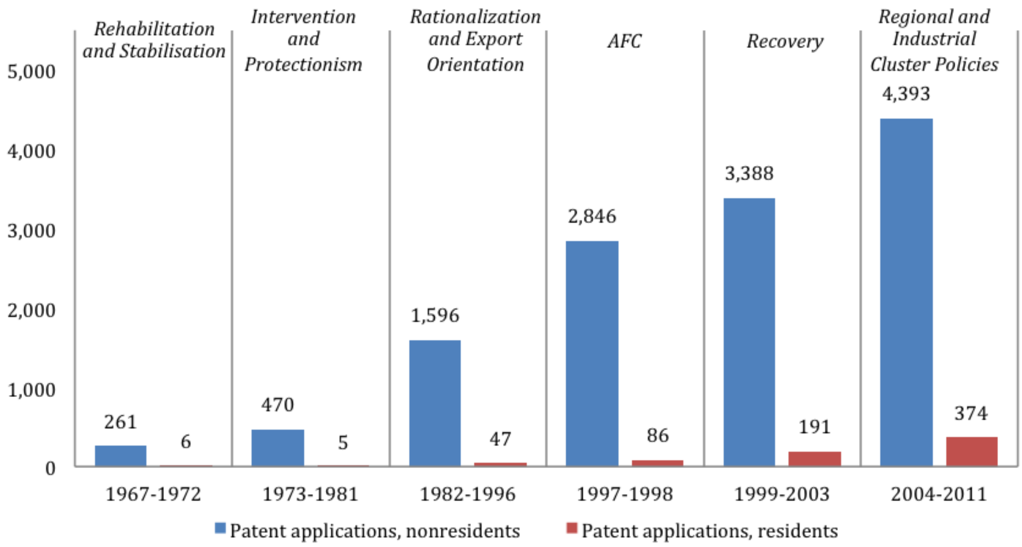

Figure 5.9: Average of patent's applications of non-residents and residents by different stages in Indonesia between 1967 and 2013.
Source: Author's compilation based on World Development Indicators (World Bank, 2015). Notes: the patent data is the average of all applications during each period with exclusion of missing years as follows: 1967, 1972, 1981, 1988, 1990, 2007, and 2008.

Figure 5.10: High-technology exports in Indonesia as a percentage of manufactured exports between 1989 and 2012.
Source: World Development Indicators (World Bank, 2015). Notes: High-technology exports include products with high R&D intensity, such as aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.

5.4.2 Human capital formation

Enhancing innovation capabilities can be achieved without an adequate creation of skilful labour, where the country's education system[23] plays a central role on it. The Indonesian Government has made important efforts in order to increase the quality and a more universal access to education and training programs, albeit several challenges emerged. For instance, the governmental financial resources to support the formation of human capital, and the substantial increase of enrolments within secondary and tertiary educational levels undermining the intensity and standard of knowledge transfer (see, for instance, OECD/ Asian Development Bank, 2015). The Indonesian Government progressively increased on average its public spending on education reaching 16% of the total government expenditure between 2004 and 2012, which is higher than other peer countries in the region (Figure 5.11). In addition, it is observed a constant increase of savings on education expenditures between 1988 and 2012. From 2004, the education outlays of savings in Indonesia overcame developing economies in East Asia and Pacific as a percentage of the Gross National Income (GNI) (Figure 5.11).

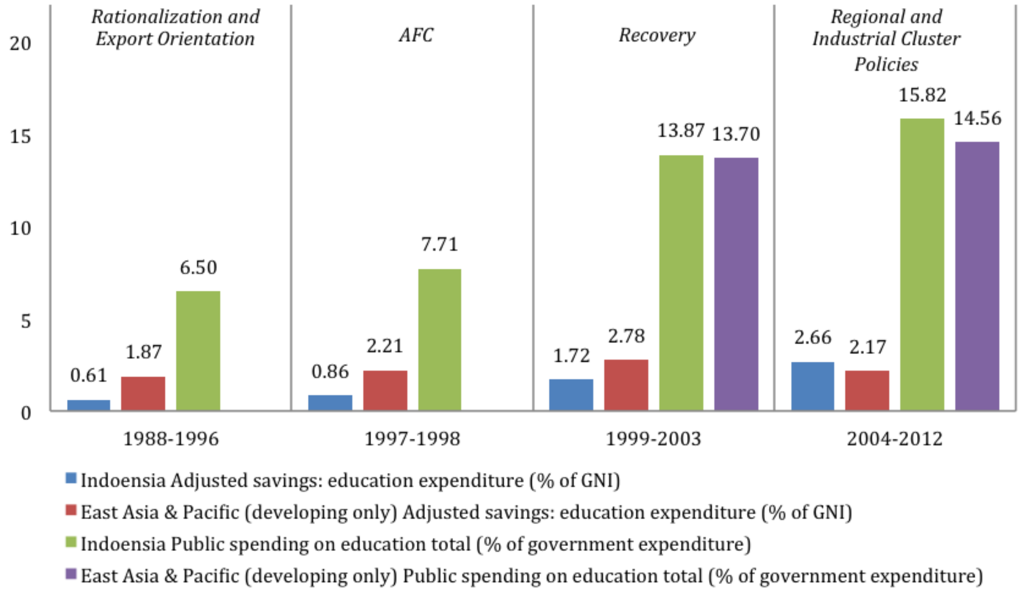

Figure 5.11: Average of education expenditure and public spending in Indonesia and East Asia and Pacific (developing only) by different stages between 1988 and 2012.

Source: Author's compilation based on World Development Indicators (World Bank, 2015). Notes: Education expenditure includes wages and salaries and excluding capital investments in buildings and equipment. Public expenditure on education consists government spending on educational institutions (public and private), education administration, and subsidies for private entities such as students. Several years are missing for the public spending on education, for Indonesia the following years are not present in the data: 1988-1993, 1998-2000, 2006; and for East Asia & Pacific (developing only) the following years are missing: 1988-1998, 2003, 2005-2006, 2009, 2010-2012.

This increase of public and private expenditures on education contributed to the enrolment in secondary and tertiary educations, which progressively increased

23. For a full overview of education system in Indonesia see, for instance, OECD/ Asian Development Bank (2015).

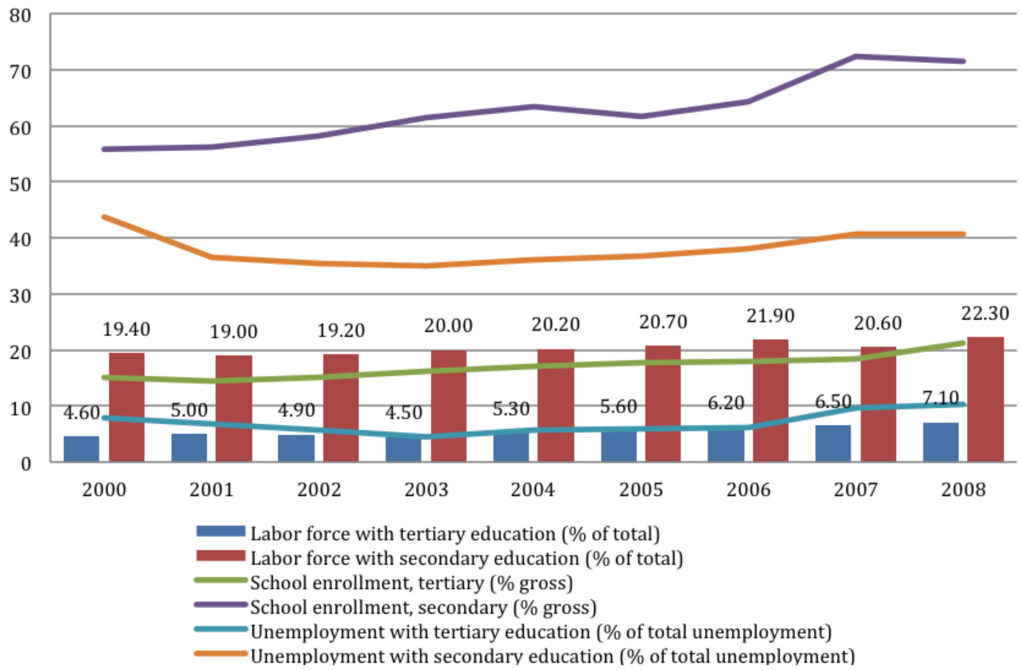

Figure 5.12: Labour force, school enrolment, and unemployment with secondary and tertiary educations in Indonesia between 2000 and 2008.
Source: World Development Indicators (World Bank, 2015).

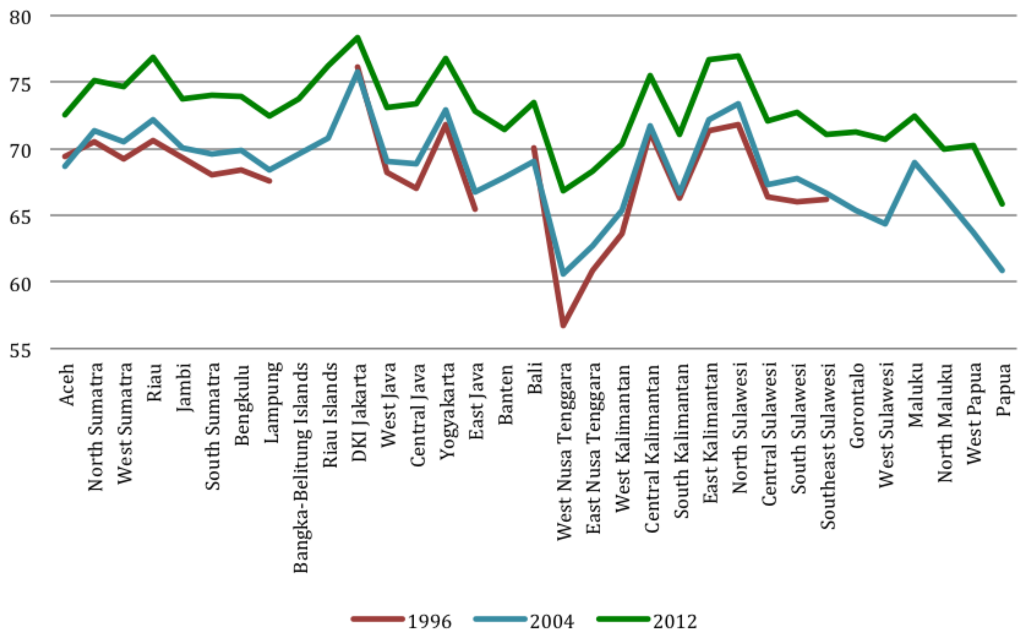

Figure 5.13: Human Development Index (HDI) by provinces in Indonesia between 1996 and 2012.
Source: BPS (Badan Pusat Statistik, 2015). Notes: The location of North Kalimantan is missing in all periods and the data for several locations are not present in 1996. The country's average of HDI is 67.7 in 1996, 68.7 in 2004, and 73.29 in 2012.

between 2000 and 2008. More than one-fifth and almost one-tenth of the labour force in Indonesia have secondary and tertiary levels of education respectively in 2008 (Figure 5.12). However, it is relevant to notice a lack of qualified job creation in the country as shown by the increase of unemployment rates holding secondary and tertiary levels of education accounting for 40% and 10% respectively of the total unemployment in 2008 (Figure 5.12). Human capital positively impacts innovation capabilities, economic and manufacturing growth and living conditions of people. Taking into account the Human Development Index (HDI)[24] as a composite measure of human development, it is notable that HDI increased in all provinces between 1996 and 2012 (Figure 5.13). Although high differences across provinces are observable, a reduction of inequalities among locations emerges where the index moved in the range between 57 and 76 (19 points) in 1996, and between 66 and 78 (12 points) in 2012 (Figure 5.13).

5.4.3 Urbanization trajectory

Indonesia is a large country in terms of geographic scale and inhabitants with almost 2 million km^2 and 250 million people. For quite long time, the country witnessed high economic growth accompanied by a rapid increased of population density and urbanization where more than 50% of the population is living in cities in 2011 (Figure 5.14) and this trend is destined to continue in the forthcoming years (population projections, Badan Pusat Statistik, 2015). Urbanization favours the emergence of agglomeration economies recalling the Krugman's framework (1991a, 1991c). Empirical evidence (see, for instance, UN-HABITAT, 2010) shows that there is a significant correlation between urbanization and industrial development since GDP per capita, living standard, firms and workers concentration and their productivity tend to increase simultaneously in more urbanized locations reducing poverty and inequity. However, urbanization can generate negative externalities when a critical threshold of over-congestion is overcome.

Although the population growth progressively decreased between 1967 and 2013, the urban population grew with much higher rates than rural population between 2% and 4%, and the population expansion within rural areas turns negative from 1997 onwards (Figure 5.15). Java Island remains the main area of agents' localization characterized by large cities, albeit a shifting of inhabitants' localization within less urban agglomeration emerges. The population in the largest cities declined as a percentage of urban population, whereas urban centres with inhabitants lower than 1 million increased their ratio with respect to the total population (Figure 5.15). Indonesia witnessed a fast urbanization where urban population will be approximately 67% by 2025 where less urbanized places grow faster than more urbanized locations (World Bank, 2012).

As emerge in Figure 5.16, the population grew with higher pace outside Java Island between 2000 and 2010 reducing inequality of population distribution creating new urban agglomerations, which can represent new manufacturing

24. The HDI is a composite measure of three dimensions of human development such as life expectancy, education, and income. The index was created by a Pakistani economist Mahbub ul Haq in order to provide an alternative measure based on people and their capabilities rather than a merely measure based on economy growth (see, for instance, United National Development Program (UNDP), 2013).

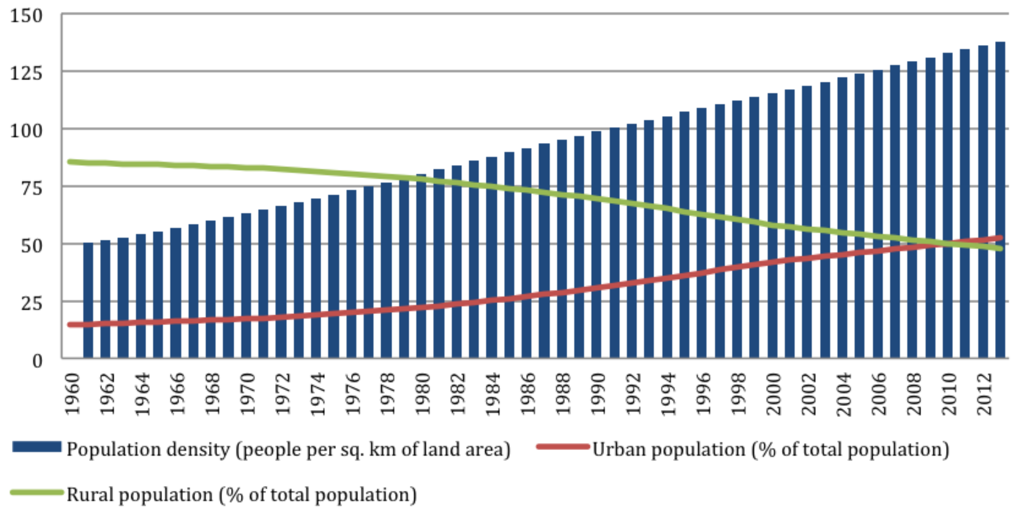

Figure 5.14: Population density, urban and rural population in Indonesia between 1960 and 2012.
Source: World Development Indicators (World Bank, 2015).

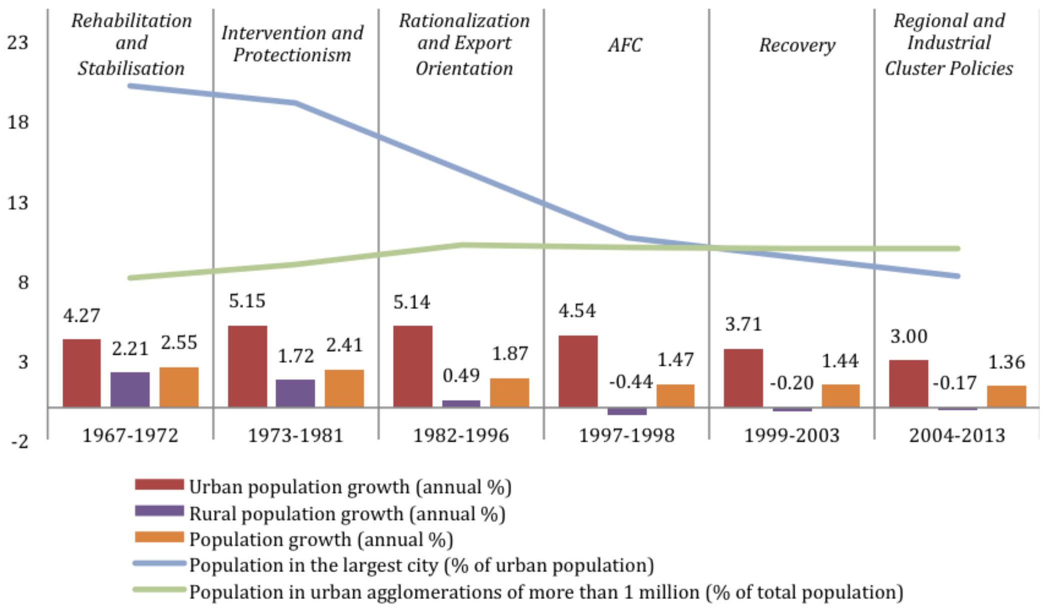

Figure 5.15: The average growth of population, urban and rural areas and population's concentration within major Indonesian cities by different stages between 1967 and 2013.
Source: Author's compilation based on World Development Indicators (World Bank, 2015). Notes: Population in urban agglomerations of more than one million is the percentage of a country's population living in metropolitan areas that in 2000 had a population of more than one million people.

opportunities in Indonesia. This also suggests that the current urbanization challenges of numerous Indonesian cities can be used as a lesson to cope with similar related urbanization issues within new urban centres. Urbanization inequalities among Indonesian locations represent an important issue, which determined a divergence of economic and industrial development. However in the last four decades, Indonesia did not gain on urban development as much as other Asian countries characterized by similar urbanization tendencies (World

Bank, 2012).

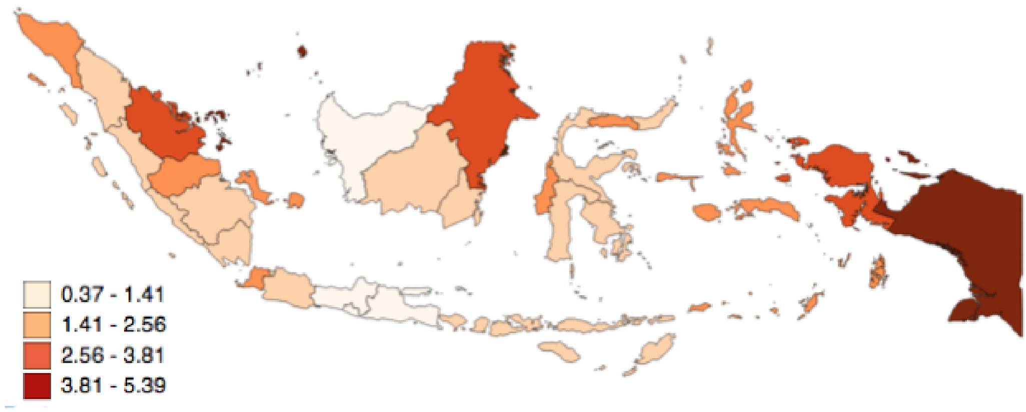

Figure 5.16: The average population growth by Indonesian provinces between 2000 and 2010.
Source: Author's compilation based on BPS's data (Badan Pusat Statistik, 2015).

5.5 Conclusions

This chapter was devoted to investigate the Indonesian economy and manufacturing evolutions within different country's stages characterized by the development of diverse policies, which were often dictated by the macro-economic mutations. Four main points emerged. First during the NOR period, Indonesian economy witnessed a structural change from an agrarian economy to an industrialized nation. This was due to favourable macroeconomic conditions (i.e. oil price boom) and the successful of the Soeharto's regime policies. Second, the AFC significantly hits the Indonesia economy and manufacturing activities highlighting the country's weaknesses to external shocks, and it struggled to recover where the economic level before crisis is far off to be reached. Third after the AFC, manufacturing has seen a significant deceleration showing a potential threat of deindustrialization though manufacturing transformation seems to be just begun towards more knowledge-based productions where innovation and human capital are more likely to play an increasing role on growth. This decline mainly was due to the reduction of manufacturing activities' competitiveness (e.g. the raise of labour costs, lack of skilled workers, the inadequacy of sophistication of goods and innovation capabilities) with particular reference to traditional sectors (mainly labor intensive) that highly contributed to the country's growth in the past.

Fourth, the deceleration of manufacturing opens a new country's phase and policymakers' challenges in order to bring back on track manufacturing leading to a second period of industrialization. This encouraged policymakers to develop more innovative and refine initiatives based on location and cluster approaches focusing on critical issues for manufacturing growth such as innovation, human capital and spatial inequalities, which are important drivers for growth that are highly recognized by more industrialized economies. This can allow regaining manufacturing competitiveness of traditional sectors, and supporting manufacturing mutation towards more technology intensity industries, which also increase industrial diversification and resilience. Although recent policies aim to support these drivers for growth, it emerges that the Indonesian Government needs to increase its efforts in terms of public and private expenditures on research and development activities and the number of researchers employed, which foster innovation capabilities. This can also encourage the localization and exportation of more technological advanced industries generating a more diverse industrial structure and qualified job creation, which is an essential condition to construct a conductive innovative environment. However, it emerged a lack of qualified job creation, which stems from the industrial composition in the country. Urbanization trajectory can also play a significant role for manufacturing revitalization through the generation of new urban centres and agglomeration externalities, which can represent new manufacturing opportunities. The next chapter manufacturing evolution of large and medium operations is investigated between 2000 and 2009 highlighting the raise and fall of sectors, which led to industrial composition change, and also the agents' localization heterogeneity between cities and regencies is examined, which causes performance differences of localized economic activities between these two types of diverse administrative units.

6 Data collected, manufacturing composition change and agents' localization heterogeneity

6.1 Introduction

The previous chapter was devoted to review the economic and policy evolutions in Indonesia. It emerged that the Asian Financial Crisis (1997-1998) substantially influenced the country's economy highlighting its weaknesses to external shocks. The country struggled to "bounce back", and recently, a potential threat of manufacturing deindustrialization in Indonesia emerged, which led to selection and adaptation of economic activities shaping the industrial structure towards higher degrees of technology intensity industries. This chapter is devoted to investigate the evolution of large and medium manufacturing shedding the light on the raise and fall of sectors after the AFC's shock in Indonesia. Numerous labour intensity industries decreased their weights and higher technology intensity industries increased their importance within large and medium manufacturing operations between 2000 and 2009. Despite this composition change, manufacturing growth in Indonesia cannot be achieved without revitalizing labour intensive sectors, since they substantially generate the majority of jobs and value added on aggregation within manufacturing. Thus, policymakers should support manufacturing transformation towards more knowledge-based productions and revitalize labour intensity industries' competitiveness. This can be achieved through innovation generation and human capital formation, which become major competitive drivers for increasing productivity and employment growth within manufacturing in Indonesia.

This chapter also aims to describe the data collected highlighting the differences of agents' localization between cities and regencies. Cities are economically denser characterized by higher localization of skilled workers and high and medium-high technology intensity industries in comparison of regencies. Whereas, this latter are denoted by higher specialization and localization of more labour intensity industries in comparison of cities; since economic activities can take advantage to be in less developed places (e.g. lower costs of labour, availability of lands). These economic differences between these two types of administrative units generate performance differential of localized economic activities. It is observed that the overall industrial structure and established firms are more productive within cities in comparison of regencies though established sectors experienced a higher growth within less developed places (regencies), which are more specialized. This chapter is organized as follows. In Section

6.2, data collected is illustrated. In Section 6.3, the trend of large and medium activities within the whole manufacturing is explored. In Section 6.4, the sectoral composition change is analysed within large and medium operations. In Section 6.5, this is further investigated exploring the growth tendency of economic activities clustered by the diverse degree of technology intensity highlighting the rise and fall of five-digit sectors within large and medium manufacturing, which led to its composition change. In Section 6.6, the differences of agents' localization between cities and regencies[25] are examined, which cause diverse performance of their localized activities. Finally conclusions are provided in Section 6.7.

6.2 Data collected

Raw data are collected from the Badan Pusat Statistik (BPS, which is the Indonesia Statistic Office) annual survey of large and medium manufacturing enterprises[26] between 2000 and 2009, with reference to five-digit manufacturing firms with more or equal to 20 employees within Indonesian regencies and cities. The Indonesian industrial classification code refers to Klasifikasi Baku Lapangan Usaha Indonesia (KBLI) 2005, which is based on the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3. For each observation, it is obtained data of the annual average of total workers per working day and value added[27]. However, the value added of 2006 (consequently the computability of labour productivity in 2006) and the full dataset of 2001 are missing. The data collected allows taking into account three dimensions of growth: employment, value added, and labour productivity[28]; which permit to capture more accurately manufacturing growth in Indonesia since value added and labour productivity increased at much higher pace than employment. This can be due to the learning processes and the adoption of more advanced technologies within the productions favouring the expansion of value added and labour productivity rather than employment. Diverse datasets are constructed. In Chapter 7, established five-digit sectors and firms are employed, which are constantly present in 2000 and 2009 capturing the effect of agglomeration economies on their evolution over time within Indonesia locations. In Chapter 8, all five-digit sectors and firms present within all years (2000 and 2009) are

25. The Indonesian administrative area is divided into provinces, subdivided into regencies and cities, which are further decomposed into districts and then villages. Regencies and cities are at the same administrative level and they have their own local government, legislative body, and a wide autonomy on economic policies following the Indonesian decentralization process initiated by the Law N. 22 and 25/1999, which came into force in 2001, and subsequently amended (for a discussion, see, for instance, Firman, 2009).

26. The Indonesia Statistic Office (BPS) annually conduces a wide survey by delivering questionnaires to all large and medium-scale manufacturing establishments with equal or more than 20 employees, which are included within the directory of the Central Bureau of Statistics (CBS).

27. The Indonesian Consumer Price Index (CPI) (Badan Pusat Statistik, 2015) has been used as a deflator for value added.

28. Labour productivity is computed as the value added per worker, which is a commonly used indicator to measure labour productivity albeit it is partially assessed since it is determined based on a single factor of productivity (see, for instance, OECD, 2001). However, this requires more data that is not available in the datasets.

considered to assess the influence of agglomeration externalities on the industrial structure within cities and regencies including established sectors and firms, the creation and destruction of sectoral branches and firms. In Chapter 9, these datasets are aggregated by locations in order to unfold spatial patterns of large and medium manufacturing activities within and across cities and regencies.

The data has been also collected through the University of Minnesota's Population Center (Minnesota Population Center, 2014) with regard to a 10% geographically stratified systematic sample (more than 20,000,000 observations), which stems from the Indonesian population census of 2000 and 2010 generated by the BPS. These data have been aggregated by locations and the following variables have been employed: the number of persons within households to compute population density as a proxy for urbanization, and the number of people who have completed the secondary and tertiary levels of education as a proxy for human capital. Several locations have been merged as new administrative units have been created in Indonesia between 2000 and 2009. This aggregation was straightforward since their genesis was made over only one location. Table 6.4 illustrates the nomenclature of variables employed, their descriptive statistics and the independent samples t-test in order to shed the light on the significant differences of agents' localization between cities and regencies, which determine economic performance differentials of their localized economic activities via the exploitation of agglomeration externalities locally available.

6.3 Share of large and medium enterprises within manufacturing

As emerged from the previous chapter, industry[29] generated the largest value added in the last two decades in Indonesia though it is accompanied by the lowest job creation comparing with other major economic sectors. Indeed, manufacturing created roughly one half of value added and two-thirds of employment within industry between 2000 and 2013. Manufacturing highly contributed to the country's GDP with almost 30% share in 2001, though its contribution decreased by 7% share between 2001 and 2013. Despite this, it is relevant to observe that manufacturing still grows in Indonesia albeit at lower pace than other economic sectors (i.e. construction, hospitality, transport and communication, finance, real estate and business services) (Badan Pusat Statistik, 2015). Looking at Figure 6.1, large and medium manufacturing enterprises generated between 50% and 60% of value added employing between 30% and 40% of workers as a share of the whole manufacturing between 2000 and 2012. From 2000 to 2005, value added decreased by 9% share though its employment just diminished by 1% share. From 2006, value added and employment as manufacturing share moved in the opposite directions. Value added progressively

29. Industry denotes the aggregation of mining and quarrying (including oil production), manufacturing, construction, and public utilities (electricity, gas, and water).

increased reaching two-thirds of manufacturing contribution in 2012, albeit it stills at lower pitch than in 2000 denoting that large and medium manufacturing operations are not fully recovered due to the shock of AFC. Employment dropped by 8% share between 2006 and 2012 accounting for less than one-thirds of manufacturing employment in 2012.

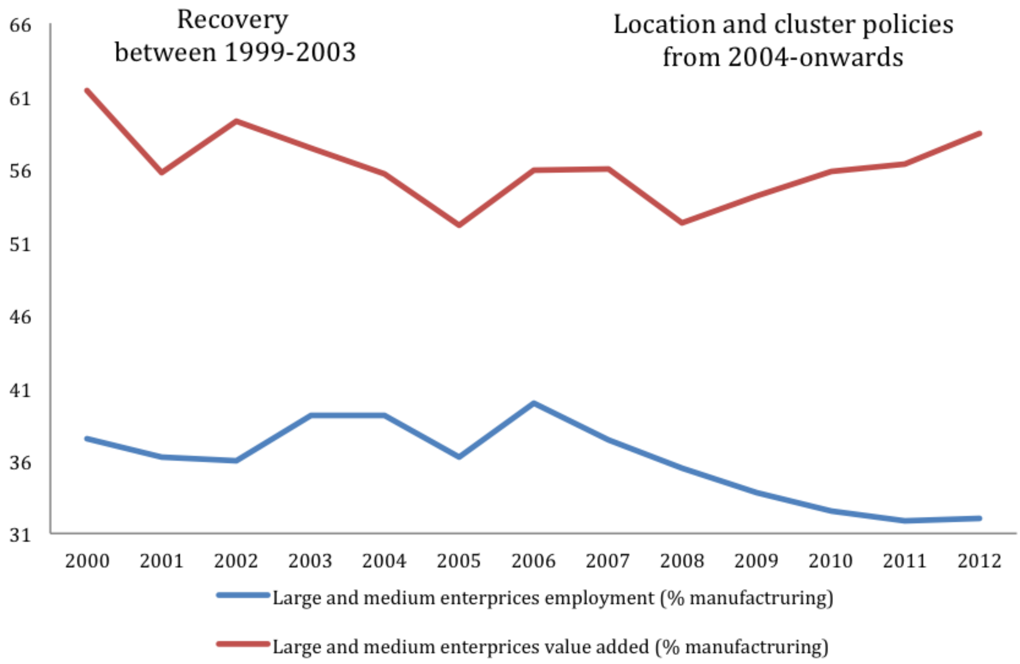

Figure 6.1: Employment and value added share of large and medium enterprises within manufacturing in Indonesia between 2000 and 2012.
Source: Author's computation based on BPS's data (Badan Pusat Statistik, 2015).

This antithetic trends between value added and employment could be due to the learning processes, the increase of production efficiency, and the adoption of more advanced technologies within manufacturing processes, which favoured the increase of productivity share with negative repercussions on employment share. It is also relevant to notice that this divergence tendency occurs subsequently the development of new policies based on cluster and location approaches. Despite the low incidence on job creation, policymakers' attention to large and medium manufacturing enterprises is advisable due to their high productivity and their contribution to the expansion of the overall industrial structure. Large and medium manufacturing operations are characterized by more inclination to invest in R&D due to their higher availability of resources than small and micro-scale manufacturing favouring innovation generation. In addition, large and medium firms have higher propensity to develop dense collaborative networking within manufacturing and other economic sectors (e.g. financial, transportation and wholesale and retail services, among others) than smaller businesses in order to lead their large operations. The importance of large and medium manufacturing within the Indonesian economy contributes to increase the relevance of the present study, since they can play an important role in leading innovation, manufacturing growth and location development.

6.4 Sectoral composition change within large and medium manufacturing industries

Indonesian manufacturing grew faster that the whole economy between 1967 and 1996, and the AFC moderately affected it in comparison of other major sectors. However recently, manufacturing grew at lower rates than the country's GDP reducing its economic contribution. Indonesia manufacturing composition is mainly based on labour intensive industries, where the abundant workforce and the relative low level of labour costs favoured this formation. The raise of wages, and the inadequacy of quality and sophistication of goods undermined the competitiveness of labour intensive industries. This favours manufacturing transformation where the more competitive and technologically advanced economic activities increased their economic importance.

Looking at Table 6.1, low technology intensity industries substantially decreased their employment by 6% share and value added fell by 8% share between 2000 and 2009, though the number of their establishments is practicably unchanged. This represents the highest decline in comparison with other technology intensity clusters based on OECD's classification (2011). The textile, and the wood and products of wood except furniture and plaiting materials industries mainly led to this reduction in terms of employment of 6% share and 4% share respectively. Although the value added of the latter industry witnessed a decrease of 1% share, the textile's value added increased by almost 3% share between 2000 and 2009. The food products and beverages, wearing apparel, and the tanning and dressing of leather industries decreased their value added between 3% share and 4% share. Despite this, food products and beverages industry increased its establishments and employment of 2% share and 3% share respectively between 2000 and 2009. This industry is highly important for manufacturing growth showing the largest number of establishments with more than 20% share, highly contributing to job creation and value added generation with around 15% share and 10% share respectively between 2000 and 2009.

The expansion (or decline) of highly localized industries are particularly relevant for manufacturing growth, in this case, with regard to less developed places. Since the food products and beverages industry is highly present within locations outside Java Island, which are more agricultural-based economies characterized by lower production costs, availability of lands and abundant of natural resources. The economic dimension of food products and beverages industry has been also favoured by its capability to attract foreign investments due to the large domestic market and the rise of middle-income class, which boosted the demand of new and innovative food and beverage products (see, for instance, BKPM, 2014, for the industry's overview). Whereas, the tobacco industry grew in all three dimensions with particular reference to value added where foreign investments (e.g. Philip Morris) played an important roles on it as well as exportations, which rose by 8%

(2,351 tons) in terms of quantity between 2000 and 2009 (Badan Pusat Statistik, 2015).

The current industrial structure is based on low technology intensity industries, which play an important role within the Indonesian economy representing more than 70% of establishments and employment in 2000 and 2009. Although, they produced a lower value added share around 65% in 2000, which substantially decreased by 10% in 2009. Taking into account the aggregation share of just four industries (the food products and beverages, the textile, the wearing apparel, and the furniture and manufacturing n.e.c.), it is interesting to notice that they represented one half of large and medium operations in terms of number of establishments and employment, though they generated a lower share of value added with around 35%. This dichotomy between employment and value added is due to their type of productions, which are characterised by low value added goods employing high quantity of workers. Moreover, they mainly demand low-qualified manpower denoted by low level of salaries due to their low value added generation. The substantial importance of few industries highlights the scarcity of manufacturing diversification with negative repercussions on its resilience. It is also observable that several industries (i.e. textile, the furniture and manufacturing n.e.c., the wearing apparel, and the rubber and plastics products industries, among others) show a divergence tendency between employment and value added. Since an increase of the number of employees does not necessary mean an increase of value added, and vice versa. Since further factors influence their behaviours (i.e. the amount of capital and technology employed, among others).

Medium-low technology intensity industries roughly accounted for 20%, 15%, and 25% shares of establishments, employment, and value added respectively between 2000 and 2009. Although the number of medium-low technology economic activities decreased by 1% share, employment and value added share increased by 3% share and 4% share respectively between 2000 and 2009. The industry that stands out among all is the other non-metallic mineral products, which experienced the highest increase of value added share with more than 8%; albeit its employment slightly rose by 1% share and its number of firms decreased by almost 2% share. On the other hand, high technology intensity industries are characterised by low levels of establishments and employment of around 1% share and 2% share respectively between 2000 and 2009. However, they highly contributed to value added generation with around 10% share in 2000, which rose by 3% share in 2009. Radio, television and communication equipment and apparatus mainly drove this increase by 2% share. Whereas, medium-high technology intensity industries increased their number of firms of 0.5% share, and labour force and value added grew by 4% share and 2% share respectively. These industries accounted for less than 10%, 12% and 5% shares of large and medium manufacturing in terms of establishments, labour force and value added respectively in 2009. The sectors that stand out among all are the chemicals and chemical products, and the electrical machinery and apparatus n.e.c., which increased their employment and value added around 1% share.

The decline of low technology intensity industries associated with the rise of higher degrees of technology intensity activities recalls the argumentation of the previous chapter that the industrial composition change can be observed within Indonesian manufacturing. This was due to the decrease of competitive advantages of labour intensive sectors (e.g. raise of labour costs) and the increase of international and domestic competition, which has been fostered by new trade agreements in the region (e.g. ASEAN), which especially favoured rivalry with countries (e.g. Vietnam and Cambodia) characterized by lower cost of productions in comparison of Indonesia. It is also notable that the reduction of shares by numerous low technology intensity industries has been spread out among industries increasing industrial diversification.

Although high and medium-high technology intensity industries did not substantially contribute to job creation and they are not highly localized, it is advisable to develop industrial policies to support their establishment and growth due to their high productivity, which contributes to GDP growth and standard of living. The development of high and medium-high technology intensity industries is also recommended for their innovation propensity, since they mainly compete based on knowledge creation and diffusion generating incremental and radical changes, which can be also adopted by other industries promoting the overall growth. In addition, the increase of more technological advanced industries within manufacturing structure enhances the industrial heterogeneity with positive repercussions on manufacturing resilience and more balanced growth. Besides this, there is no doubt that medium-low and low technology intensity industries are highly important within large and medium manufacturing since they represent the large majority of industrial composition, and this is also true considering the whole manufacturing (Badan Pusat Statistik, 2011). Thus, revitalizing medium-low and low technology intensity industries is also advisable where innovation and human capital can play as well an important role on it.

Table 6.1: Two-digit sector shares of establishments, employment and value added in 2000 and their variations within large and medium manufacturing.

		2000			Change (%) between 2000 and 2009		
Two-digit sector	**Technology intensity**	**No.Firms**	**Employment**	**Value added**	**No.Firms**	**Employment**	**Value added**
15 - Food products and beverages	Low	21.09	13.28	11.94	2.06	2.68	-3.32
16 - Tobacco	Low	4.25	6.76	3.47	0.45	1.68	2.94
17 - Textiles	Low	9.57	16.74	11.91	-0.40	-5.94	2.53
18 - Wearing apparel	Low	11.5	12.19	9.66	-0.79	-0.9	-4.49
19 - Tanning and dressing of leather	Low	2.70	6.76	5.08	0.05	-1.22	-3.16
20 - Wood and products of wood except furniture and plaiting materials	Low	7.63	8.42	4.44	-2.28	-3.85	-0.65
21 - Paper and paper products	Low	1.78	2.15	3.92	0.10	0.73	-0.79
22 - Publishing, printing and reproduction of recorded media	Low	2.46	1.44	3.40	0.51	0.06	-0.51
23 - Coal, refined petroleum products and nuclear fuel	Medium-low	0.16	0.07	2.53	0.16	0.08	-0.45
24 - Chemicals and chemical products	Medium-high*	4.31	3.98	0.16	-0.08	1.06	0.16
25 - Rubber and plastics products	Medium-low	5.92	6.38	3.34	0.72	1.48	-2.31
26 - Other non-metallic mineral products	Medium-low	8.58	3.63	9.63	-1.78	0.64	8.37
27 - Basic metals	Medium-low	0.77	1.21	3.50	0.10	0.08	-2.11
28 - Fabricated metal products, except machinery and equipment	Medium-low	3.76	2.45	4.30	-0.26	0.37	0.86
29 - Machinery and equipment n.e.c.	Medium-high	1.13	0.72	0.05	0.55	0.90	0.14
30 - Office, accounting and computing machinery	High	0.02	0.01	0.01	0	0.06	0.01
31 - Electrical machinery and apparatus n.e.c.	Medium-high	1.02	1.41	0.83	0.03	0.43	1.18
32 - Radio, television and communication equipment and apparatus	High	0.79	2.30	2.17	-0.23	-0.63	2.07
33 - Medical, precision and optical instruments, watches and clocks	High	0.15	0.09	7.35	0.07	0.20	0.73
34 - Motor vehicles, trailers and semi-trailers	Medium-high	1.19	1.35	0	0.07	0.80	0.04
35 - Other transport equipment	Medium-high**	1.26	1.27	1.77	-0.1	0.46	0.82
36 - Furniture and manufacturing n.e.c.	Low	9.6	7.31	3.13	0.83	0.77	-1.23
37 - Recycling	Low	0.36	0.08	7.41	0.22	0.06	-0.83

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: * The code 24 is classified as medium-high technology intensity with exclusion of 2423, which belongs to high technology intensity. ** The code 35 is classified as medium-high technology intensity with exceptions of 353 and 351, which belong to high and medium-low technology intensity respectively. The industrial classification refers to KBLI 2005, which corresponds of ISIC rev. 3 at two-digit level. Not elsewhere classified is denoted by n.e.c.

6.5 Trajectories of technology intensity industries and five-digit sectors within large and medium manufacturing operations

Figure 6.2 shows the trend of high and medium-high, and medium-low and low technology intensity industries in terms of employment, value added and labour productivity between 2000 and 2009. It is relevant to notice that the two technology intensity clusters expanded their activities in all three dimensions of growth, albeit job creation grew with much lower intensity than value added and labour productivity. High and medium-high technology intensity activities have higher labour productivity than medium-low and low technology intensity industries between 2000 and 2009. Since they produce high value added goods utilizing less labour force. As aforementioned, the majority of industrial composition is represented by medium-low and low technology intensity industries, which highly contributed to job creation. Since they require a larger quantity of workforce though they do not generate as much as higher value added in comparison of high and medium-high technology intensity industries. However, this latter grew faster in terms of employment, value added and labour productivity than medium-low and low technology intensity industries between 2000 and 2009. This further confirms the increasing importance of sectors that are more technological intense.

Disaggregating the manufacturing structure into five-digit levels allows unfolding the trend of single micro sector identifying which economic activities contributed to the raise and fall of two-digit industries as reported in Table 6.1. Table 6.2 and Table 6.3 illustrate the twenty-highest and the twenty-lowest, respectively, average annual growth rates of five-digit sectors in terms of number of firms, employment, value added, and labour productivity between 2000 and 2009. Furniture sector (36109 code that is not included in 36101 until 36104[30]) experienced the highest average annual establishment growth over 12%, and its employment and value added significantly rose by 12% and 17% respectively (Table 6.2). Also, the structural clay product other than brick and tiles sector (26324 code) had an outstanding performance where its establishments, employment, value added and labour productivity increased by 9%, 12%, 25%, and 14% respectively (Table 6.2).

Within the textile industry (17 code), some five-digit sectors had exceptional performance and others witnessed a substantial decline. For instance, the made up textile for health purposes (17212 code) and the preparation of textile fibres (17111 code) sectors substantially expanded their activities (Table 6.2). In particular, the latter sector had a remarkable growth with the highest average annual labour productivity expansion of 21%, the second largest value added generation of 32%, and its establishments and employees rose by 12% and 7%

30. 36101 and 36104 refer to the wood furniture and the metal furniture industries respectively.

respectively (Table 6.2). Whereas, the spinning mills (17112), and the madeup textile article except wearing apparels (17211 code), among others sectors experienced a significant decline (Table 6.3). These divergent trends of five-digit sectors led to selection and adaptation within the two-digit classification. It is curios to observe that the liquors sector (15510 code) showed the second highest employment growth of 13%, and a substantial increase of its value added and establishments of 20% and 9% respectively (Table 6.2). Whereas, other five-digit sectors within the food products and beverages industry (15 code) manifested important decline. For instance, the salted and sweetened fruits and vegetables sector (15132 code) had the highest decrease of average annual value added growth of 13%, and its establishments, employment, labour productivity fell by 4%, 6%, and 7% respectively (Table 6.3). The highest employment decreased is by the dried fruits and vegetables sector (15134 code) of 14%, albeit its value added just dropped by 3% (Table 6.3). For this latter sector, a substantial decrease of employment accompanied by a slight decline of value added has generated an increase of value added per worker of 11% on annual average (Table 6.2), which highlights the limitation of labour productivity computed based on a single factor of production.

Other sectors characterized by an outstanding growth are: the components and parts of prime movers (29113 code), the other general purpose machine (29199 code), and the household with electronic appliances sectors (29302 code); where their employment increased between 8% and 9% (Table 6.2). On the other hand, negative trends of five-digit sectors within the same two-digit industries can be observed. For instance, employment and value added of the machine for mining, quarrying, and construction sector (29240 code) dropped by 10% and 7% respectively (Table 6.3). Furthermore, it is interesting to notice that the mixed, compound and complex fertilizers sector (24123 code) had the largest average annual employment and value added growth rates of 16% and 36% respectively, and the second average annual labour productivity growth of 20% (Table 6.2). This is largely due to the exponential increase of fertilizers subsidies to farmers by Indonesian government from 4% in 2003 to 28% in 2008 as a share of the national agricultural spending (see, for instance, Osorio, Abriningrum, Armas, & Firdaus, 2011).

It is surprise to observe a significant decline of the motorcycle components and apparatus (35912 code) and the bicycle and tricycle components (35922 code) sectors in Indonesia between 2000 and 2009 (Table 6.3). This can be associated with a transportation mode shifting towards automobile mobility, which has been favoured by the rising of high and middle-income classes and the government's incentives on car purchasing with negative repercussions on those sectors (see, for instance, EMIS, 2013; KPMG, 2014, for the automotive industry's overview). This rise and fall of five-digit sectors led to industrial composition change, where the more efficient and competitive economic activities increase their importance and the inefficient and less competitive ones decrease their contributions within two-digit sectors, which modify the overall manufacturing structure in its composition.

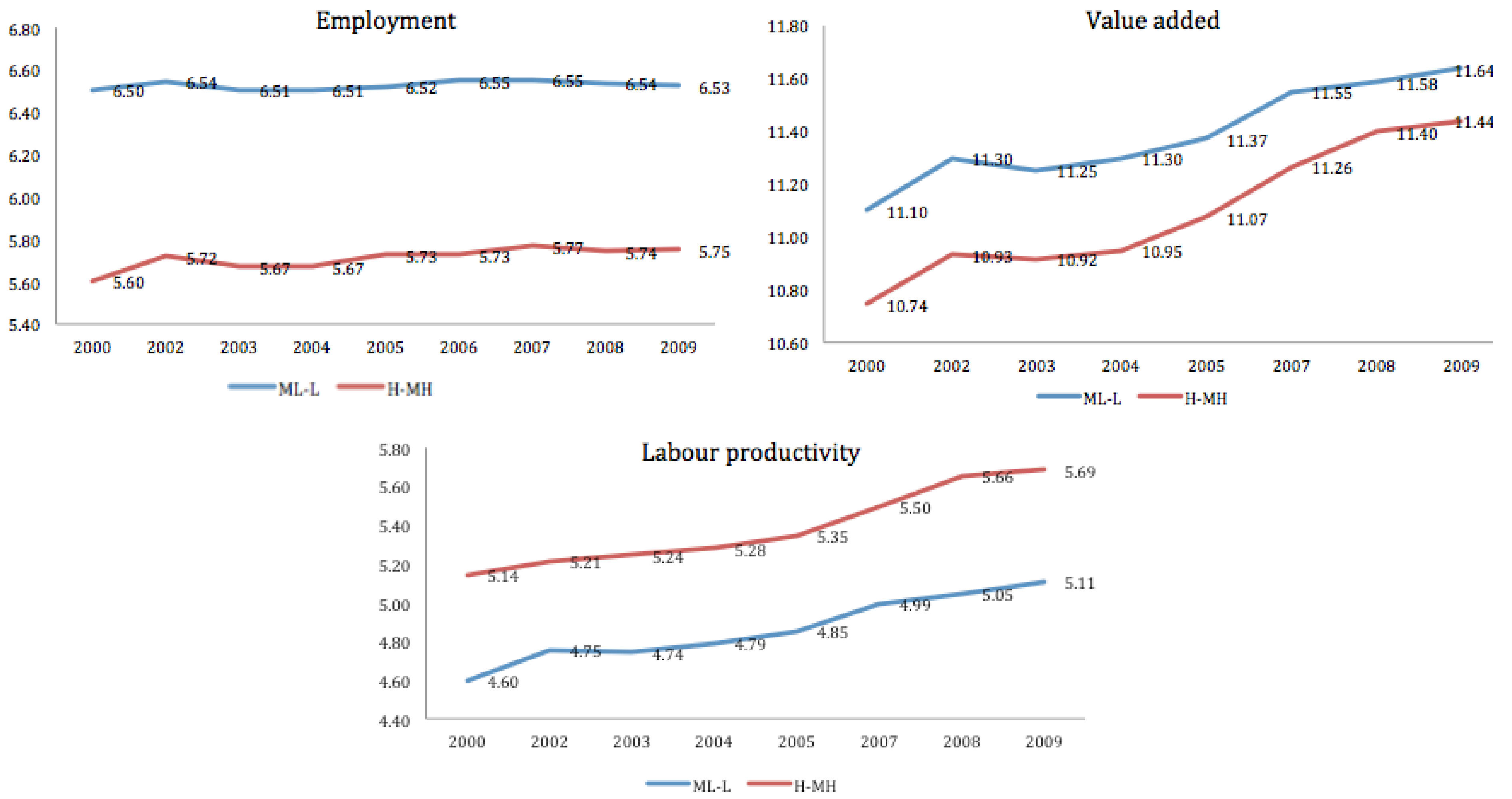

Figure 6.2: Employment, value added, labour productivity (log scale) of technology intensity clusters within large and medium manufacturing enterprises between 2000 and 2009.

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: the code 35 belongs to high and medium-high technology intensity (H-MH) with an exception of 351, which has been included within medium-low and low technology intensity (ML-L), which is based on the OECD's classification (2011).

Table 6.2: The twenty-highest five-digit sectors of average annual growth rates (%) in terms of number of establishment, employment, value added and labour productivity within large and medium manufacturing between 2000 and 2009.

Five-digit sectors	**Establishments growth**	**Five-digit sectors**	**Employment growth**	**Five-digit sectors**	**Value added growth**	**Five-digit sectors**	**Labour productivity growth**
36109	12.16	24123	15.78	24123	36.17	17111	20.61
21019	11.11	15510	13.06	17111	32.27	24123	20.39
22210	9.87	36109	12.42	26324	25.25	29263	19.85
15123	9.39	36103	11.80	31900	20.22	31900	17.88
15510	9.39	17111	11.66	28939	19.75	15314	16.63
26324	8.91	26324	11.65	15510	19.62	16003	15.86
36922	8.23	21019	10.85	30003	18.65	28939	14.76
22120	8.15	20292	10.47	16004	18.56	26411	14.42
20292	8.05	28112	9.08	28931	18.48	20103	13.76
28910	7.63	24132	9.08	28112	18.30	26324	13.60
26601	7.26	29113	8.88	26411	18.29	15122	13.53
15332	7.08	30003	8.86	29263	16.93	24232	12.97
29113	6.82	29199	8.63	25191	16.92	31101	12.74
17111	6.54	29302	8.42	36109	16.86	35911	12.66
18103	6.44	25191	8.11	36103	16.72	24115	12.55
27101	6.44	20299	8.03	36922	16.17	28920	12.53
17231	6.27	26311	7.37	16003	15.92	17294	12.15
15324	6.12	17212	7.32	26509	15.65	16004	11.81
29199	5.91	26601	7.15	26311	15.13	28931	11.47
15318	5.78	36922	7.11	20299	15.05	15134	11.34

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: The industrial classification refers to KBLI 2005. The five-digit sectors are not present in all years within large and medium manufacturing enterprises survey, thus it is computed the average annual growth rates of five-digit sectors that are present at the initial (2000) and final (2009) periods. The denominations of each five-digit sector are reported in the Appendix 6.A.

Table 6.3: The twenty-lowest five-digit sectors of average annual growth rates (%) in terms of number of establishments, employment, value added and labour productivity within large and medium manufacturing between 2000 and 2009.

Five-digit sectors	Establishments growth	Five-digit sectors	Employment growth	Five-digit sectors	Value added growth	Five-digit sectors	Labour productivity growth
17215	-5.30	15134	-13.98	15132	-13.00	28119	-13.14
20102	-5.19	29240	-9.85	28119	-10.12	15132	-6.51
22220	-5.11	23202	-7.56	22190	-7.32	35912	-4.66
17294	-4.61	15132	-6.48	29240	-7.07	18103	-4.63
20104	-4.46	31202	-5.67	23202	-6.59	22190	-3.92
23202	-4.42	20104	-5.66	21014	-4.79	36912	-3.59
26129	-4.28	15314	-5.46	35922	-4.20	26321	-2.77
15132	-3.91	17112	-5.39	15424	-3.95	15324	-2.04
35922	-3.54	21014	-5.10	18103	-3.38	35922	-1.23
25112	-3.18	27310	-5.09	17211	-3.21	24117	-1.08
17123	-3.00	20102	-5.04	24117	-2.73	17232	-0.82
29240	-2.84	24114	-4.81	27202	-2.72	24132	-0.74
24114	-2.64	17294	-4.81	17232	-2.66	29150	-0.43
29192	-2.46	15316	-4.69	15134	-2.63	17213	-0.39
29263	-2.46	17211	-4.63	24114	-2.11	33111	-0.28
20220	-2.46	22220	-4.58	15316	-1.99	15499	-0.26
20294	-2.31	20211	-4.41	35912	-1.89	17293	-0.12
24121	-2.27	24122	-4.22	28999	-1.64	15424	-0.06
15314	-2.18	15424	-3.89	26323	-1.43	25199	-0.05
35921	-2.13	20294	-3.81	15324	-0.98	26323	-0.03

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: The industrial classification refers to KBLI 2005. The five-digit sectors are not present in all years within large and medium manufacturing enterprises survey, thus it is reported the average annual growth rates of five-digit sectors that are present at the initial time (2000) and final period considered (2009). The denominations of each five-digit sector are reported in the Appendix 6.A.

6.6 Agents' localization between cities and regencies

Researchers have often investigated agents' localization effects within cities since they argued that the generation and magnitude of agglomeration externalities are more intense and effective within urban areas due to their dense economic proximity (see, for instance, Glaeser et al., 1992; Henderson, Kuncoro, & Turner, 1995). The present work extends the examination to wider geographic scales (Indonesian regencies), since due to recent technological progress, the economic closeness has become less relevant for building linkages between economic activities (see, for instance, Bathelt et al., 2004; Rallet & Torre, 1999). However, the present study assesses the influence of agglomeration externalities on manufacturing growth distinguishing cities and regencies, this is for two main reasons. First, this allows comparing the results with previous studies' outcomes within cities (see, for instance, Glaeser et al., 1992; Henderson et al., 1995). Second, the heterogeneity of cities and regencies in terms of area size, demographic and economic characteristics (Badan Pusat Statistik, 2011) can lead to diverse results, which cannot be properly captured considering indiscriminately all of the country. In addition in 2001, a decentralization process begun in Indonesia aiming to empower local authorities in order to develop financial and industrial policies based on local needs. This gave to local governments large discretionary on their policy design with particular regard to regencies and cities, which contributes to increase the necessity to analyse separately these two types of administrative units.

Distinguishing urban dense areas from larger geographical scales characterized by diverse attributes (see Table 6.4 and Table 6.5) allows a more accurate investigation and inference on industrial policies. This recalls the notion of ecological fallacy (Robinson, 1950) where the covariation between variables at the micro-level may vary at the macro-level (see, for instance, Simpson, 1951; Yule & Kendall, 1950) causing spurious inference at the lower-level analysing the higher-level. The result of aggregation is to lose variability and consequently information, which may produce diverse outcomes where the most disaggregated level generates the most consistent economic theories. De Groot et al. (2009) raise the same point in their meta-analysis arguing that the level of aggregations (e.g. geographical and sectoral) matter in determining the effect of agglomeration externalities. Burger, Van Oort, and Van der Knaap (2007) investigate agglomeration externalities on different areal units in the Netherlands keeping sectoral composition constant, concerning the modifiable areal unit problem (MAUP) (see, for instance, Amrhein, 1995; Fotheringham & Wong, 1991; Openshaw & Taylor, 1979). Whereas, Mameli, Faggian, and Mccann (2014) test agglomeration externalities at different levels of sectoral aggregations (two and three-digit) in Italy keeping constant the geographical scale. These studies argue that the level of aggregation plays an important role in leading to inconsistent results. The analysis is conducted employing the lowest digit-level within the Indonesian industrial classification (KBLI 2005) considering also the single economic unit, which allows capturing micro variations and avoiding potential sectoral aggregation bias. Due to the heterogeneity between cities and regencies, the influence of agglomeration externalities is investigated discriminating between these two administrative units, which allows interpreting the results more accurately. The rest of this section aims to descriptive the data collected disaggregated by cities and regencies shedding the light on their statistical differences on average in terms of agents' localization and performance differentials of localized economic activities.

6.6.1 Cities and regencies heterogeneity

Table 6.4 shows the denominations and descriptive statistics of variables employed in the empirical investigation (Chapter 7 and Chapter 8), and the independent samples t-test analysis[31] to examine the significant mean differences between cities and regencies. Although regencies cover much larger areas than cities, almost all means of agglomeration forces are significantly higher within cities than those in regencies. This denotes a denser concentration of agents within urban places in terms of population density ($POPDEN$), skilled workers ($HUMCAP$), general variety ($VARIETY$), heterogeneous industries (UV), competition ($COMP$), and high and medium-high technology intensity related industries ($RVHMH$). The higher concentration of diverse industrial structure and technologically advanced industries within cities rather than regencies have been favoured by the increasing firm' returns to scale, the availability of skilled workers, and the diverse customers' needs within large markets. However, a dense local market increases rivalry for products and factors of production, which arises costs of proximity triggering selection and adaptation of economic activities generating footloose of agents towards more profitable places. On the other hand, regencies show a significant larger sectoral specialization (LQ) and localization of medium-low and low technology intensity related industries ($RVMLL$) on average in comparison of cities. Thus, cities are more densely concentrated than regencies, though this latter attracts more manufacturing activities from the same sector with particular reference to labour-intensive related sectors. Since firms can take advantage of being in less economically-concentrated locations characterized by lower competition and costs of factors of production. However, the means of related variety (RV) are not statistically different between cities and regencies at the 5% level.

These economic differences between cities and regencies generate performance differentials of localized economic activities due to the diverse magnitude of agglomeration externalities generated through agents' localization heterogeneity. It is notable that established sectors experienced higher performance on average within regencies than those localized in cities between 2000 and 2009. The sectoral average annual employment ($SEMPGROWTH$) and value added

31. The independent samples t-test has been adopted to compare the means of two independent unbalanced samples (cities and regencies), which are not paired or linked to each other. For the computation methodology see Appendix 6.B.

($SVAGROWTH$) growth rates have significant higher means within regencies than those in cities. Whereas, established firms are more productive within large and dense urban environments, as shown by their significant higher means of average annual value added ($FVAGROWTH$) and labour productivity ($FPRODGROWTH$) growth rates within cities than those in regencies between 2000 and 2009. However, the means of average annual labour productivity growth for sectors ($SPRODGROWTH$) and the average annual employment growth at the firm-level ($FEMPGROWTH$) are not statistically different between cities and regencies at the 5% level. Considering all industrial structure, five-digit sectors show significant higher means in terms of value added (SVA) and labour productivity ($SVAEMP$) within urban centres than regencies. As well as, firms have higher performance within dense urban environment than wider geographical scale, as shown by their higher means of employment ($FEMP$), value added (FVA) and labour productivity ($FVAEMP$) than localized firms within regencies. However, the means of employment for five-digit sectors ($SEMP$) are not statistically different between cities and regencies at the 5% level.

It is observed that established firms and the overall industrial structure have higher performance within urban areas than regencies, since a dense and diverse concentration, and the localization of more technologically advanced industries favour spin-off, and the transmission, accumulation and recombination of knowledge, which enhance innovation capabilities and growth of localized activities. As argued by numerous scholars (see, for instance, Duranton & Puga, 2003; Melo et al., 2009; Puga, 2010; Rosenthal & Strange, 2004). Instead established five-digit sectors grow faster within regencies than cities, which can be associated with the role of localization externalities due to the higher specialization of regencies. Although knowledge spillover is likely to occur among high and medium-high technology intensity industries, the flow of know-how can not be excluded among medium-low and low technology intensity sectors. This becomes particular relevant considering the predominant localization of these industries within the country, with particular regard to the industrial configuration of regencies characterized by more labour intensity industries.

Following the same approach, Table 6.5 shows the independent samples t-test to compare the mean differences of two-digit industries between cities and regencies in terms of employment, value added, and labour productivity[32]. Eight two-digit industries witnessed a significant higher job creation on average within regencies than those in cities, and seven sectors show significant higher means on employment within cities than those in regencies. Considering value added and labour productivity, this situation is inverted. Thirteen sectors experience significant higher means on value added and labour productivity within cities in comparison of regencies; and only, five and two sectors show significant higher

32. The average annual growth of employment, value added, and labour productivity is not reported since very few sectors show significant differences between cities and regencies. However, they are presented in the work of Ercole and O'Neill (forthcoming).

means on value added and labour productivity respectively within regencies than those localized in cities. It is relevant to observe that the food products and beverages and the furniture and manufacturing n.e.c. industries show higher localization of employment on average within regencies than those in cities; despite this, they are more productive on average within cities than those in regencies.

The higher performance of sectors within urban areas in comparison of regencies, with particular regard to value added and labour productivity, can be explained by the urban economic structure, which allow increasing firms returns to scale and facilitating knowledge spillovers among agents. It is relevant to observe that the majority of medium-low and low technology intensity industries have a better performance within cities than in regencies. For instance, the tobacco, the wood and products of wood except furniture and plaiting materials, the publishing, printing and reproduction of recorded media, and the basic metals industries. Although workers' salaries, and more in general the costs of factors of production, are higher within dense economic environments; these industries can take advantage to be within a urban proximity exploiting large final demand, labour pool and the minimization of transportation costs. Sectors are encouraged to lead their businesses within cities until when agglomeration benefits overcome their costs; otherwise footloose of economic activities is generated towards places (i.e. regencies) considered more economically attractive. On the other hand, higher sectoral expansion within regencies, with particular regard to job creation, can be associated with localization economies, availability of natural resources (e.g. lands and raw materials), and lower costs of factors of production within less concentrated markets. It is relevant to notice that several high and medium-high sectors experience higher development within regencies than those in cities. For instance, the radio, television and communication equipment and apparatus, the machinery and equipment n.e.c., and the office, accounting and computing machinery. According to the large and medium manufacturing survey, these industries show higher specialization on average within regencies than those in cities.

Although cities are characterized by the localization with just around 35% of operations with respect to the total survey, the higher productivity on average within cities is confirmed indiscriminately based on firms' employment sizes in comparison of regencies. $FSMALL$, $FMEDIUM$, and $FLARGE$ show higher expansion within cities than those in regencies with an exception of employment for large operations, which is not statistically different between cities and regencies at the 5% level. Thus, regencies show higher localization of firms within larger areas in comparison of cities, though this latter shows higher density of economic localization than regencies. As emerges in Table 6.4 and Table 6.5, cities and regencies differ in terms of industrial structure, market size and the localization of human capital generating agglomeration externalities differentials, which lead to sectoral and firms' performance differentials between these two diverse administrative units. Based on this, cities and regencies are analysed separately in order to take into account for their heterogeneity, since considering indiscriminately the entire country can lead to erroneous inference as emerged in the work of Ercole and O'Neill (forthcoming).

Table 6.4: Nomenclature of variables and descriptive statistics disaggregated by cities and regencies, and the Independent Samples t-test.

Variable	Description	Cities		Regencies		Independent samples t-test
		Mean	SD	Mean	SD	t-value
Explained variables of five-digit sectors within locations.						
SEMP (log)	Employment during 2000 and 2009.	5.06	1.50	5.07	1.53	-0.66
SVA(log)	Value added during 2000 and 2009.	15.37	2.23	15.11	2.33	12.01***
SVAEMP (log)	Labour productivity during 2000 and 2009.	10.31	1.26	10.04	1.40	21.23***
SEMPGROWTH	Average annual employment growth between 2000 and 2009.	-0.73	5.14	0.19	5.85	-4.67***
SVAGROWTH	Average annual value added growth between 2000 and 2009.	5.10	8.13	6.07	9.09	-3.12**
SPRODGROWTH	Average annual labour productivity growth between 2000 and 2009.	12.61	1.49	12.71	1.90	-1.66
Explained variables at the firm-level within locations.						
FEMP (log)	Employment during 2000 and 2009.	4.17	1.17	4.14	1.16	5.26***
FVA (log)	Value added during 2000 and 2009.	14.25	1.90	13.79	2.14	44.66***
FVAEMP (log)	Labour productivity during 2000 and 2009.	10.07	1.20	9.64	1.45	64.01***
FEMPGROWTH	Average annual employment growth between 2000 and 2009.	-0.36	2.72	-0.21	3.12	-1.94
FVAGROWTH	Average annual value added growth between 2000 and 2009.	5.71	5.99	5.38	6.42	2.09*
FPRODGROWTH	Average annual labour productivity growth between 2000 and 2009.	6.07	5.51	5.60	5.89	3.27**
Sector-specific characteristics explanatory variables within locations during 2000 and 2009.						
LQ (log)	Specialization as a measure of MAR externalities.	0.89	1.46	1.56	1.81	-87.27***
COM (log)	Competition denoting the local sectoral rivalry degree.	0.41	0.87	0.37	0.86	11.46***
Location-specific characteristics explanatory variables within locations during 2000 and 2009.						
POPDEN (log)	Population density as a proxy of urbanization.	6.66	0.65	4.52	0.81	627.22***
HUMCAP (log)	Scholars that have completed secondary and tertiary educational levels.	10.64	0.96	9.91	0.81	165.07***
VARIETY	General variety without any sectoral linkages measuring Jacobian externalities in the old fashion.	4.43	1.13	3.93	1.37	84.27***
UV	Unrelated varieties computed based on the Indonesian industrial classification (KBLI 2005) associated with portfolio diversification.	2.98	0.76	2.49	0.94	123.82***
RV	Related varieties computed based on Indonesian industrial classification (KBLI 2005) to measure inter-industry knowledge spillovers.	1.44	0.50	1.44	0.61	0.57
RVHMH	High and medium-high technology intensity related industries based on OECD's classification (2011).	0.22	0.20	0.13	0.18	100.96***
RVMLL	Medium-low and low technology intensity related industries based on OECD's classification (2011).	1.22	0.44	1.32	0.54	-43.32***

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: For the agglomeration externalities computation see chapter 4. The average annual growth is computed for economic activities that are present in 2000 and 2009, see Chapter 7. All other variables are derived from the unbalanced datasets employed in Chapter 8, which included all economic activities in all years. The two-tailed t-values are presented for the independent samples t-test. The levels of statistical significant are denoted by *** 0.1%; ** 1%; * 5%. The unpaired samples t-test has been computed using equal or unequal variances when it was the case, which has been assessed through the variance ratio test (F-test). The Satterthwaite's degrees of freedom approximation (Satterthwaite, 1946) has been used for the independent samples t-test with unequal variances. All continuous predictors are natural log transformed with exception of the set of varieties, which allows reducing the influence of outliers and preserving the assumption of the Gaussian distribution of the independent samples t-test.

Table 6.5: The Independent Samples t-test of employment, value added, and labour productivity of two-digit sectors between cities and regencies.

Two-digit sectors	**SEMP**				**SVA**				**SVAEMP**				**Independent Samples t-test (t-value)**		
	Cities		**Regencies**		**Cities**		**Regencies**		**Cities**		**Regencies**				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	**SEMP**	**SVA**	**SVAEMP**
15 - Food products and beverages	4.80	1.32	4.87	1.45	14.91	2.11	14.76	2.27	10.12	1.26	9.89	1.38	-2.81**	3.43***	8.72***
16 - Tobacco	6.20	2.01	5.98	1.84	16.80	3.16	15.44	2.63	10.54	1.70	9.44	1.71	2.19*	5.63***	8.09***
17 - Textiles	5.34	1.62	5.44	1.70	15.22	2.18	15.15	2.46	9.89	1.02	9.70	1.24	-1.89	0.96	5.21***
18 - Wearing apparel	5.98	2.29	5.74	1.98	15.64	2.76	15.22	2.48	9.68	0.84	9.48	0.98	1.93	2.66**	3.63***
19 - Tanning and dressing of leather	5.33	1.62	5.62	1.84	15.29	1.90	15.63	2.34	9.97	0.79	10.01	1.03	-3.18**	-2.76**	-0.73
20 - Wood and products of wood except furniture and plaiting materials	5.05	1.52	4.87	1.44	15.09	2.12	14.56	2.04	10.04	1.03	9.68	1.09	3.64***	7.34***	9.71***
21 - Paper and paper products	4.88	1.34	5.50	1.52	15.25	2.09	16.34	2.48	10.39	1.19	10.82	1.40	-8.12***	-8.41***	-5.90***
22 - Publishing, printing and reproduction of recorded media	5.05	1.30	4.78	1.30	15.49	1.93	15.06	2.20	10.46	1.09	10.27	1.36	3.82***	3.53***	2.64***
23 - Coal, refined petroleum products and nuclear fuel	4.50	0.78	4.29	0.93	15.86	1.54	15.40	1.91	11.36	1.31	11.11	1.53	1.66	2.09*	1.18
24 - Chemicals and chemical products	5.14	1.47	4.93	1.27	16.28	2.44	15.90	2.35	11.16	1.56	10.98	1.65	4.40***	4.52***	3.20**
25 - Rubber and plastics products	5.35	1.59	5.54	1.50	15.71	2.20	15.84	2.11	10.36	1.12	10.30	1.29	-3.69***	-1.73	1.43
26 - Other non-metallic mineral products	4.73	1.39	4.77	1.36	14.86	2.16	14.43	2.19	10.11	1.20	9.66	1.31	-0.63	4.81***	8.86***
27 - Basic metals	5.59	1.36	5.23	1.32	17.22	2.23	16.59	2.26	11.63	1.32	11.34	1.45	3.40***	3.91***	2.87**
28 - Fabricated metal products, except machinery and equipment	4.84	1.29	4.78	1.30	15.28	1.98	15.11	2.11	10.44	1.15	10.32	1.26	1.30	2.17*	2.65**
29 - Machinery and equipment n.e.c.	4.61	1.21	4.83	1.34	14.99	1.97	15.32	2.14	10.39	1.29	10.52	1.40	-3.46***	-3.10**	-1.97*
30 - Office, accounting and computing machinery	3.64	0.46	5.33	1.60	14.41	0.93	15.90	2.02	10.70	0.94	10.60	0.96	-4.66***	-2.76**	0.28
31 - Electrical machinery and apparatus n.e.c	5.42	1.32	5.50	1.43	16.36	1.98	16.46	2.19	10.95	1.16	10.97	1.32	-0.93	-0.69	-0.22
32 - Radio, television and communication equipment and apparatus	5.56	1.62	6.17	1.84	16.42	2.21	17.21	2.53	10.80	1.17	11.02	1.35	-3.25**	-2.84**	-1.54
33 - Medical, precision and optical instruments, watches and clocks	4.72	1.17	5.05	1.32	15.00	1.48	15.26	1.87	10.29	0.98	10.23	1.08	-2.01*	-1.14	0.44
34 - Motor vehicles, trailers and semi-trailers	5.35	1.75	5.25	1.71	16.17	3.02	15.97	2.71	10.84	1.63	10.72	1.48	0.75	0.88	0.96
35 - Other transport equipment	5.21	1.54	4.86	1.33	15.00	2.49	15.28	2.31	10.81	1.38	10.45	1.46	3.64***	4.26***	3.64***
36 - Furniture and manufacturing n.e.c.	4.98	1.44	5.09	1.57	14.84	1.86	14.69	2.08	9.86	0.88	9.60	1.03	-2.21*	2.15*	7.90***
37 - Recycling	4.38	0.95	4.29	0.95	14.56	1.61	13.69	1.46	10.17	1.11	9.43	0.93	0.80	4.36***	5.27***
FSMALL – Firms' workers between 20 and 49.	3.38	0.29	3.37	0.28	13.19	1.21	12.94	1.36	9.81	1.15	9.57	1.30	2.67**	10.67***	10.61***
FMEDIUM – Firms' workers between 50 and 249 .	4.69	0.46	4.67	0.46	14.97	1.40	14.64	1.50	10.29	1.25	9.97	1.38	2.24*	14.94***	15.70***
FLARGE – Firms with ≥ 250 workers.	6.76	0.96	6.79	0.96	17.50	1.63	17.26	1.72	10.74	1.21	10.47	1.37	-1.85	8.94***	13.14***

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: The variables stem from the unbalanced datasets employed in Chapter 8, which includes all economic activities in all years. The three dimensions of average annual manufacturing growth by two-digit sectors is omitted, since they do not improved the analysis, which are presented in Ercole and O'Neill (forthcoming). The two-tailed t-values are reported for the independent samples t-test where the levels of statistical significant are denoted by *** 0.1%; ** 1%; * 5%. The independent samples t-test has been computed using equal or unequal variances when it was the case, which has been assessed through the variance ratio test (F-test). The Satterthwaite's degrees of freedom approximation (Satterthwaite, 1946) has been used for the independent samples t-test with unequal variances.

6.7 Conclusions

This chapter investigated the large and medium manufacturing evolution between 2000 and 2009 highlighting the raise and fall of sectors, which led to industrial composition change where the most efficient and competitive economic activities grow faster than others. Numerous low technology intensity industries substantially decreased their importance within large and medium manufacturing, albeit they represent the large majority of manufacturing structure. This denotes low degrees of industrial diversification in the country, which negatively affects the ability of manufacturing to react and absorb industry-specific negative effects. As a result, a reduction of low technology intensity industries competitiveness after the AFC undermined the overall manufacturing growth generating a potential threat of deindustrialization.

On the other hand, high and medium-high technology intensity sectors grew faster in terms of employment, value added and labour productivity than medium-low and low technology intensity industries between 2000 and 2009. Although high and medium-high technology intensity industries did not substantially contributed to job creation, it is advisable to encourage their localization and growth due to their high productivity, innovation propensity, and industrial diversification. Policymakers should support the localization and growth of these industries in order to revitalize manufacturing growth, though it cannot be achieved without an increase of labour-intensity industries competitiveness and growth due to their high localization and job creation in the country. In this context, innovation and human capital are fundamental drivers for manufacturing rehabilitation, also by the fact of the rising importance of knowledge-based production activities in Indonesia.

This chapter also highlighted the idiosyncratic differences of agents' localization on average between cities and regencies. This raises the necessity to investigate separately these two diverse administrative units in order to avoid spurious inference and misleading policy design considering indiscriminately the entire county. In particular, it emerged that although cities cover much smaller areas than regencies, urban areas showed a denser concentration on average than regencies; albeit this latter showed higher specialization and the localization of more labor intensive industries on average in comparison of cities. These agents' localization differences can explain the economic performance differentials of localized economic activities within these two types administrative units. It is observed that established firms and the overall industrial structure had a higher performance within cities in comparison of regencies, and established sectors showed higher growth on annual average within regencies than those in cities. In the following chapter, the influence of agglomeration externalities is investigated on the annual average growth of established five-digit sectors and firms in terms of employment, value added and labour productivity for Indonesian cities and regencies in two data points in time (2000 and 2009).

Appendix

6.A Appendix: Denominations of the twenty highest and lowest five-digit sectors growth

Table 6.6: Nomenclature of the five-digit sectors presented in Table 6.2 and Table 6.3.

Code	The highest growth of five-digit sectors reported in Table 6.2.	Code	The lowest growth of five-digit sectors reported in Table 6.3.
15122	Salted /dried fish and other similar products	15132	Salted and sweetened fruits and vegetables
15123	Smoked fish and other similar products	15134	Dried fruits and vegetables
15134	Dried fruits and vegetables	15314	Peeling, cleaning and drying of cacao
15314	Peeling, cleaning and drying of cacao	15316	Peeling and cleaning of nuts
15318	Kopra	15324	Sago
15324	Sago	15424	Syrup
15332	Concentrate animal feeds	15499	Other food products
15510	Liquors	17112	Spinning mills
16003	Cigarettes	17123	Printed textiles
16004	Other type of cigarettes	17211	Madeup textile article except wearing apparels
17111	Preparation of textile fibres	17213	Textile for cosmetic purposes
17212	Made up textile for health purposes	17215	Other sacks
17231	Rope, twine	17232	Goods made of rope or twine
17294	Non woven	17293	Embroidery
18103	Wearing apparel made of leather	17294	Non woven
20103	Preserved rattan, bamboo and the like	18103	Wearing apparel made of leather
20292	Plaits from plants except rattan and bamboo	20102	Preserved wood
20299	Other goods made of wood, rattan, cork and bamboo	20104	Processed rattan
21019	Paper n.e.c.	20211	Plywood
22210	Printing	20220	Molding and building components
24115	Basic organic chemical of vegetables or animal origin	20294	Kitchen utensils made of wood, rattan and bamboo
24123	Mixed, compound and complex fertilizers	21014	Special paper
24132	Synthetic rubber	22190	Other publishing
24232	Drugs and medicines	22220	Supporting service for printing industries
25191	Products of rubber for household purposes	23202	Natural gas refineries
26311	Refractory bricks and the like	24114	Basic inorganic chemicals n.e.c.
26324	Structural clay product other than brick and tiles	24117	Basic organic chemicals from crude oil, natural gas and coal

Continued on next page.

Table 6.6: Continued.

Code	The highest growth of five-digit sectors reported in Table 6.2.	Code	The lowest growth of five-digit sectors reported in Table 6.3.
26411	Cement	24121	Manufacture natural fertilizer / non synthetic
26509	Other marble and granite product	24122	Straight fertilizers
26601	Structural asbestos products	24132	Synthetic rubber
27101	Iron and steel basic industries	25112	Vulcanized tire
28112	Fabricated structural aluminium products	25199	Products of rubber n.e.c.
28910	Forging, pressing, stamping, and roll forming of metal	26129	Glass n.e.c.
28920	Supporting services for processing of metal	26321	Household wares made of clay
28931	Agricultural tools made of steel	26323	Clay tiles
28939	Other tools made of metal	27202	Non ferrous metal rolling industry
29113	Components and parts of prime movers	27310	Iron and steel smelting industry
29199	Other general purpose machine	28119	Fabricated metal products n.e.c.
29263	Textile machineries	28999	Products of metal n.e.c.
29302	Household with electronic appliances	29150	Lifting and moving machineries
30003	Electronic office, computing and accounting machineries	29192	Weighing machine
31101	Electric motors	29240	Machine for mining, quarrying, and construction
31900	Other electrical apparatus and components	29263	Textile machineries
35911	Motorcycles	31202	Electric control apparatus
36103	Plastic furniture	33111	Instrument and appliance for surgical, therapy, and dental practice
36109	Other furniture that not include in 36101 until 36104*	35912	Motorcycle component and apparatus
36922	Non traditional musical instruments	35921	Bicycle and tricycles
		35922	Bicycle and tricycles components
		36912	Personal adornment made of precious metal

Notes: The five-digit codes refer to KBLI 2005 elaborated by BPS. The five-digit sectors are sorted based on industrial code. * 36101 and 36104 refer to wood furniture and metal furniture respectively. Not elsewhere classified is denoted by n.e.c.

6.B Appendix: The Independent Samples t-test.

The *t-test* is a statistical method widely adopted in order to compare groups' means differences of continuous variables. It assumes that samples are randomly drawn from normally distributed populations with unknown population variances. The *t-test* can be computed based on one sample, paired samples, and independent samples (see, for instance, Hoel, 1984). The independent samples t-test has been employed in Table 6.4 and Table 6.5 to compare the means difference between two independent unbalanced samples (cities and regencies), which are not paired or linked to each other. The hypothesis tested is that the mean difference of a given variable between cities and regencies is zero. Mathematically, $H_0 = \mu_{j,1} - \mu_{j,2} = 0$ where μ_j indicates the means of a given variable j within cities and regencies (1 and 2 respectively). However before running the independent samples t-test[33], the equal variance needs to be assessed, otherwise the t-test is biased due to the incorrect variance assumption and the degrees of freedom employed. The *F-test* is commonly used to examine whether two populations have the same variance in a statistical sense (see, for instance, Armitage, Berry, & Matthews, 2002; Bland, 2000), where the null hypothesis is $s^2_{j,1} = s^2_{j,2}$. The *F-statistic* is defined as:

$$F_j = \frac{s^2_{j,1}}{s^2_{j,2}} \sim F(n_1 - 1, n_2 - 1)$$

where F_j denotes the variance (s^2) ratio of a certain variable j with respect to cities and regencies, which is distributed with $n_1 - 1$ and $n_2 - 1$ degrees of freedom where n indicates the number of observations within the respective samples. For the *chi-squared* computation of *F-test*, see, for instance, Bland (2000). If *F-test* does not reject the equality of variance, it can be pooled with individual sample variances weighted by the number of observations of the two groups computing the *t-statistic* as follows:

$$t = \frac{\left(\mu_{j,1} - \mu_{j,2}\right)}{\left\{\frac{(n_1-1)s^2_{j,1}+(n_2-1)s^2_{j,2}}{n_1+n_2-2}\right\}^{1/2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)^{1/2}} \sim t(n_1 + n_2 - 2)$$

where the degrees of freedom of the *Student's t* is $n_1 + n_2 - 2$. If *F-test* rejects the equal variance assumption, individual variances need to be used and the degrees of freedom are approximated, where the Satterthwaite's formula has been employed (Satterthwaite, 1946). In this case, the *t-test* is given by:

$$t = \frac{\left(\mu_{j,1} - \mu_{j,2}\right)}{\left(\frac{s^2_{j,1}}{n_1}+\frac{s^2_{j,2}}{n_2}\right)^{1/2}} \sim t(df_{Satterthwaite})$$

33. For a more comprehensive mathematical description and procedure to compute the independent samples t-test see, for instance, Acock (2014) and Hoel (1984).

where the Satterthwaite's degrees of freedom is defined as follows:

$$t = \frac{\left(\frac{s_{j,1}^2}{n_1} + \frac{s_{j,2}^2}{n_2}\right)^2}{\frac{\left(\frac{s_{j,1}^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_{j,2}^2}{n_2}\right)^2}{n_2 - 1}}$$

7 The influence of agglomeration externalities on established manufacturing growth

7.1 Introduction

The previous chapter highlighted the raise and fall of sectors, which led to industrial composition change within large and medium manufacturing structure in Indonesia between 2000 and 2009. It emerged that policymakers should support key labour-intensive industry competitiveness and manufacturing mutation towards more knowledge-based productions in order to revitalize manufacturing growth. In this context, innovation and human capital are essential drivers behind it. Indonesian Government is highly engaged in these directions promoting key local clusters and the formation of skilled workers adopting more innovative policies based on cluster and location approaches. It will be argued via empirical evidence that the recent reconceptualization of economic varieties based on sectoral linkages can provide valuable insights for policy design in order to pursue manufacturing revitalization in Indonesia.

This chapter aims to academically contribute to previous studies in several directions. First, agglomeration externalities are employed in order to assess their influence on manufacturing growth adopting the decomposition of economic variety based on sectoral linkages, which addresses the misspecification of Jacobian externalities. This can resolve the long-term academic debate on which agglomeration externality is more predominant for growth (see, for instance, Beaudry & Schiffauerova, 2009; De Groot et al., 2009; Glaeser et al., 1992; Henderson et al., 1995; Van der Panne, 2004). The idiosyncratic economic role-played by inter-industry knowledge spillover and portfolio diversification can be more accurately evaluated, and their effects along with urbanization externalities can be conducted to more appropriate theoretical foundations. In addition, identifying economic relatedness and heterogeneous degrees allows *tailor-made* initiatives towards economic growth and diversification, which can allow to reduce the risk of lock-in effect and lack of economic resilience (typical drawbacks of having a location highly specialized) by promoting key clusters characterized by large interconnectedness. Second, most work has considered developed economies in the application of economic variety decomposition (see, for instance, Bishop & Gripaios, 2010; Boschma & Iammarino, 2009; Boschma et al., 2012; Frenken et al., 2007; Hartog et al., 2012; Quatraro, 2010). The present study applies it in Indonesia, which is one of the most dynamic countries in South-East Asia, and the Asia's fifth largest economy characterized by lower-middle income, large domestic market and stable economic growth (OECD, 2012). Analysing the impact of agglomeration externalities on manufacturing growth in Indonesia can provides new empirical insights due to the different country's development stage.

Third, researchers (see, for instance, Glaeser et al., 1992; Henderson et al., 1995) commonly focused their attention to cities, arguing that the most innovations are generated within urban areas given by their dense economic proximity. The investigation has been extended to wider geographic scales (Indonesian regencies), since the close proximity has become less relevant in order to take advantage from agglomeration externalities due to recent technological progress (Bathelt et al., 2004; Rallet & Torre, 1999). However, the empirical analysis is conducted separately assessing the influence of agglomeration externalities on manufacturing growth within cities and regencies. Since urban areas exhibited denser economic proximity and human capital than regencies on average, and this latter is characterized by higher specialization and the localization of more labour-intensive related industries in comparison of cities on average (see Table 6.4). This diversity between cities and regencies generates performance differentials for their localized economic activities (see Table 6.4 and Table 6.5) through the idiosyncratic formation and magnitude of agglomeration externalities. Thus, analysing indiscriminately the entire country can lead to erroneous inference and policy design due to the heterogeneity of these two types of administrative units as argued by Ercole and O'Neill (forthcoming)[34].

Fourth, employment has been widely adopted by numerous authors (see, for instance, Bishop & Gripaios, 2010; De Vor & De Groot, 2010; Hartog et al., 2012; Lengyel & Kanó, 2013; Mameli, Iammarino, & Boschma, 2012) as a dependent proxy for industrial growth, though it does not accurately assess the increase of productivity due to the learning process. Thus, value added and labour productivity are introduced as further predicted variables in order to determine more precisely the idiosyncratic influence of agglomeration economies on manufacturing growth in Indonesia. This is particular important in order to examine manufacturing development in Indonesia between 2000 and 2009, since value added and labour productivity increase at much higher pace than employment. Fifth, agglomeration externalities are often tested on aggregation growth (see, for instance, Boschma & Frenken, 2009; Boschma et al., 2012; De Vor & De Groot, 2010; Mameli et al., 2012) neglecting their micro-foundation nature losing information regarding single units and often without considering unobservable characteristics of observations, which might cause a potential estimation bias. Following this, agglomeration externalities are tested at the

34. See Ercole and O'Neill (forthcoming) for results comparison between the entire country (provided as a benchmark), and cities and regencies, which lead to misleading inference and policy relevance in several cases. In particular, the diverse outcomes between these two types of administrative units (e.g. human capital and population density) could not be captured considering indiscriminately the entire country highlighting the notion of ecological fallacy (Robinson, 1950).

lowest level within the Indonesian industrial classification (five-digit) and firm-level, which allow capturing micro variations and avoiding sectoral aggregation bias. Unobservable characteristics are controlled including several control variables (small and large firm sizes, human capital, employment and labour productivity at the initial time) and dummies variables of two broader groups: two-digit sectors and provinces, which ensures that the estimates are not affected by the variation of their developments that are unrelated to five-digit sectors and Indonesian cities and regencies' characteristics.

This chapter is devoted to investigate the influence of agglomeration externalities on the annual average growth of established five-digit manufacturing sectors and firms in terms of employment, value added and labour productivity in two data points in time (2000 and 2009) analysing separately Indonesian cities and regencies. Urbanization, competition, specialization and a set of varieties are tested; in particular, general variety without any sectoral linkages is decomposed into related and unrelated varieties using the Indonesian industrial classification (KBLI 2005) and the technology intensity industries classification (OECD, 2011) in order to assess their idiosyncratic economic roles. All explanatory variables are measured at the first time point of the full dataset (2000) underlying the notion of path dependency mechanism of agglomeration economies, which can explain the sectoral and firm' growth between 2000 and 2009. The data employed refers to established manufacturing sectors and firms that are present within Indonesian regencies and cities during 2000 and 2009. Empirical evidence of this chapter supports the conceptualization that Jacobian externalities (Jacobs, 1969), computed as general variety in the old fashion and related variety as proposed by Frenken et al. (2007), are the preponderant sources for manufacturing growth. Whereas, specialized clusters negatively influence it contradicting the assumption of the MAR model (Glaeser et al., 1992). Competition is inversely related to manufacturing growth though it fosters sectoral employment within Indonesian regencies. In addition, it is observed that population density and human capital diversely affect cities and regencies due to their heterogeneity in terms of distinctive urbanization trajectories and industrial compositions.

To the best of my knowledge, no similar research has been conducted in the country employing the decomposition of variety on employment, value added and labour productivity at sectoral and firm levels discriminating cities and regencies. This can provide significant empirical insights for researchers and policymakers. The rest of this chapter is organized as follows. In section 7.2, the dependent variables are deified and the specification of the models is examined. In Section 7.3, the construction of data and the descriptive statistics are exposed. In Section 7.4, the empirical results are presented and discussed with regard to employment, value added, and labour productivity growth at the sectoral and firm levels. Finally, conclusions are provided in Section 7.5.

7.2 Empirical specification

Following the seminal contribution of Glaeser et al. (1992), and subsequently numerous other works (see, for instance, De Vor & De Groot, 2010; Henderson, 1997, 2003), which investigate the impact of agglomeration externalities on growth, the influence of urbanization, specialization, competition and the set of varieties are tested on manufacturing expansion within Indonesian locations. Industrial diversity is often measured without any distinction of sectoral interconnectedness, which has been criticized as a misspecification of Jacobian externalities (see, for instance, Boschma et al., 2012; Frenken et al., 2007). Since the flow of knowledge is likely to occur between interconnected sectors rather than disconnected sectors, and this latter is more associated with the portfolio diversification effect rather than inter-industry knowledge spillover. The empirical investigation aims to extend previous studies including the decomposition of varieties as suggested by Frenken et al. (2007). This is conducted employing the Indonesian industrial classification (KBLI 2005) and the technology intensity classification (OECD, 2011) useful to investigate the impact of (un)linked variety on manufacturing growth within Indonesian locations.

Bearing in mind that manufacturing growth is not properly explained by employment growth, value added and labour productivity are also examined in order to investigate sectoral and firms' growth more accurately. As emerge in Chapter 6, employment slightly grew, and value added and labour productivity experienced an exponential expansion between 2000 and 2009. Similarly, Boschma and Iammarino (2009) investigate the role of relatedness on these three dimensions of growth in Italy though they fail to take into account the MAR's externalities and the micro-level of analysis. This investigation incorporates the location quotient as a proxy for intra-industry knowledge spillovers and considering the lowest level of analysis of five-digit sectors and firms within cities and regencies. The three dependent variables for the average annual employment, value added and labour productivity growth rates are defined as follows:

$$SEMPGROWTH_{r,i} = 100 \cdot \log\left(\frac{SEMP_{r,i,2009}}{SEMP_{r,i,2000}}\right) \Bigg/ 9 \tag{7.1}$$

$$SVAGROWTH_{r,i} = 100 \cdot \log\left(\frac{SVA_{r,i,2009}}{SVA_{r,i,2000}}\right) \Bigg/ 9 \tag{7.2}$$

$$SPRODGROWTH_{r,i} = 100 \cdot \log\left(\frac{SVA_{r,i,2009}/SEMP_{r,i,2009}}{SVA_{r,i,2000}/SEMP_{r,i,2000}}\right) \Bigg/ 9 \tag{7.3}$$

where $SEMP_{r,i}$ represents the annual average of total workers per working day of five-digit sector r (=1,2,3...,R) in a location i (=1,2,3...,N), and $SVA_{r,i}$ denotes the value added of r within i. The year is indicated by subscripts. $SEMPGROWTH_{r,i}$, $SVAGROWTH_{r,i}$, and $SPRODGROWTH_{r,i}$ refer to the average annual growth rates of employment, value added, and labour productivity respectively of five-digit sector within a location between 2000 and 2009. Although value added per worker is commonly used to measure labour productivity, it is partially assessed. Since, labour productivity depends on the degree of other inputs utilized in the production process such as capital, intermediate inputs and technology (see, for instance, OECD, 2001). However, this requires more data that is not available in the datasets. Furthermore using the same structure of equations 7.1, 7.2, and 7.3, manufacturing growth is examine at the firm-level f (=1,2,3...,F) for employment ($FEMPGROWTH_{f,r,i}$), value added ($FVAGROWTH_{f,r,i}$) and labor productivity ($FPRODGROWTH_{f,r,i}$) within five-digit sector r and location i. The baseline model for sectoral growth is defined as follows:

$$\begin{aligned} y_{r,i} = {} & \alpha + \beta_1^{OS} SEMP_{r,i} + \beta_2^{OS} SVAEMP_{r,i} + \beta_3^{OS} LQ_{r,i} + \beta_4^{OS} COMP_{r,i} \\ & + \beta_5^{OS} POPDEN_i + \beta_6^{OS} HUMCAP_i + \beta_7^{OS} VARIETY_i \\ & + \sum_{g=1}^{G} \delta_g^{OS} SECT_g + \sum_{v=1}^{V} \theta_v^{OS} PROV_v + \varepsilon_{r,i} \end{aligned} \tag{7.4}$$

where $y_{r,i}$ is the response variable of average annual growth for either employment ($SEMPGROWTH_{r,i}$), value added ($SVAGROWTH_{r,i}$) or labour productivity ($SPRODGROWTH_{r,i}$) within five-digit sector r and location i. The right-hand side of the model incorporates sector-specific and location-specific characteristics. Sectoral employment ($SEMP_{r,i}$) and labour productivity ($SVAEMP_{r,i} = SVA_{r,i,2000}/SEMP_{r,i,2000}$) within r in location i at the initial time are included in order to unfold if their initial status foster further growth. $LQ_{r,i}$, $COM_{r,i}$, and $VARIETY_i$ refer to location quotient, competition and general variety respectively as defined in Chapter 4. Population density ($POPDEN_i$) is computed as the ratio of number of people within households in a location over its area size, as a proxy of urbanization. The share of number of scholars who have completed the secondary and tertiary levels of education within a location over its aggregation over all of Indonesia ($HUMCAP_i$) is also tested as a proxy for relative human capital concentration. $SECT_g$ and $PROV_v$ are dummy variables in order to control for fixed effects within two-digit sectors g (=1,2,3...,G) and provinces v (=1,2,3...,V) respectively. $\varepsilon_{r,i}$ represents the disturbance term. Furthermore, a similar model at the firm-level is estimated, which is defined as follows:

$$
\begin{aligned}
y_{f,r,i} = \alpha &+ \beta_1^{OF} FEMP_{f,r,i} + \beta_2^{OF} FVAEMP_{f,r,i} + \beta_3^{OF} FSMALL_{f,r,i} \\
&+ \beta_4^{OF} FLARGE_{f,r,i} + \beta_5^{OF} LQ_{r,i} + \beta_6^{OF} COMP_{r,i} + \beta_7^{OF} POPDEN_i \\
&+ \beta_8^{OF} HUMCAP_i + \beta_9^{OF} VARIETY_i + \sum_{g=1}^{G} \delta_g^{OF} SECT_g \\
&+ \sum_{v=1}^{V} \theta_v^{OF} PROV_v + \varepsilon_{f,r,i}
\end{aligned} \tag{7.5}
$$

where $y_{f,r,i}$ represents the average annual growth for either employment ($FEMPGROWTH_{f,r,i}$), value added ($FVAGROWTH_{f,r,i}$) or labour productivity ($FPRODGROWTH_{f,r,i}$) for firm f which belongs to a five-digit sector r and location i. From equation 7.4, the number of employees and labour productivity for sector ($SEMP_{r,i}$ and $SVAEMP_{r,i}$) at the initial time are replaced at firm-level f ($FEMP_{f,r,i}$ and $FVAEMP_{f,r,i} = FVA_{f,r,i,2000}/FEMP_{f,r,i,2000}$, respectively). Dummy variables for small and large firm' size are introduced, where the former is defined between 20 and 49 workers ($FSMALL_{f,r,i}$) and the latter equal and over 250 employees ($FLARGE_{f,r,i}$). These are included in the model since small operations substantially contributed to manufacturing growth (see Figure 7.1), and large firms can influence the overall manufacturing growth within Indonesian locations as they lead large operations. $\varepsilon_{f,r,i}$ denotes the error term of the explained variable, and β, δ and θ are parameters to be estimated for sectors (OS) and firms (OF), which determine the slope of the associated variable. In addition, equations 7.4 and 7.5 are extended by disaggregating variety ($VARIETY_i$) into unrelated (UV_i) and related (RV_i) varieties based on KBLI 2005, and the latter indicator is further decomposed into high and medium-high ($RVHMH_i$), and medium-low and low ($RVMLL_i$) technology intensity related industries based on OECD's classification (2011). All explanatory variables are assessed at the initial period to unfold the impact of the initial conditions on manufacturing growth within Indonesian cities and regencies, underling the notion of path dependency mechanism of agglomeration externalities. It is expected that locations with higher initial status grow faster than locations with lower values.

The influence of agglomeration externalities on manufacturing growth is estimated distinguishing cities and regencies, which allows comparing the results with previous studies' outcomes within cities (see, for instance, Glaeser et al., 1992; Henderson et al., 1995), and a more accurate inference towards these two diverse administrative units. Taking into account indiscriminately the entire country, the heterogeneity between cities and regencies is not considered, which lead to erroneous results at the lower-level analysing the higher-level, which recall the notion of ecological fallacy (Robinson, 1950). Several scholars (Burger et al., 2007; De Groot et al., 2009; Mameli et al., 2014) point out that level of aggregations (e.g. regional and sectoral) matter in determining the effect of agglomeration externalities. This has implications for previous studies (see, for instance, De Groot et al., 2009, for a review of thirty-one studies) that merely analyse agglomeration externalities at the country or regional-level since these findings need to be interpreted carefully. Following this, cities and regencies are separately analysed in order to assess their idiosyncratic outcomes. The sectoral composition is kept constant employing the lowest level within the Indonesian industrial classification and considering also the single economic unit, which allow capturing micro variations and avoiding sectoral aggregation bias.

Given the nature of this research and variables employed, a potential problem is the presence of endogeneity in the models, which stems from the correlation of the error term with one or more independent variables. The endogeneity problem can be overcome using instrumental variables, which are correlated with the predictors and uncorrelated with the predicted variable. However, instrumental variables are often unavailable in regional growth studies (Henderson, 2003) as in this case. The presence of endogenous regressors biases the estimations; in particular, the dynamic notion of agglomeration economies, embraced by this study, underpinned the potential problem of simultaneity. Cities and regencies that experience higher manufacturing growth attract more agents as much as denser localizations of inhabitants and economic activities foster manufacturing growth. The role of related variety as a diversification driver could be seen as a further potential source of reverse causality since they can generate regional (un)related branches affecting the overall manufacturing expansion, which affects the localization of varieties. The conceptualization of path-dependency is modelled including all covariates nine years before manufacturing growth occurs assuming that economic activities react to it rather than anticipate manufacturing expansion, since agglomerations are affected after the growth is manifest rather than before. Simultaneity seems to be a week issue, in particular considering that the majority of explanatory variables (population density, human capital, and the set of varieties) are measured at the location level, whereas the explained variables are computed at the location-industry and firm levels. Unobservable characteristics are controlled introducing dummy variables for two-digit sectors and provinces, small and large firm sizes, and several control variables are employed such as human capital, employment and labour productivity at the initial time for sectors and firms in order to purge unmodeled sources out from the error term, which may cause inconsistent parameters.

Multicollinearity is also tested using the Pearson's correlation matrix and the variance inflation factor (VIF)[35] for all regressions. Pearson's correlation matrix shows that all dependent variables have values included between ± 0.7 with

35. The variance inflation factor (VIF) assesses the multicollinearity within ordinary least squares regression quantifying how much the variance of single coefficient is inflated contributing to the standard error in the regression. A common cut-off value is when the variance is over 10 (see, for instance, Hair, Anderson, Tatham, & Black, 1995; Kennedy, 1992), which can be interpreted as a problematic issue stemming from the correlation between a certain variable and other explanatory variables.

several exceptions where the maximum correlation is 0.77[36]. However, the variance inflation factor reveals that all variables have VIF's values less than 7, which suggests that multicollinearity does not substantially bias the results. In addition, it is run the Breush–Pagan/Cook–Weisberg test for all OLS models in order to assess for heteroskedasticity. It shows that estimations are characterized by large *chi-squared* within a significant level of 5% rejecting the null hypothesis of homoscedasticity suggesting for the possible presence of non-constant variance of residuals. Heteroskedasticity does not bias the estimates but they are no longer the best linear unbiased estimator (BLUE). Therefore, it is controlled by running OLS regressions using heteroskedasticity-robust standard errors[37].

7.3 Data construction and descriptive statistics

Based on the data collected from the Indonesia Statistic Office (BPS) and the University of Minnesota's Population Center (Minnesota Population Center, 2014), two datasets have been constructed selecting five-digit sectors and firms within Indonesian cities and regencies that are constantly present in 2000 and 2009. These observations can be considered as firms and sectors that survive and evolve over time within Indonesian locations. Forty-one five-digit sectors and thirteen firms outliers have been excluded from the estimations[38]. As a result two datasets for sectors and firms are constructed. The latter includes 244 five-digit sectors within 162 Indonesian locations, of which 43 cities and 119 regencies with total observations of 3,315. The former contains 6,557 firms within 183 locations of which 53 cities and 130 regencies. However, the observations are not homogeneously distributed geographically.

Table 7.1 shows the descriptive statistics of the datasets for sectors and firms disaggregated by cities and regencies. As highlighted in the previous chapter, differences in agents' localization between cities and regencies generate diverse magnitude of agglomeration externalities, which lead to performance differentials of localized economic activities within cities and regencies. Established firms and the overall industrial structure show higher performance within urban areas than regencies due to the dense concentration of economic activities, which enhances their innovation capability and development. However, established five-digit sectors grow faster within regencies than cities due to intra-industry knowledge spillovers. Differences between cities and regencies in terms of agents' localization and economic activity performance

36. Correlations between independent variables have been assessed for those predictors that are simultaneously included in the models. Given the derivation of the set of varieties, unrelated variety (UV_i) is highly correlated with general variety ($VARIETY_i$) (roughly 0.90), and medium-low and low technology intensity related measure ($RVMLL_i$) is highly correlated with related variety (RV_i) (roughly 0.90), which are not simultaneously included within the models.

37. However, cluster-robust standard errors for locations have been also tested within all regressions though they do not substantially affect the inference.

38. The Studentized residuals has been used to check for outliers with a cut-off point of >|2.5|, which is a common value used in similar studies (see, for instance, Hartog et al., 2012).

highlight the necessity to discriminate these two types of administrative units in the empirical analysis.

Figure 7.1 shows that high and medium-high (H-MH) technology intensity firms have, in almost all classifications, higher average growth than medium-low and low (ML-L) technology intensity economic activities within Indonesian locations between 2000 and 2009. High and medium-high technology intensity operations grew faster in all three dimensions between 2000 and 2009 indiscriminately by locations and firms' sizes. It is expected that H-MH technology intensity related industries foster manufacturing growth due to their innovation propensity and faster expansion, though they account for only 10% of the overall observations. In addition, small firms experience higher growth on average in comparison of larger firms in almost all classifications; it is also expected that small operations increase manufacturing growth. This can be due to the role of large operations, which may contribute to small firms expansion through spin-off and cooperation linkages facilitating knowledge spillovers and the development of the entire industrial structure.

Table 7.1: Nomenclature of variables and their means and standard deviations disaggregated by cities and regencies.

Variable	Description	Cities		Regencies	
		Mean	SD	Mean	SD
Explained variables of average annual growth computed between 2000 and 2009.					
SEMPGROWTH	Sectoral employment.	-0.73	5.14	0.19	5.85
SVAGROWTH	Sectoral value added.	5.10	8.13	6.07	9.09
SPRODGROWTH	Sectoral labour productivity.	12.61	1.49	12.71	1.90
FEMPGROWTH	Employment at the firm-level.	-0.36	2.72	-0.21	3.12
FVAGROWTH	Value added at the firm-level.	5.71	5.99	5.38	6.42
PRODGROWTH	Labour productivity at the firm-level.	6.07	5.51	5.60	5.89
Explanatory variables measured at the initial time.					
Sector and firm-specific characteristics					
SEMP (log)	Sectoral employment.	2.43	0.66	2.37	0.67
SVAEMP (log)	Sectoral labor productivity.	4.19	0.51	4.09	0.59
LQ (log)	Specialization as a measure of MAR's externalities.	0.24 (0.39)	0.68 (0.60)	0.33 (0.75)	0.74 (0.79)
COMP (log)	Competition denoting the local rivalry degree.	0.30 (0.19)	0.47 (0.42)	0.27 (0.20)	0.50 (0.43)
FEMP (log)	Employment at the firm-level.	1.95	0.55	1,91	0.53
FVAEMP (log)	Labor productivity at the firm-level.	4.06	0.50	3.89	0.58
FSMALL FLARGE	Dummy variables for Small (S) and Large (L) firms' size.	# obs.: S:1,023; L:515		# obs: S:1,835; L:785	
Location-specific characteristics					
POPDEN (log)	Population density as a proxy of urbanization. The population resident stems from the population census in 2000.	3.86 (3.88)	0.25 (0.24)	2.98 (3.00)	0.27 (0.26)
HUMCAP (log)	Location share of skilled workers, which stems from the population census in 2000.	-1.96 (-1.91)	0.45 (0.42)	-2.28 (-2.27)	0.32 (0.34)
VARIETY	General variety as a measure of Jacobian externalities computed without any sectoral linkages.	4.45 (4.53)	1.25 (1.15)	4.13 (3.91)	1.21 (1.38)
UV	Unrelated variety based on KBLI 2005 measuring industrial diversity.	3.03 (3.07)	0.81 (0.76)	2.67 (2.49)	0.92 (1.00)
RV	Related variety based on KBLI 2005 associated with inter-industry knowledge spillovers.	1.42 (1.46)	0.53 (0.49)	1.46 (1.42)	0.49 (0.58)
RVHMH	Related variety of high and medium-hight technology intensity industry based on OECD's classification.	0.23 (0.23)	0.20 (0.19)	0.14 (0.12)	0.17 (0.16)
RVMLL	Related variety of medium-low and low technology intensity industry based on OECD's classification.	1.19 (1.23)	0.44 (0.41)	1.32 (1.30)	0.45 (0.53)
Number of observations		**1,124 (2,465)**		**2,191 (4,092)**	

Notes: The databases at the firm and sectoral levels are not identical, thus, the values between brackets refer to the firm's dataset.

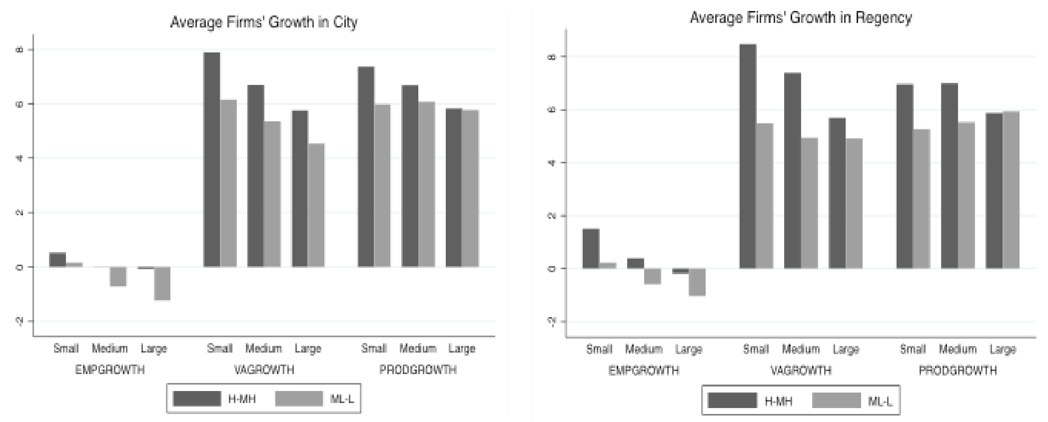

Figure 7.1: The average of annual employment, value added and labour productivity growth rates at the firm-level between 2000 and 2009 disaggregated by types of locations, technology intensity industries and firm' sizes.
Notes: Firm's size is expressed in terms of employment where small denotes firms between 20 and 49 workers, medium between 50 and 249, and large equal and over 250 employees.

7.4 Estimation results

The influence of agglomeration forces on the average annual employment, value added and labour productivity growth rates are analysed within Indonesian locations between 2000 and 2009 at the five-digit sector and firm levels. This is conducted discriminating cities and regencies for a more accurate inference sine they substantially differ in terms of agents' localization. Without taking into account for these differences often lead to incorrect results (Ercole & O'Neill, forthcoming).

Employment growth.

The results of annual average employment growth rate between 2000 and 2009 within Indonesian locations for sectors and firms are illustrated in Table 7.2. It is notable that specialization (LQ) plays a negative role for sectors indiscriminately by locations (S.1-6) and firm' employment growth within regencies (F.4-6) thought it is not significant within cities at the firm-level (F.1-3). Numerous scholars (see, for instance, De Groot et al., 2009; De Vor & De Groot, 2010) have found negative relationship between the degree of specialization and employment growth, though this is in contrast with the conceptualization of the MAR model (Glaeser et al., 1992), which assumes that specialized clusters enhance innovation and growth due to intra-industry knowledge spillovers. Competition ($COMP$) has a positive effect on employment growth for sectors within regencies (S.4-6) though it has negative coefficients at the firm-level with regard to all locations (F.1-6). These diverse results for sectors and firms can be associated with the selection of economic activities within the same sector, since a higher rivalry causes smart selection of firms making the sectoral aggregation more efficient and innovative.

Population density ($POPDEN$) seems to have a positive effect on sectoral employment growth within regencies (S.4-6) and negative for firms within cities (F.1-3). Human capital ($HUMCAP$) negatively affects firms' growth within regencies (F.4-6) though it is not statistically significant for sector in all locations (S.1-6) and firms within cities (F.1-3). These divergence effects between cities and regencies are also confirmed for value added and labour productivity growth (see Table 7.3 and Table 7.4). Indonesia experienced a rapid urbanization where urban population is predicted to reach more than 65% by 2025, though population expanded faster in less dense locations (World Bank, 2012) and the number of inhabitants declined within the largest cities as a share of urban population (World Bank, 2015). This generated new urban centres and manufacturing opportunities explaining the antithetic relationship between population density and manufacturing growth within regencies and cities. Whereas, the divergence influence of human capital is explainable in terms of industrial composition heterogeneity between the two types of administrative units. Since, regencies show a predominant localization of labour-intensive related industries demanding mainly unskilled workers; and cities that are highly characterized by the presence of high and medium-high technology intensity related industries require more qualified labour, which supports the expansions of these industries and the overall growth due to their innovation propensity.

Results also reveal that general variety ($VARIETY$) positively influences the average annual employment growth rate within cities for sectors (S.1) and within regencies for firms (F.4) underpinning the conceptualization of Jacobian externalities computed without any sectoral linkages. When general variety is disaggregated into unrelated (UV) and related (RV) varieties based on Indonesian industrial classification, the former increases employment for firms within regency (F.5-6) and the latter positively affects the sectoral employment growth within cities (S.2) though it is only significance at 10%. A further disaggregation of related variety based on technological intensity highlights that higher localization of high and medium-high technology intensity related industries ($RVHMH$) is beneficial for sectoral employment growth within cities (S.3). Whereas, medium-low and low technology intensity related industries ($RVMLL$) seem to have a negative impact on firms' employment growth within urban areas (F.3). The significant and positive outcomes of related varieties for job creation are associated with inter-industry knowledge spillovers increasing established sectors and firms' innovation capabilities due to the recombination and accumulation of related competences. This positive role of related variety on employment expansion is supported by the findings of several authors, for instance, Frenken et al. (2007) in the Netherlands, Bishop and Gripaios (2010) in Great Britain, Boschma et al. (2012) in Spain, and Hartog et al. (2012) in Finland.

In addition, it is observed the localization of small firms ($FSMALL$) is beneficial for employment growth within cities (F.1-3) and the presence of large economic activities ($FLARGE$) fosters job creation within regencies (F.4-6). According to the datasets employed, small operations are highly localized within Indonesian cities accounting for 42% of urban manufacturing employment; thus, they play an important role for urban job creation. Whereas, regencies are characterized by large operations roughly with 70% of their manufacturing employment, thus, an increase of large economic activities within regencies stimulates employment growth though they account for just 20% of firms within regencies.

Value added growth.
Table 7.3 shows the influence of agglomeration externalities on average annual value added growth for five-digit sectors and firms within Indonesian locations between 2000 and 2009. The location quotient (LQ) still plays a negative effect on manufacturing growth (S.10-12 and F.10-12) though it is not statistically significant within cities (S.7-9 and F.7-9). Also, competition ($COMP$) affects negatively firms' value added growth (F.7-12) since enterprises need to face higher rivalry for prices and factors of production due to an increase in competition. Looking back at the employment growth estimates (Table 7.2), it is notable that the set of varieties becomes more statistically significance for value added expansion holding the same sign (Table 7.3) as well as for labour productivity growth (Table 7.4).

It is observed that an increase of industrial relatedness is beneficial for sectoral and firm's value added growth since interconnected industries within a location raise inter-industry knowledge spillovers favouring their innovations capabilities. This generates disproportional profitability of economic activities incrementing also the sectoral attractiveness favouring new entrants due to higher returns. In particular, general variety ($VARIETY$) computed without any sectoral linkages fosters value added growth within Indonesian locations (S.7, S.10, and and F.10). Disaggregating it, unrelated variety (UV) plays a positive role for firms within regencies (F.11-12), and related variety (RV) is beneficial for sectors and firms (S.8, S.11 and F.11) though it is not significant for firms within cities (F.8). The role of related variety becomes more evident when high and medium-high technology intensity related industries ($RVHMH$) are considered, which foster the sectoral and firms' value added growth within Indonesian locations (S.9, S.12 and F.9, S.12). These industries mainly compete based on innovations generating incremental and radical changes stimulating the development of sectors and firms with positive implications on value added growth. Instead, medium-low and low technology intensity related industries ($RVMLL$) is significant only within regencies (F.12) holding a positive sign. The positive implications of related variety for value added growth can be found in Boschma and Iammarino (2009) and Boschma et al. (2012) in Italy and Spain respectively.

As aforementioned, the distinct impacts of population density ($POPDEN$) and human capital ($HUMCAP$) can be attributed to the diverse urbanization trajectories and industrial structures of cities and regencies. Population density has a positive effect on sectoral value added growth within regencies (S.10-12) and a negative effect within cities for sectors and firms (S.7-9 and F.7-9).

Human capital is beneficial for firms' value added growth within cities (F.7-9) and negative for sectors and firms within regencies (S.10-12 and F.10-12). These idiosyncratic influences could not be captured considering the entire country without discriminating cities and regencies.

Labour productivity growth

The results of average annual labour productivity growth within Indonesian locations between 2000 and 2009 for sectors and firms are illustrated in Table 7.4. Specialized clusters (LQ) continue to negatively affect growth within regencies (S.16-18 and F.16-18), however, it is notable that the location quotient turns to be positive within cities (S.13-15 and F.13-15) though it is statistically significant in only one regression (S.15). Also, sectoral competition ($COMP$) continues to negatively influence manufacturing growth (S.13-18 and F.13-18). General variety ($VARIETY$) and related varieties (RV, $RVHMH$ and $RVMLL$) are positively associated with labour productivity growth, though several coefficients are not statistically significant within cities (S.13-18 and F.13-18). Boschma and Iammarino (2009) find weak evidence that related variety fosters labour productivity within Italian provinces thought economic activities located in the South of Italy witnessed higher labour productivity growth with respect to other areas within the country (employing dummy variables). They argue that the Southern part of Italy experienced higher productivity growth, diversification of industrial and export structures in comparison of the national average. Therefore, taking into account for these differences and analysing separately the Italian areas might lead to diverse results recalling the ecological fallacy notion (Robinson, 1950). Furthermore, the results in Table 7.4 confirm the previous outcomes that an increase of population density ($POPDEN$) plays a positive role on manufacturing growth within regencies (S.16-18) and slows down growth within cities (S.13-15); and an increase of human capital ($HUMCAP$) positively influence manufacturing growth within cities (S.13-15 and F.13-15) and negatively related to regencies (S.16-18).

Table 7.2: The influence of agglomeration externalities on average annual employment growth of five-digit sectors and firms disaggregated by cities and regencies between 2000 and 2009.

	Sectors						Firms					
Variables		**Cities**			**Regencies**			**Cities**			**Regencies**	
	S.1	**S.2**	**S.3**	**S.4**	**S.5**	**S.6**	**F.1**	**F.2**	**F.3**	**F.4**	**F.5**	**F.6**
SEMP (or FEMP)	-2.634***	-2.654***	-2.664***	-2.755***	-2.755***	-2.789***	-1.044***	-1.031***	-1.046***	-2.328***	-2.325***	-2.313***
	(0.380)	(0.383)	(0.382)	(0.263)	(0.263)	(0.264)	(0.302)	(0.303)	(0.304)	(0.293)	(0.292)	(0.293)
SVAEMP (or FVAEMP)	0.829*	0.831*	0.781*	0.782***	0.782***	0.724**	1.083***	1.087***	1.069***	1.196***	1.196***	1.183***
	(0.381)	(0.380)	(0.379)	(0.232)	(0.232)	(0.236)	(0.142)	(0.142)	(0.142)	(0.115)	(0.115)	(0.116)
FSMALL							0.566**	0.571**	0.589**	0.271	0.271	0.281^
							(0.181)	(0.181)	(0.181)	(0.165)	(0.165)	(0.166)
FLARGE							-0.065	-0.074	-0.077	0.767**	0.766**	0.757**
							(0.288)	(0.289)	(0.289)	(0.263)	(0.263)	(0.264)
LQ	-0.805**	-0.798**	-0.840**	-1.059***	-1.059***	-1.043***	-0.112	-0.116	-0.127	-0.386***	-0.379***	-0.382***
	(0.303)	(0.303)	(0.302)	(0.208)	(0.208)	(0.207)	(0.128)	(0.128)	(0.128)	(0.085)	(0.085)	(0.085)
COMP	0.474	0.458	0.391	0.931**	0.931**	0.907**	-0.621**	-0.610**	-0.646**	-0.901***	-0.896***	-0.893***
	(0.567)	(0.569)	(0.568)	(0.339)	(0.339)	(0.340)	(0.225)	(0.225)	(0.225)	(0.180)	(0.180)	(0.180)
POPDEN	-1.074	-1.367	-0.688	1.522*	1.525^	1.695*	-1.499**	-1.378**	-1.096*	0.425	0.328	0.359
	(1.412)	(1.492)	(1.523)	(0.759)	(0.780)	(0.783)	(0.506)	(0.519)	(0.530)	(0.328)	(0.356)	(0.356)
HUMCAP	-0.766	-0.711	-0.914	-0.936	-0.939	-0.860	0.319	0.249	0.231	-0.735**	-0.660*	-0.633*
	(0.697)	(0.702)	(0.702)	(0.628)	(0.641)	(0.642)	(0.239)	(0.244)	(0.243)	(0.277)	(0.287)	(0.289)
VARIETY	0.589**			0.081			-0.074			0.199***		
	(0.220)			(0.142)			(0.080)			(0.052)		
UV		0.343	0.192		0.079	-0.164		0.060	-0.005		0.236**	0.174^
		(0.387)	(0.401)		(0.170)	(0.224)		(0.160)	(0.165)		(0.072)	(0.095)
RV		1.013^			0.086			-0.265			0.111	
		(0.588)			(0.276)			(0.216)			(0.117)	
RVHMH			3.290*			1.913			0.545			0.625
			(1.378)			(1.193)			(0.488)			(0.546)
RVMLL			0.649			-0.030			-0.473*			0.083
			(0.607)			(0.285)			(0.238)			(0.118)
Constant	0.076	0.945	-0.314	1.804	1.792	2.651	2.870	2.249	1.823	-3.170*	-2.780^	-2.637^
	(5.466)	(5.638)	(5.643)	(2.696)	(2.766)	(2.833)	(1.984)	(2.082)	(2.069)	(1.387)	(1.466)	(1.472)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provincial fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,124	1,124	1,124	2,191	2,191	2,191	2,465	2,465	2,465	4,092	4,092	4,092
R^2	0.196	0.196	0.199	0.220	0.220	0.221	0.115	0.115	0.116	0.133	0.133	0.134
Adjusted R^2	0.167	0.167	0.169	0.206	0.206	0.206	0.097	0.097	0.098	0.123	0.123	0.123

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses.

Table 7.3: The influence of agglomeration externalities on average annual value added growth of five-digit sectors and firms disaggregated by cities and regencies between 2000 and 2009.

Variables	Sectors						Firms					
	Cities			Regencies			Cities			Regencies		
	S.7	**S.8**	**S.9**	**S.10**	**S.11**	**S.12**	**F.7**	**F.8**	**F.9**	**F.10**	**F.11**	**F.12**
SEMP (or FEMP)	-2.514***	-2.542***	-2.553***	-1.996***	-2.042***	-2.137***	0.327	0.296	0.269	-1.027*	-1.030*	-0.943^
	(0.518)	(0.522)	(0.521)	(0.376)	(0.379)	(0.379)	(0.550)	(0.550)	(0.548)	(0.486)	(0.487)	(0.487)
SVAEMP (or FVAEMP)	-7.214***	-7.212***	-7.269***	-6.947***	-6.937***	-7.109***	-6.868***	-6.877***	-6.910***	-5.847***	-5.847***	-5.939***
	(0.594)	(0.594)	(0.599)	(0.372)	(0.371)	(0.377)	(0.276)	(0.277)	(0.278)	(0.226)	(0.226)	(0.228)
FSMALL							0.277	0.263	0.295	-0.129	-0.129	-0.062
							(0.341)	(0.341)	(0.341)	(0.301)	(0.301)	(0.302)
FLARGE							0.018	0.040	0.034	0.701	0.703	0.637
							(0.542)	(0.541)	(0.540)	(0.457)	(0.457)	(0.457)
LQ	-0.453	-0.443	-0.491	-2.114***	-2.101***	-2.057***	-0.073	-0.061	-0.082	-1.640***	-1.648***	-1.668***
	(0.413)	(0.412)	(0.413)	(0.313)	(0.313)	(0.310)	(0.241)	(0.240)	(0.240)	(0.164)	(0.165)	(0.164)
COMP	-0.665	-0.688	-0.765	-0.165	-0.195	-0.264	-1.321**	-1.349**	-1.416***	-2.471***	-2.478***	-2.454***
	(0.791)	(0.795)	(0.798)	(0.504)	(0.505)	(0.503)	(0.418)	(0.419)	(0.422)	(0.339)	(0.339)	(0.339)
POPDEN	-4.428*	-4.825*	-4.045^	3.352**	3.684**	4.180***	-1.745^	-2.058*	-1.533	0.346	0.477	0.694
	(2.075)	(2.189)	(2.266)	(1.118)	(1.153)	(1.152)	(0.922)	(0.936)	(0.969)	(0.583)	(0.631)	(0.633)
HUMCAP	1.595	1.670	1.436	-2.165*	-2.447**	-2.189*	1.642***	1.823***	1.791***	-1.093*	-1.194*	-1.004^
	(1.026)	(1.035)	(1.041)	(0.897)	(0.931)	(0.932)	(0.474)	(0.503)	(0.503)	(0.482)	(0.518)	(0.522)
VARIETY	0.994**			0.560**			0.051			0.884***		
	(0.347)			(0.216)			(0.156)			(0.099)		
UV		0.661	0.487		0.378	-0.345		-0.296	-0.418		0.834***	0.393*
		(0.603)	(0.623)		(0.245)	(0.324)		(0.316)	(0.328)		(0.128)	(0.172)
RV		1.569^			1.058*			0.544			1.004***	
		(0.904)			(0.443)			(0.391)			(0.223)	
RVHMH			4.188^			6.470***			2.052*			4.620***
			(2.176)			(1.676)			(0.974)			(1.011)
RVMLL			1.151			0.676			0.155			0.809***
			(0.923)			(0.457)			(0.420)			(0.228)
Constant	50.250***	51.429***	49.980***	32.062***	30.767***	33.417***	41.667***	43.270***	42.478***	25.960***	25.433***	26.438***
	(8.141)	(8.397)	(8.427)	(3.859)	(4.010)	(4.118)	(3.800)	(3.999)	(3.998)	(2.385)	(2.555)	(2.573)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provincial fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,124	1,124	1,124	2,191	2,191	2,191	2,465	2,465	2,465	4,092	4,092	4,092
R^2	0.306	0.306	0.307	0.303	0.303	0.307	0.310	0.311	0.311	0.266	0.266	0.269
Adjusted R^2	0.281	0.280	0.281	0.291	0.291	0.294	0.296	0.297	0.297	0.257	0.257	0.260

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses.

Table 7.4: The influence of agglomeration externalities on average annual labour productivity growth of five-digit sectors and firms disaggregated by cities and regencies between 2000 and 2009.

Variables	Sectors						Firms					
	Cities			Regencies			Cities			Regencies		
	S.13	**S.14**	**S.15**	**S.16**	**S.17**	**S.18**	**F.13**	**F.14**	**F.15**	**F.16**	**F.17**	**F.18**
SEMP (or FEMP)	-0.078	-0.079	-0.201**	0.135*	0.121^	0.102	1.370**	1.327**	1.315**	1.300**	1.295**	1.370***
	(0.077)	(0.078)	(0.076)	(0.068)	(0.070)	(0.070)	(0.462)	(0.461)	(0.460)	(0.413)	(0.413)	(0.414)
SVAEMP (or FVAEMP)	-2.218***	-2.218***	-2.008***	-2.456***	-2.453***	-2.489***	-7.951***	-7.963***	-7.979***	-7.043***	-7.044***	-7.123***
	(0.134)	(0.134)	(0.135)	(0.159)	(0.158)	(0.160)	(0.240)	(0.240)	(0.242)	(0.189)	(0.189)	(0.190)
FSMALL							-0.289	-0.308	-0.294	-0.399	-0.400	-0.343
							(0.284)	(0.284)	(0.284)	(0.253)	(0.253)	(0.254)
FLARGE							0.083	0.114	0.111	-0.066	-0.063	-0.120
							(0.457)	(0.456)	(0.456)	(0.395)	(0.395)	(0.395)
LQ	0.056	0.057	0.171*	-0.338***	-0.333***	-0.325***	0.039	0.055	0.045	-1.254***	-1.269***	-1.286***
	(0.067)	(0.067)	(0.067)	(0.063)	(0.063)	(0.062)	(0.210)	(0.209)	(0.209)	(0.141)	(0.142)	(0.142)
COMP	-0.376**	-0.377**	-0.261*	-0.440***	-0.449***	-0.464***	-0.701^	-0.739*	-0.770*	-1.570***	-1.582***	-1.561***
	(0.120)	(0.121)	(0.115)	(0.125)	(0.126)	(0.126)	(0.365)	(0.365)	(0.367)	(0.288)	(0.288)	(0.288)
POPDEN	-0.986**	-0.996**	-0.787***	0.513*	0.613**	0.717**	-0.245	-0.680	-0.437	-0.079	0.148	0.334
	(0.303)	(0.302)	(0.179)	(0.206)	(0.219)	(0.221)	(0.695)	(0.701)	(0.732)	(0.497)	(0.529)	(0.532)
HUMCAP	0.639***	0.641***	0.875***	-0.434*	-0.519**	-0.461*	1.323***	1.574***	1.559***	-0.358	-0.534	-0.371
	(0.172)	(0.174)	(0.142)	(0.170)	(0.182)	(0.181)	(0.396)	(0.429)	(0.429)	(0.406)	(0.438)	(0.441)
VARIETY	0.108^			0.173***			0.126			0.685***		
	(0.056)			(0.046)			(0.129)			(0.084)		
UV		0.100	-0.027		0.119*	-0.033		-0.357	-0.413		0.598***	0.220
		(0.094)	(0.082)		(0.047)	(0.057)		(0.269)	(0.278)		(0.109)	(0.145)
RV		0.122			0.322**			0.809*			0.893***	
		(0.133)			(0.101)			(0.328)			(0.195)	
RVHMH			0.788**			1.460***			1.507^			3.994***
			(0.273)			(0.312)			(0.801)			(0.849)
RVMLL			0.092			0.237*			0.629^			0.726***
			(0.097)			(0.101)			(0.351)			(0.199)
Constant	25.317***	25.346***	25.312***	20.698***	20.310***	20.881***	38.797***	41.022***	40.655***	29.129***	28.214***	29.075***
	(1.385)	(1.379)	(1.079)	(0.790)	(0.805)	(0.838)	(2.998)	(3.180)	(3.190)	(2.035)	(2.170)	(2.181)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provincial fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,124	1,124	1,124	2,191	2,191	2,191	2,465	2,465	2,465	4,092	4,092	4,092
R^2	0.478	0.478	0.390	0.462	0.464	0.467	0.442	0.443	0.443	0.370	0.370	0.372
Adjusted R^2	0.459	0.459	0.386	0.453	0.454	0.457	0.431	0.432	0.432	0.362	0.363	0.365

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses.

Robustness check: Time frame definition changing.
The empirical analysis exposed in this chapter refers to the influence of agglomeration externalities at the initial time on manufacturing growth between 2000 and 2009. A potential issue of validity of results refers to different time frames employed, which might generate diverse findings in terms of coefficients' sign. Thus, two diverse intervals have been also tested (2000-2004 and 2005-2009) employing the same conceptualization proposed in this chapter. The selection of these time frames is not casual but they are particular relevant in Indonesia for two main reasons. First, important events occurred in the country such as earthquakes and tsunamis in Sumatra on 26 December 2004 and in Java Island on 17 July 2006, and the first direct presidential election in Indonesia completed on 20 September 2004. For events occurred in 2004, they produce their effects on manufacturing growth from the following calendar years and revealed in the annual data from 2005. Second, new innovative policies have been adopted based on cluster and location approaches from 2004, which affected large and medium manufacturing operations growth as emerged in Chapter 6. However, estimating the influence of agglomeration externalities on manufacturing growth within these two intervals did not substantially change the findings in terms of coefficients' signs.

7.5 Conclusions

This chapter investigated the influence of agglomeration externalities on average annual employment, value added and labour productivity growth rates of established sectors and firms in two points in time (2000 and 2009) analysing separately cities and regencies. Investigating these three dimensions of manufacturing growth were particularly relevant in Indonesia during 2000 and 2009, since manufacturing experienced a significant increase of value added and labour productivity rather than employment. Taking into account the only employment dimension, manufacturing growth was not properly captured in the country. In addition, agglomeration externalities are tested discriminating cities and regencies since they showed diverse structure of agents' localization, which allow avoiding erroneous inference considering indiscriminately the entire country.

It is interesting to note the diverse outcomes of population density and human capital within cities and regencies, which could not be captured analysing the entire country. Population density had a negative influence within cities and a positive impact within regencies. Human capital was beneficial for manufacturing expansion within cities and negatively related to regencies. This could be due to the diverse urbanization tendencies and industrial compositions of these two types of administrative units. The findings suggest to encourage population expansion of unskilled workers within regencies in order to support highly localized labour-intensive industries; and favouring the formation of qualified labour within urban areas underpinning the growth of high and medium-high technology intensity industries, which are highly localized within cities. It is only found this significant and diverse influence between cities and regencies. Weak evidence has been observed to support that competition increases sectors' performance due to smart selection of firms. An increase in rivalry has a positive effect on employment growth for sectors within regencies, though it negatively affects sectoral labour productivity and the three dimensions of growth at the firm-level in all locations. It is only found this divergent impact of agglomeration externalities between sectors and firms. The negative influence of competition on growth is in contrast with the view of Porter (1990) and Jacobs (1969), who argue that local competition increases innovation, albeit it is supported by the MAR model (Glaeser et al., 1992), which embraces the Schumpeterian notion. Specialized clusters are negatively associated with sectoral and firms' growth within Indonesian locations. This is not really surprising since Indonesia experienced a process of diversification of manufacturing growth in terms of sectors and locations, and this tendency is also confirmed by the prevalent role of varieties on growth.

Robust evidence has been found to support that economic diversity measured as general variety, are the preponderant sources for manufacturing growth in Indonesia locations. However, when general variety is disaggregated into unrelated and related varieties based on the Indonesian industrial classification their idiosyncratic economic roles are assessed. Evidence revealed the prevalent and positive impact of related variety with particular regard to value added and labour productivity growth for sectors and firms. A further decomposition of related variety based on the technology intensity classification highlighted the importance of high and medium-high technology intensity related industries for manufacturing expansion within Indonesian cities and regencies, as most innovations are generated by these industries. The economic role of related variety is associated with learning process between interconnected industries, which is more intense than unrelated activities enhancing innovation capabilities of established operations. Whereas, an increase of unrelated variety is beneficial for manufacturing growth though only within Indonesian regencies. This can be explained in terms of their industrial specialised structure, where an increase of heterogeneous industries reduces the local exposure to industry-specific shocks, which enhance local stability and more balanced growth.

The overall findings highlighted the importance of industrial relatedness for established manufacturing growth. The following chapter aims to further investigate the impact of agglomeration externalities on the overall manufacturing structure employing a panel data analysis from 2000 to 2009.

8 The dynamic impact of agglomeration externalities on manufacturing structure

8.1 Introduction

The importance of knowledge spillover is widely recognized by scholars as a main driver for regional growth (Karlsson & Manduchi, 2001), which needs to be considered dynamic due to the persistent agents' interactions over time (Iammarino, 2005; Rigby & Essletzbichler, 2006) self-enforcing innovation capability and profitability of localized economic activities. However, the constant swapping of know-how reduces agents' dissimilarity in terms of competences making the learning process less effective, which may lead to lock-in. In the previous chapter, the conceptualization of path-dependency was modelled including all covariates nine years before manufacturing growth was manifest in order to explain the growth of established sectors and firms. In a similar conceptual fashion, two-year lag of continuous explanatory variables are tested to unfold the evolution of the entire manufacturing structure. The datasets employed refer to all five-digit sectors and firms within Indonesian cities and regencies adopting panel data analysis from 2000 to 2009, aiming to capture the impact of agglomeration externalities on the overall manufacturing structure including established economic activities, the disruption and genesis of firms and sectoral branches. The analysis is further extended disaggregating sectoral structure based on technology intensity degrees and two-digit-sectors. Since industries characterized by diverse characteristics can exploit agglomeration economies differently, which may be also influenced by the heterogeneity between cities and regencies making certain agglomeration externalities more available than others.

As aforementioned in Chapter 7, the empirical investigation is devoted to contribute to previous studies in numerous directions. Employing the economic variety decomposition allows addressing the misspecification of Jacobian externalities, which contributes to formulate more effective policies towards economic growth and diversification, and resolves the long-term academic debate on which externality is more predominance on growth. In particular, the promotion of key industries with large intersectoral linkages consent to reduce the risk associated with lock-in effect within clusters and lack of resilience within a location (typical drawbacks of having a location highly specialized). In addition, decomposing economic variety adopting the entropy formula permits to assess urbanization and MAR externalities along with general variety (without any sectoral discrimination) in order to compare the empirical results with previous studies' outcomes (see, for instance, De Groot et al., 2009, 2015), and decaying the latter into unrelated and related varieties to measure their idiosyncratic economic roles without causing necessarily multicollinearity within regression analysis. The country and the geographical scale of analysis can provide as well further insights due to the idiosyncratic development of the Indonesian economy and manufacturing, and discriminating cities and regencies enhances inference due to their heterogeneity (see Table 6.4 and Table 6.5). The empirical analysis also employs the lowest digit level within KBLI 2005 (five-digit sectors) and considering single economic activities, which allow capturing micro variations and avoiding sectoral aggregation bias.

The data collected are tested on three dimensions of manufacturing growth as a function of agglomeration externalities in order to assess manufacturing expansion more accurately, since value added and labour productivity grew faster than employment between 2000 and 2009. Besides this, most work applied economic variety decomposition to cross-sectional analysis (see, for instance, Bishop & Gripaios, 2010; Boschma & Iammarino, 2009; Boschma et al., 2012; Frenken et al., 2007; Quatraro, 2010), whereas panel data analysis is proposed in this chapter. This can provide further insights comparing the results with the previous chapter's outcomes, which employs cross-sectional models for the growth of established economic activities. Although researchers assess the influence of related variety on diverse geographical scales, measures of relatedness, periods covered, control variables and countries (Bishop & Gripaios, 2010; Boschma & Iammarino, 2009; Boschma et al., 2012; Castaldi et al., 2014; Frenken et al., 2007; Hartog et al., 2012; Quatraro, 2010, 2011), they seem to be unanimous that related variety plays an important role on growth.

These peculiarities of the present study make a unique attempt in its genre contributing to existing theoretical and empirical literature aiming to revitalize Indonesian manufacturing. Empirical evidence shows the preponderant role of specialised clusters for the entire manufacturing expansion indiscriminately by cities and regencies. The positive role of relatedness on growth also emerges, which can support clusters' competitiveness and their development. In particular, medium-low and low technology intensity related industries came to light as an important source for value added and labour productivity expansion. Although high and medium-high technology intensity related industries negatively affect value added and labour productivity within regencies; disaggregating the industrial structure based on technology intensity industries, this negative effect is driven by their non-technological related activities (medium-low and low). Further decomposing the industrial structure by two-digit sectors emerges that technological relatedness matters for the growth of localized economic activities. In this framework conditions where intra and inter-industry knowledge spillovers are important sources for growth, human capital come to light as a key driver for manufacturing development indiscriminately by locations and type of economic activities. This suggests that policymakers should strongly support the formation and development of skilled workers underpinning specialised clusters and their relatedness, which foster localization externalities and clusters' competitiveness.

The rest of this chapter is structured as followed. In Section 8.2, the specification of models is examined. In Section 8.3, the construction of datasets and their descriptive statistics are explored. In Section 8.4, empirical results are discussed in terms of the overall manufacturing structure and disaggregated by the degree of technology intensity and two-digit sectors. Finally conclusions are provided in Section 8.5.

8.2 Empirical specification

The seminal work of Glaeser et al. (1992) is combined with the contribution of Frenken et al. (2007) employing the disaggregation of varieties based on sectoral linkages to assess more accurately the idiosyncratic economic influence of (un)linked varieties. The Indonesian industrial classification (KBLI 2005) and technology intensity classification (OECD, 2011) is employed to determine the cognitive proximity between sectors. Agglomeration externalities are tested on sectoral and firms' employment, value added and labour productivity analysing separately cities and regencies in order to enhance inference of their policy relevance. In order to capture the dynamism of agglomeration externalities, causality is modelled based on two-year lag of explanatory variables as a function of employment, value added and labour productivity. Castaldi et al. (2014) investigate the influence of (semi-)related and unrelated varieties on patents as a proxy for innovation within US states as a function of one-year lag of agglomeration externalities. A particularity of this study is that they find evidence of related variety are beneficial for innovations in general, and the combination of unrelated knowledge can produce radical innovations generating technological 'breakthroughs'. This study add a novelty in comparison of the original work of Frenken et al. (2007), which assumes that unrelated varieties are associated with portfolio diversification effect disregarding the flow of knowledge between unrelated economic activities, which is rare but it can not be excluded. Neffke, Henning, Boschma, et al. (2011) explore the dynamic impact of agglomeration externalities on value added based on the industry life cycle within Swedish municipalities. They assume a dynamic prospective captured by two-year lag of agglomeration forces though Jacobian externalities are computed without any distinction of relatedness. In a similar fashion, two-year lag of all explanatory variables are employed. The assumption behind the selection of two-years lag is that the effect of agglomeration externalities are not promptly operate[39], since manufacturing performance is the result of the past variability of agglomeration

39. However, three-years lag has been also tested albeit it does not improve the empirical investigation.

economies. This becomes particular relevant considering the annual data collected, which does not allow time disaggregation (e.g. months), therefore, the effect of agglomeration externalities on manufacturing growth is expected to affect the data employed from the second year rather than after one year.

Panel data analysis within estimator is employed, which allows controlling for heterogeneity of unobservable characteristics of entities that are not explained by the covariates (e.g. specific sectoral capabilities and entrepreneurial abilities), where each five-digit sector and firm have a time-varying intercept term and the same slope parameter associated with each predictor. The fixed effect estimator has been selected based on the Hausman test[40], which rejected the null hypothesis of uncorrelation between the time-invariant individual-specific unobservable effects ($u_{r(f)}$) and the time-varying regressors, which is allowed by within estimator. The baseline model at the sectoral level is defined as follows:

$$\begin{aligned} y_{r,i,t} &= \alpha_0^{PS} + \beta_1^{PS} LQ_{r,i,t-2} + \beta_2^{PS} COMP_{r,i,t-2} + \beta_3^{PS} POPDEN_{i,t-2} \\ &+ \beta_4^{PS} HUMCAP_{i,t-2} + \beta_5^{PS} VARIETY_{i,t-2} + \sum_{t=1}^{T} \varphi_t^{PS} DYEAR_t \\ &+ u_r + \varepsilon_{r,i,t} \end{aligned} \tag{8.1}$$

where $y_{r,i,t}$ represents the predicted variable either for employment ($SEMP_{r,i,t}$), value added ($SVA_{r,i,t}$) or labour productivity ($SVAEMP_{r,i,t}$) for five-digit sector r (=1,2,3...,R) within a location i (=1,2,3...,N) at time t (=1,2,3...,T). The dependent variables are modelled as a function of two-year lag of all continuous independent variables to take into account the fact that employment, value added and labour productivity expansion is the result of prior efforts rather than to produce immediate effects. Location quotient ($LQ_{r,i,t-2}$) denotes five-digit sectoral specialization, competition ($COM_{r,i,t-2}$) indicates the degree of sectoral rivalry, population density ($POPDEN_{i,t-2}$) measures the market size, and human capital ($HUMCAP_{i,t-2}$) denotes skilled workers. $VARIETY_{i,t-2}$ indicates general variety computed without any sectoral linkages, which is decomposed into unrelated ($UV_{i,t-2}$) and related ($RV_{i,t-2}$) varieties based on KBLI 2005. This latter is further disaggregated into high and medium-high ($RVHMH_{i,t-2}$), and medium-low and low ($RVMLL_{i,t-2}$) technology intensity related industries based on OECD's classification (2011). $DYEAR_t$ denotes dummy variables for years in order to control for the unobservable variation during 2000 and 2009 such as the first direct presidential election in Indonesia in 2004, and the two important earthquakes and tsunamis that hit Sumatra in 2004 and Java Island in 2006. Since these events inevitably affected manufacturing industries in the country and they are not explained by the covariates. $\varepsilon_{r,i,t}$ denotes the disturbance term. In equation 8.1, the two-digit industry dummy variables are excluded for multicollinearity. A similar model is estimated at the firm-level as follows:

40. The standard Hausman test (Hausman, 1978) is commonly used in order to select the more appropriate estimator for panel data (see, for instance, Wooldridge, 2002).

$$
\begin{aligned}
y_{f,r,i,t} = {} & \alpha_0^{PF} + \beta_1^{PF} LQ_{r,i,t-2} + \beta_2^{PF} COMP_{r,i,t-2} + \beta_3^{PF} POPDEN_{i,t-2} \\
& + \beta_4^{PF} HUMCAP_{i,t-2} + \beta_5^{PF} VARIETY_{i,t-2} + \sum_{g=1}^{G} \delta_g^{PF} SECT_g \\
& + \sum_{t=1}^{T} \varphi_t^{PF} DYEAR_t + u_f + \varepsilon_{f,r,i,t} \qquad (8.2)
\end{aligned}
$$

where $y_{f,r,i,t}$ represents the predicted variable either for employment ($FEMP_{f,r,i,t}$), value added ($FVA_{f,r,i,t}$) or labour productivity ($FVAEMP_{f,r,i,t}$) for firm f (=1,2,3...,F) within five-digit sector r in a location i at time t. In comparison of equation 8.1, dummy variables ($SECT_g$) of two-digit sectors g (=1,2,3,..G) based on KBLI 2005 are included in the right-hand side of the model to control for unobservable variations based on the broader industrial classification that they are not capture by the covariates. $\varepsilon_{f,r,i,t}$ denotes the error term of the explained variable, and β, δ and φ are parameters to be estimated for sectors (PS) and firms (PF). Multicollinearity is assessed using the Pearson's correlation matrix, which shows that almost all dependent variables have a correlation coefficients between ± 0.7 with several exceptions where the maximum correlation is 0.74[41]. However, the variance inflation factor (VIF) - using the conventional OLS regression - shows that all variables have VIF's values less than 4, which suggests that multicollinearity does not substantially bias the results. Heteroskedasticity is controlled by using robust standard errors[42].

8.3 Data construction and descriptive statistics

Based on the data collected from the Indonesia Statistic Office (BPS) and the University of Minnesota's Population Center (Minnesota Population Center, 2014), unbalanced panel datasets for five-digit sectors and firms are constructed[43] within 236 Indonesian locations, of which 64 cities and 172 regencies. The sectoral database includes all firms aggregated within five-digit sectors that are present during 2000 and 2009 capturing the evolution of five-digit industries within Indonesian locations including established sectors and the genesis and disruption of sectoral branches. The firms' dataset incorporates all firms that are present during 2000 and 2009, which can be interpreted as the dynamic evolution of manufacturing structure at the firm-level within Indonesian locations taking into account the turnover (firms that failed and new venture creations) and established firms.

41. Given the derivation of the set of varieties, the decomposed measures show high correlation with the original source though they are not simultaneously included within the models.
42. The robust standard errors (White, 1980) is used, which do not affect the parameters but the only the standard errors increasing the validity of inference with particular reference to large samples (see, for instance, Wooldridge, 2002). However, cluster-robust standard errors for locations have been also tested for all regressions though they do not substantially affect the inference.
43. Sectors and firms with just one observation have been excluded from the analysis. In addition, the Studentized residuals have been used to check for outliers with a cut-off point of >|2.5|, which is a common value used in similar studies (see, for instance, Hartog et al., 2012). Based on this, roughly 5% of five-digit sectors and firm's observations have been excluded from the estimations.

However, the observations are not homogeneously distributed geographically and temporally. During 2000 and 2009, new administrative units have been created in Indonesia, thus several locations have been merged, which was straightforward since their genesis was made over only one administrative unit. The same approach is adopted discriminating cities and regencies since they are characterized by diverse attributes in terms of area size, industrial composition, population density and availability of skilled workers determining the performance differentials of their localized economic activities. This allows avoiding spurious inference and policy design relevance for these two diverse administrative units. Table 8.1 illustrates the nomenclature of variables employed and their descriptive statistics.

Table 8.1: Nomenclature of variables and their descriptive statistics of five-digit sectors and firms disaggregated by cities and regencies.

Variable	Description	Cities		Regencies	
		Mean	SD	Mean	SD
Explained variables during 2000 and 2009.					
Five-digit sector.					
SEMP(log)	Employment of five-digit sector.	5.06	1.50	5.07	1.53
SVA (log)	Value added of five-digit sector.	15.37	2.23	15.11	2.33
SVAEMP (log)	Labour productivity of five-digit sector.	10.31	1.26	10.04	1.40
Firm indicators.					
FEMP (log)	Employment at the firm-level.	4.17	1.17	4.14	0.51
FVA (log)	Value added at the firm-level.	14.25	1.90	13.79	0.93
FVAEMP (log)	Labour productivity at the firm-level.	10.07	1.20	9.64	0.62
Explanatory variables during 2000 and 2009.					
Sector-specific characteristics.					
LQ (log)	Specialization as a measure of MAR's externalities.	0.89	1.46	1.56	1.81
COMP (log)	Competition denoting the local sectoral rivalry degree.	0.41	0.87	0.37	0.86
Location-specific characteristics.					
POPDEN (log)	Population density denotes the population resident over the area size. The population resident stems from the census 2000 and 2010, for the years onward the first data point, the annual average growth has been added progressively.	6.66	0.65	4.52	0.81
HUMCAP (log)	Scholars that have completed the secondary and tertiary levels of education, which stem from the population census 2000 and 2010, for the years onward the first data point, the annual average growth has been added progressively.	10.64	0.96	9.91	0.81
VARIETY	General variety computed without any sectoral linkages.	4.43	1.13	3.93	1.37
UV	Unrelated variety computed based on Indonesian industrial classification (KBLI 2005).	2.98	0.76	2.49	0.94
RV	Related variety computed based on Indonesian industrial classification (KBLI 2005).	1.44	0.50	1.44	0.61
RVHMH	High and medium-high technology intensity related industries based on OECD's classification (2011).	0.22	0.20	0.13	0.18
RVMLL	Medium-low and low technology intensity related industries based on OECD's classification (2011).	1.22	0.44	1.32	0.54

Notes: All explanatory variables are computed within the full dataset of the respective year.

8.4 Empirical results

Empirical results are discussed in the light of the impact of agglomeration externalities on manufacturing development within cities and regencies, which is further analysed through discriminating economic activities based on their technology intensity degrees and two-digit sectors. The distinction between cities and regencies, also in this case, can provide valuable insights for the functional role of agglomeration externalities on localized activities. It is possible to argue that economic activities characterised by similarity in their attributes (e.g. technology intensity degree and production activities) embedded within different local configurations can diversely exploit agglomeration externalities based on their local availability. Since agglomeration economies diversely operate due to different sectoral and space attributes as argued by several scholars (see, for instance, Bishop & Gripaios, 2010; De Groot et al., 2009; Rosenthal & Strange, 2004; Van Oort, 2007). This section is organized as follows. In Section 8.4.1, the influence of agglomeration externalities on the overall manufacturing structure is explored. In Section 8.4.2, the effect of agglomeration economies based on the diverse degrees of technology intensity industries is examined. In Section 8.4.3, the impact of (un)related variety on two-digit sectors is investigated.

8.4.1 The impact of agglomeration externalities on manufacturing structure

Table 8.2, Table 8.3, and Table 8.4 show the estimation results of the impact of agglomeration forces on sectoral and firm's employment, value added and labour productivity respectively between 2000 and 2009 within Indonesian cities and regencies. The findings are separately analysed for these three dimensions of manufacturing growth.

Employment generation.
The results of employment between 2000 and 2009 within Indonesian locations are illustrated in Table 8.2 for sectors and firms. Specialized clusters (LQ) positively affect sectoral employment expansion (A.1-6), albeit it is not statistically significant for firms (B.1-6). This positive effect of localized activities within the same sector is further confirmed for value added and labour productivity in Table 8.3 and Table 8.4 respectively, which underpin the conceptualization of MAR externalities (Glaeser et al., 1992). Intra-industry knowledge spillovers among agents increase innovation capabilities generating disproportional profitability of localized activities, which favours new entrants and spin-off increasing further innovation and competition beneficial for cluster's performance.

Human capital ($HUMCAP$) is negatively related to firms' employment expansion indiscriminately by locations (B.1-6), though it is not statistically significant for sectors (A.1-6). This can be explained in terms of manufacturing composition in Indonesia, since the predominant localization of labour-intensity industries constrains the absorption of skilled workers. Thus, higher employment growth is expected within locations characterized by lower levels of human capital, since labour-intensity industries require mainly unskilled workers to lead their productions. However, evidence in Table 8.3 and Table 8.4 shows that human capital is an essential driver for manufacturing revitalization favouring value added and labour productivity expansion indiscriminately by locations. This suggests that policymakers should strongly encourage the formation of human capital, which is a crucial component to construct an effective innovation environment supporting knowledge-based productions, and more in general manufacturing competitiveness. However, the substantial importance of few labour-intensive industries (see Chapter 5 and Chapter 6) constrains knowledge spillovers, high-qualified jobs creation, and manufacturing resilience. Policymakers should also support industrial diversification with particular regard to the development and growth of technological advanced industries, which increase the creation and absorption of human capital enhancing innovation capabilities and resilience in the country. Population density ($POPDEN$) positively impacts employment expansion for sectors and firms within regencies (A.4-6 an B.4-6) though it is not significant within cities (A.1-3 an B.1-3). The divergent effects of human capital and population density continue also for value added and labour productivity (see Table 8.3 and Table 8.4). Population density is negatively related and human capital is positively associated with value added and labour productivity. Although the outcomes of population density is in contrast with the Krugman's model (1991a, 1991c), these findings are in line with the argumentation proposed by Henderson (1986) supporting the conceptualization of intra-industry knowledge spillovers, which can explain the localization and growth of economic activities rather than local demand.

In addition, the higher pace of other manufacturing growth dimensions rather than employment can explain why numerous coefficients for sectors (A.1-6) and firms (B.1-6) are not statistically significant or they are negatively related to employment growth. The exponential expansion of value added and labour productivity can be due to the learning process, and the adoption of more advanced technologies. A significant expansion of sectoral competition could contribute to this divergence, where an increase of rivalry fosters the rational allocation of firms' resources reducing jobs generation and augmenting their productivity. Competition ($COMP$) negatively impacts employment creation at the firm-level within all locations (B.1-6), though it is not significant for sectors (A.1-6). This negative effect is also confirmed for firms' value added albeit only within regencies (see Table 8.3). Since an increase of rivalry arises competition for markets and factor of productions shrinking their value added. However, firms' labour productivity benefit of having higher rivalry as a consequence of rational allocation of their resources, albeit it is only significant within urban centres (see Table 8.4).

General variety ($VARIETY$) negatively impacts employment expansion within cities for sectors (A.1) and within regencies for firms (B.4), which contradict the findings of Glaeser et al. (1992) that economic diversity (without any sectoral linkages) fosters growth. Disaggregating it based on industrial classification into related and unrelated varieties their effects can be separately assessed. Unrelated varieties (UV) is negatively associated with employment growth for sector within cities (A.2-3), and for firms within regencies (B.5-6); and related variety (RV) negatively impacts firms' employment within regencies (B.5). Considering value added and labour productivity (see Table 8.3 and Table 8.4), it is relevant to observe an increasing positive role of related varieties (RV, $RVHMH$, and $RVMLL$) with particular regard to sectors and urban areas; and antithetic effects are noticed for unlinked variety (UV) between cities and regencies. This is can be due to the taxonomy of knowledge spillover where the dense economic proximity facilitates know-how exchanges; and an increase of industrial diversity differently affects the performance of their localized economic activities due to the diverse degree of industrial heterogeneity and density within these two types of administrative units. These idiosyncratic effects could not be captured considering general variety without any sectoral linkages, and the entire country without taking into account for city-regency heterogeneity. Disaggregating related variety into diverse degrees of technology intensity industries suggests that the presence of high and medium-high technology intensity related industries ($RVHMH$) are beneficial for job creation at the sectoral and firm levels within regencies (A.6 and B.6). Whereas, the localization of medium-low and low technology intensity related industries ($RVMLL$) is negatively associated with employment growth within regencies though only statistically relevant for firms (B.6). Similarly, Hartog et al. (2012) find in Finland regions that related variety in general has not impact on employment growth, and when it is decomposed into high tech related sectors, and medium-low and low tech related sectors, evidence shows that the former positively influence employment growth, though they did not find any significant impact for the latter.

This opposite influence of $RVHMH$ and $RVMLL$ can be explained in terms of spin-off, recombination and accumulation of complementary competencies. Since knowledge-based production activities are likely to lead innovation and form more qualified professionals than $RVMLL$, and the generation and flow of related-skills may create new embedded (un)related branches. The mobility of related competences among economic activities allows recombination between existing and complementary expertises increasing the performance of firms (Boschma, Eriksson, & Lindgren, 2009; Timmermans & Boschma, 2013), industries (Neffke & Svensson Henning, 2008) and locations (Boschma, Eriksson, & Lindgren, 2014; Neffke & Henning, 2013). For instance, mobility of related skills is considered an essential driver of knowledge spillovers in Silicon Valley (Almeida & Kogut, 1999), where start-ups and established businesses constantly look for high-qualified related talents to enhance their product and services. However, new venture creations and mobility of workers are likely to be embedded within a pre-existing local industrial configuration as asserted by

Neffke, Henning, and Boschma (2011). Thus, it possible to argue that although the formation of skilled workers is likely to occur within high and medium-high technology intensity industries, the industrial structure of regencies encourages the establishment of medium-low and low technology related intensity activities, and job opportunities are likely to be found within these industries, which increase their learning capabilities. This argumentation can contribute to explain the relevant positive impact of $RVMLL$ on value added and labour productivity (see Table 8.3 and Table 8.4) along with the high localization of medium-low and low technology intensity industries in the country.

Value added generation.
Table 8.3 shows the influence of agglomeration externalities on value added expansion for five-digit sectors and firms within cities and regencies. Specialized clusters (LQ) continue to positively affect manufacturing expansion (A.7-12 and B.7-9), thought it is not significant for firms within regencies (B.10-12). This confirms the beneficial role played by intra-industry knowledge spillovers for manufacturing growth. However, the presence of supporting and related industries increases the competitive advantage and growth of clusters as argued by Porter (1990). It is observed that related variety (RV) positively impacts sectoral value added within urban places (A.8), and medium-low and low technology intensity related industries ($RVMLL$) positively affects sectors indiscriminately by locations though at 10% level of significant within regencies (A.9 and A.12). This positive role of relatedness seems to be more effective within urban areas characterised by dense economic proximity where knowledge spillover is easier to be transferred among agents in close vicinity rather than in a more dispersed environment. This is further confirmed for sectoral labour productivity (see Table 8.4). It is also observed that an increase of high and medium-high technology intensity related industries ($RVHMH$) reduces value added generation for sectors and firms within regencies (A.12 and B.12). This divergent relationship between $RVHMH$ and $RVMLL$ on value added is further confirmed for labour productivity (see Table 8.4). The positive and negative effects respectively of these two measures can be explained in terms of industrial composition, where medium-low and low technology intensity industries generate large part of manufacturing value added in the country. In addition, knowledge spillover between these latter industries cannot be excluded, in particular considering their predominant localization in Indonesia. However, it is relevant to notice that the negative effect of $RVHMH$ within regencies is led by medium-low and low technology intensity industries as shown in Table 8.5.

A further divergent influence can be observed on value added between cities and regencies due to an increase of unrelated variety (UV). It negatively impacts sectoral and firms' value added within cities (A.8-9 and B.8-9); and unlinked sectors positively affect sectors within regencies (A.11-12) though it is not statistically significant for firms with regencies (B.11-12). As aforementioned, this opposite influence is due to the diverse degree of their industrial heterogeneity.

Urban centres are highly economic dense and diverse, and a further increase of their industrial diversity negatively impacts value added generation, since this increases urban congestion and more in general agglomeration costs. On the other hand, regencies show high specialization and manufacturing structure can take advantage from having a more heterogeneous industrial configuration increasing resilience, more balanced growth, and avoiding lock-in trap, which are typical drawbacks of highly specialized locations. However, it is relevant to notice that the coefficients of general variety ($VARIETY$) are either significantly positive or negative, or other times they are not statistically significant (A.7, A.10, B.7, and B.10). Disaggregated it into sectoral relatedness (RV, $RVHMH$, and $RVMLL$) and unlinked variety (UV) based on the Indonesian industrial classification (KBLI 2005) and the technology intensity classification (OECD, 2011) their idiosyncratic roles on growth are separately assessed. Competition ($COMP$) negatively influences firms' value added within regencies (B.10-12), whereas other estimates are not statistically significant (A.7-12 and B.7-9). An increase in competition reduces firms' value added performance on average due to an increase of rivalry for market and factor of productions, which may lead to the selection of economic activities making their aggregations more efficient. However, it is not found any evidence with this regard, since competition for sectors is not statistically significant on the three dimensions of manufacturing growth (see Table 8.2, Table 8.3, and Table 8.4). Population density ($POPDEN$) is negative related for sectors and firms indiscriminately by locations (A.10-12 and B.7-12), albeit it is not significant for sectors within cities (A.7-9). The preponderant positive role of human capital ($HUMCAP$) is confirmed as an important driver for the development of the entire manufacturing structure indiscriminately by locations (A.7-12 and B.7-12).

Labour productivity generation.

The estimation results of agglomeration externalities on labour productivity within Indonesian locations between 2000 and 2009 are reported in Table 8.4. Specialized clusters (LQ) positively affect labour productivity expansion for sectors and firms with cities (A.13-15 and B.13-15), thought they are not statistically significant within regencies (A.16-18 and B.16-18). The results in Table 8.2, Table 8.3, and Table 8.4 suggest that intra-industry knowledge spillover is the preponderant source for the growth of manufacturing structure in Indonesia as professed by the conceptualization of MAR externalities (Glaeser et al., 1992). In addition, the positive role of relatedness (RV and $RVMLL$) within urban areas is confirmed for sectoral labour productivity (A.14-15), and $RVMLL$ also seems to be beneficial for firms' labour productivity within regencies (B.18) though statically significant at 10%. Although, the increase of localization of high and medium-high technology intensity related industries ($RVHMH$) decreases labour productivity (A.18 and B.18) and value added (see Table 8.3) within regencies, this is led by medium-low and low technology intensity industries (see Table 8.5)[44]. Whereas, unrelated variety (UV) is negatively related to labour productivity for sectors and firms within urban areas (A.14-15 and B.14-15) and it is positively associated with regencies for sectors (A.17-18), though it is not statistically significant for firms within cities (B.17-18). These findings suggest that Indonesian policymakers should promote unrelated variety within regencies enhancing diversification, and they should underpin sectoral interconnectivity rather than further industrial heterogeneity within cities.

Scholars (Bishop & Gripaios, 2010; Boschma & Iammarino, 2009; Boschma et al., 2012; Castaldi et al., 2014; Frenken et al., 2007; Hartog et al., 2012; Quatraro, 2010, 2011), that investigated the role of (un)related varieties on growth, find substantial evidence for linked variety, though the majority of studies (see, for instance, Boschma & Iammarino, 2009; Boschma et al., 2012; Hartog et al., 2012; Quatraro, 2010, 2011) found little evidence to support the portfolio diversification effect. Frenken et al. (2007) find evidence that unrelated variety reduces unemployment growth though its coefficients are insignificant for employment and productivity growth. Castaldi et al. (2014) argue via empirical evidence that unrelated variety can generate "breakthrough" innovations due to their recombination of diverse competences creating radical changes. Following this, it is argued that identifying local heterogeneous configuration provides as well useful information for policy design to pursue further relatedness and/or diversification. In addition promoting economic activities that are currently unrelated, this might increases the future local relatedness due to the recombination of their diverse competences and technologies, which can generate regional related branches from unlinked sectors, as discussed in Castaldi et al. (2014).

Although higher competition ($COMP$) reduces firms' employment within urban places (see Table 8.2), it turns positive for labour productivity (B.13-15). These findings are not in contrast but inter-related since an increase of rivalry forces enterprises to allocate their resources more rationally, which augments value added per worker. This is the only positive evidence found for competition on manufacturing expansion. The antithetic influence between population density ($POPDEN$) and human capital ($HUMCAP$) is confirmed for labour productivity indiscriminately by locations. The former is negatively related for sectors and firms though it is not significant for sectors within cities (A.13-18 and B.13-18), and the latter is positively associated with labour productivity expansion for sectors and firms in all locations (A.13-18 and B.13-18).

44. Disaggregated the industrial structure by technology intensity industries, the negative impact of high and medium-high technology intensity related industries ($RVHMH$) within regencies is also found for labour productivity, which is not reported. Since the estimations for value added reported in Table 8.5 and labour productivity are substantially identical in terms of coefficients sign.

Table 8.2: Agglomeration externalities impact on five-digit sectors and firms' employment in cities and regencies between 2000 and 2009.

Variables	Sectors						Firms					
	Cities			Regencies			Cities			Regencies		
	A.1	**A.2**	**A.3**	**A.4**	**A.5**	**A.6**	**B.1**	**B.2**	**B.3**	**B.4**	**B.5**	**B.6**
LQ	0.072***	0.073***	0.074***	0.111***	0.111***	0.112***	-0.002	-0.002	-0.002	0.002	0.002	0.002
	(0.019)	(0.019)	(0.019)	(0.016)	(0.016)	(0.016)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
COMP	-0.034	-0.033	-0.033	-0.024	-0.024	-0.023	-0.029***	-0.029***	-0.029***	-0.046***	-0.046***	-0.046***
	(0.028)	(0.028)	(0.028)	(0.022)	(0.022)	(0.022)	(0.007)	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)
POPDEN	-0.527	-0.511	-0.548	0.521*	0.526*	0.520*	0.022	0.022	0.023	0.056*	0.056*	0.057*
	(0.410)	(0.408)	(0.407)	(0.229)	(0.228)	(0.228)	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)
HUMCAP	-0.103	-0.101	-0.091	0.143^	0.142^	0.136	-0.197***	-0.199***	-0.199***	-0.059**	-0.059**	-0.065**
	(0.208)	(0.208)	(0.207)	(0.082)	(0.082)	(0.083)	(0.036)	(0.037)	(0.037)	(0.022)	(0.022)	(0.023)
VARIETY	-0.047^			0.014			0.001			-0.024***		
	(0.024)			(0.022)			(0.007)			(0.007)		
UV		-0.074*	-0.090*		0.001	-0.006		0.009	0.009		-0.024*	-0.032**
		(0.036)	(0.037)		(0.032)	(0.033)		(0.012)	(0.013)		(0.011)	(0.011)
RV		-0.014			0.027			-0.010			-0.024**	
		(0.045)			(0.033)			(0.012)			(0.009)	
RVHMH			0.277			0.278^			-0.000			0.151**
			(0.175)			(0.163)			(0.036)			(0.054)
RVMLL			-0.028			0.023			-0.011			-0.027**
			(0.046)			(0.033)			(0.012)			(0.009)
Constant	9.922***	9.835***	9.971***	1.394^	1.403^	1.479^	6.159***	6.175***	6.178***	4.619***	4.619***	4.677***
	(1.451)	(1.457)	(1.454)	(0.752)	(0.754)	(0.757)	(0.321)	(0.323)	(0.323)	(0.177)	(0.177)	(0.178)
Industry fixed effects	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observations	11,497	11,497	11,497	21,792	21,792	21,792	44,655	44,655	44,655	91,011	91,011	91,011
F (p-value)	8.790	7.752	6.865	24.280	20.239	18.271	14.869	12.416	10.677	36.475	30.895	27.771
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses.

Table 8.3: Agglomeration externalities impact on five-digit sectors and firms' value added in cities and regencies between 2000 and 2009.

	Sectors						Firms					
Variables	**Cities**			**Regencies**			**Cities**			**Regencies**		
	A.7	**A.8**	**A.9**	**A.10**	**A.11**	**A.12**	**B.7**	**B.8**	**B.9**	**B.10**	**B.11**	**B.12**
LQ	0.185***	0.188***	0.188***	0.176***	0.177***	0.175***	0.029**	0.029**	0.029**	0.008	0.008	0.007
	(0.037)	(0.037)	(0.037)	(0.024)	(0.024)	(0.024)	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)
COMP	0.031	0.035	0.034	-0.013	-0.013	-0.015	0.023	0.023	0.024	-0.044***	-0.045***	-0.045***
	(0.051)	(0.051)	(0.051)	(0.035)	(0.035)	(0.035)	(0.016)	(0.016)	(0.016)	(0.012)	(0.012)	(0.012)
POPDEN	-1.753	-1.676	-1.689	-2.833***	-2.844***	-2.827***	-0.700***	-0.701***	-0.703***	-0.800***	-0.798***	-0.800***
	(1.071)	(1.073)	(1.075)	(0.345)	(0.344)	(0.345)	(0.165)	(0.166)	(0.166)	(0.091)	(0.091)	(0.091)
HUMCAP	3.767***	3.780***	3.783***	3.313***	3.317***	3.329***	3.145***	3.159***	3.160***	2.102***	2.102***	2.120***
	(0.523)	(0.523)	(0.524)	(0.127)	(0.127)	(0.127)	(0.226)	(0.228)	(0.229)	(0.059)	(0.059)	(0.058)
VARIETY	0.008			0.123***			-0.098***			-0.015		
	(0.050)			(0.036)			(0.027)			(0.018)		
UV		-0.144*	-0.154*		0.157**	0.174**		-0.140***	-0.123**		-0.033	-0.007
		(0.072)	(0.075)		(0.053)	(0.054)		(0.037)	(0.040)		(0.026)	(0.026)
RV		0.210*			0.089			-0.046			0.001	
		(0.089)			(0.055)			(0.044)			(0.022)	
RVHMH			0.353			-0.514^			-0.205			-0.565***
			(0.345)			(0.286)			(0.131)			(0.126)
RVMLL			0.206*			0.102^			-0.034			0.016
			(0.090)			(0.055)			(0.045)			(0.022)
Constant	-12.362***	-12.844***	-12.789***	-5.329***	-5.357***	-5.530***	-14.001***	-14.087***	-14.117***	-3.226***	-3.218***	-3.388***
	(2.726)	(2.748)	(2.747)	(1.168)	(1.169)	(1.171)	(1.609)	(1.624)	(1.630)	(0.515)	(0.515)	(0.510)
Industry fixed effects	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observations	9,958	9,958	9,958	18,972	18,972	18,972	38,963	38,963	38,963	80,457	80,457	80,457
F (p-value)	60.188	51.220	44.197	185.435	155.691	133.962	101.337	84.434	72.094	289.849	243.222	216.977
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses.

Table 8.4: Agglomeration externalities impact on five-digit sectors and firm's labour productivity in cities and regencies between 2000 and 2009.

Variables	Sectors						Firms					
	Cities			Regencies			Cities			Regencies		
	A.13	**A.14**	**A.15**	**A.16**	**A.17**	**A.18**	**B.13**	**B.14**	**B.15**	**B.16**	**B.17**	**B.18**
LQ	0.063**	0.066**	0.066**	0.019	0.019	0.017	0.031**	0.031**	0.031**	0.009	0.009	0.008
	(0.025)	(0.025)	(0.025)	(0.018)	(0.018)	(0.018)	(0.010)	(0.010)	(0.010)	(0.007)	(0.007)	(0.007)
COMP	0.043	0.046	0.046	0.015	0.016	0.014	0.060***	0.061***	0.061***	0.014	0.014	0.013
	(0.034)	(0.034)	(0.034)	(0.025)	(0.025)	(0.025)	(0.015)	(0.015)	(0.015)	(0.012)	(0.012)	(0.012)
POPDEN	-1.235	-1.159	-1.156	-3.350***	-3.370***	-3.355***	-0.725***	-0.727***	-0.729***	-0.865***	-0.863***	-0.866***
	(1.003)	(1.009)	(1.011)	(0.250)	(0.249)	(0.250)	(0.173)	(0.173)	(0.174)	(0.095)	(0.095)	(0.095)
HUMCAP	3.824***	3.836***	3.835***	3.149***	3.157***	3.168***	3.356***	3.374***	3.375***	2.166***	2.166***	2.189***
	(0.484)	(0.484)	(0.485)	(0.097)	(0.097)	(0.097)	(0.236)	(0.239)	(0.240)	(0.058)	(0.058)	(0.058)
VARIETY	0.037			0.089**			-0.099***			0.006		
	(0.038)			(0.028)			(0.027)			(0.018)		
UV		-0.113*	-0.113^		0.152***	0.168***		-0.154***	-0.135***		-0.007	0.026
		(0.055)	(0.058)		(0.039)	(0.040)		(0.035)	(0.038)		(0.026)	(0.026)
RV		0.237***			0.026			-0.032			0.019	
		(0.064)			(0.040)			(0.044)			(0.022)	
RVHMH			0.236			-0.521*			-0.212			-0.717***
			(0.248)			(0.216)			(0.130)			(0.129)
RVMLL			0.239***			0.038			-0.018			0.038^
			(0.065)			(0.041)			(0.046)			(0.022)
Constant	-21.598***	-22.076***	-22.084***	-6.393***	-6.446***	-6.602***	-20.279***	-20.391***	-20.427***	-7.833***	-7.826***	-8.048***
	(2.233)	(2.255)	(2.257)	(0.872)	(0.870)	(0.874)	(1.668)	(1.685)	(1.692)	(0.496)	(0.496)	(0.491)
Industry fixed effects	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observations	9,958	9,958	9,958	18,972	18,972	18,972	38,963	38,963	38,963	80,457	80,457	80,457
F (p-value)	113.669	98.562	85.360	260.685	219.912	189.423	120.585	100.043	85.429	319.134	267.660	241.109
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses.

8.4.2 The effect of agglomeration forces on technological relatedness

The previous section was devoted to investigate the impact of agglomeration externalities disaggregated by cities and regencies without any distinction between industries. This section is intended to shed the light on which externality is the preponderant source for the development of which industry based on technology intensity disaggregation. As argued by several scholars (see, for instance, Boschma & Frenken, 2009; De Groot et al., 2009; Neffke, Henning, Boschma, et al., 2011; Puga, 2010; Rosenthal & Strange, 2004; Van Oort, 2007), industries characterized by diverse attributes are more or less responsive to the effect of agglomeration economies. In addition, this can be also influenced by the location structure (see, for instance, Bishop & Gripaios, 2010; De Groot et al., 2009; Rosenthal & Strange, 2004; Van Oort, 2007), where the same type of industry located within cities and regencies can diversely respond to agglomeration externalities based on their local availability. Disaggregating manufacturing structure based on the degree of technology intensity, the idiosyncratic influence of agglomeration externalities within cities and regencies can be more accurately assessed. As argue by numerous scholars (see, for instance, Burger et al., 2007; De Groot et al., 2009; Mameli et al., 2014), the level of aggregation plays an important role in leading to diverse outcomes where the most disaggregated level generates the most consistent economic theories. Table 8.5 illustrates the results for value added disaggregated by high and medium-high (H-MH), and medium-low and low (ML-L) technology intensity industries[45] analysing separately cities and regencies.

Location quotient (LQ) still plays a positive role indiscriminately by the degrees of technology intensity industries and locations (C.4-6 and D.1-6), though it is not statistically significant for HMM within cities (C.1-3). It is relevant to observe that the positive influence of interconnected varieties for sectors highlighted in Table 8.3 is confirmed with particular regard to H-MH industries within cities. Related variety (RV) positively impacts value added for H-MH industries within cities (C.2) though it is not statistically significant within regencies (C.5). Although at 10% of significant, related variety (RV) seems to have a positive influence on value added generation indiscriminately by locations for ML-L industries (D.2 and D.5). Looking back at Table 8.3, the coefficients of $RVHMH$ for sectoral value added were not significant within cities; and disaggregated the industrial structure based on technology intensity, $RVHMH$ positively influences value added expansion for H-MH industries within cities though at 10% significant (C.3). Whereas, the negative impact of $RVHMH$ on sectoral value added within regencies as shown in Table 8.3 is driven by ML-L industries (D.6). Although several H-MH industries show higher value added generation within regencies than those in cities (see Table 6.5), the localization of $RVHMH$ industries is beneficial for H-MH' s value

45. The outcomes of employment and labour productivity are omitted since they do not improve the analysis. The majority of coefficients are not statistically significant for employment generation, and the results in terms of coefficient signs for labour productivity are substantially identical of which are obtained for value added.

added within cities (C.3) and counterproductive for ML-L' s value added within regencies (D.6). These findings can be explained in terms of increase of their technological relatedness, which is also confirmed disaggregating the industrial structure by two-digit sectors (see Table 8.6 and Table 8.7).

It is relevant to observe the positive role of $RVMLL$ indiscriminately by technology intensity industries and types of locations (C.3, D.3 and D.6), though it is not statistically significant for H-MH within regencies (C.6). Considering the results in Table 8.3 where the positive role of unrelated variety (UV) on value added is observed within regencies, it emerges that this is driven by ML-L industries (D.5-6) and it is not significant for other estimations (C.2-3, C.5-6, and D.2-3). The predominant role of human capital ($HUMCAP$) for manufacturing development is confirmed indiscriminately by the degrees of technology intensity industries and locations (C.1-6 and D.1-6), which emerges as a key element for manufacturing development in Indonesia. The negative role of population density ($POPDEN$) within regencies (C.4-6 and D.4-6) is also confirmed regardless to the degrees of technology intensity industries, and it stills statistically insignificant within cities (C.1-3 and D.1-3).

Table 8.5: Agglomeration externalities effect on five-digit sectors' value added disaggregated by technology intensity industries within cities and regencies between 2000 and 2009.

	H-MH						ML-L					
Variables	**Cities**			**Regencies**			**Cities**			**Regencies**		
	C.1	**C.2**	**C.3**	**C.4**	**C.5**	**C.6**	**D.1**	**D.2**	**D.3**	**D.4**	**D.5**	**D.6**
LQ	0.087	0.102	0.103	0.330***	0.328***	0.328***	0.198***	0.200***	0.199***	0.161***	0.162***	0.159***
	(0.116)	(0.116)	(0.116)	(0.085)	(0.085)	(0.086)	(0.039)	(0.039)	(0.039)	(0.025)	(0.025)	(0.025)
COMP	0.053	0.059	0.064	0.181	0.181	0.175	0.012	0.015	0.015	-0.033	-0.033	-0.035
	(0.158)	(0.157)	(0.157)	(0.111)	(0.111)	(0.112)	(0.053)	(0.053)	(0.053)	(0.037)	(0.037)	(0.037)
POPDEN	-2.373	-1.178	-1.274	-2.225^	-2.320^	-2.293^	-1.809	-1.774	-1.773	-2.903***	-2.910***	-2.897***
	(3.522)	(3.581)	(3.574)	(1.236)	(1.239)	(1.242)	(1.101)	(1.103)	(1.104)	(0.361)	(0.360)	(0.360)
HUMCAP	4.863**	4.527**	4.523**	3.277***	3.309***	3.314***	3.611***	3.625***	3.625***	3.301***	3.304***	3.317***
	(1.703)	(1.704)	(1.705)	(0.451)	(0.451)	(0.453)	(0.541)	(0.541)	(0.542)	(0.134)	(0.133)	(0.134)
VARIETY	0.072			-0.011			0.006			0.133***		
	(0.193)			(0.147)			(0.051)			(0.037)		
UV		-0.480	-0.607^		0.160	0.195		-0.103	-0.102		0.158**	0.173**
		(0.298)	(0.325)		(0.224)	(0.230)		(0.074)	(0.077)		(0.054)	(0.055)
RV		0.636**			-0.161			0.155^			0.109^	
		(0.246)			(0.214)			(0.094)			(0.057)	
RVHMH			1.503^			-0.563			0.138			-0.529^
			(0.821)			(0.725)			(0.379)			(0.309)
RVMLL			0.547*			-0.138			0.162^			0.121*
			(0.260)			(0.216)			(0.095)			(0.057)
Constant	-20.622*	-24.132**	-23.167**	-6.972*	-7.129*	-7.345*	-10.296***	-10.573***	-10.591***	-5.002***	-5.021***	-5.184***
	(8.064)	(8.276)	(8.269)	(3.244)	(3.249)	(3.269)	(2.841)	(2.855)	(2.853)	(1.259)	(1.261)	(1.263)
Industry fixed effects	No	No	No	No	No	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observations	1,760	1,760	1,760	2,578	2,578	2,578	8,198	8,198	8,198	16,394	16,394	16,394
F (p-value)	11.567	11.163	9.738	30.196	25.429	21.968	51.039	43.002	37.346	158.645	133.120	114.611
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses. H-MH denotes high and medium-high technology intensity industries, and ML-L refers to medium-low and low technology intensity industries.

8.4.3 The role of (un)related variety on two-digit sectors

This section aims to extend the investigation on two-digit sectors focusing on the effect of (un)related variety and continuing to discriminate cities and regencies. The distinction of these two types of administrative units can provide further insights for the functional role of agglomeration externalities on localized sectors. Since agglomeration economies diversely operate on different sectors and space characterized by diverse characteristics, which make some economic activities growth faster than others as they exploit certain agglomeration externalities largely local available rather than others less present. Thus, it is possible to argue that the same two-digit industry located within cities and regencies can diversely respond to agglomeration externalities based on their local availability generating performance differentials.

Bishop and Gripaios (2010) investigate the impact of (un)related variety on employment growth in Great Britain for industry, distribution, business, and personal services. They find that related variety has a positive effect in only three out of twenty-three two-digit sectors and a negative effect in one sector, though this study does not found any evidence for manufacturing. Indeed, Bishop and Gripaios (2010) find more significant evidence for unrelated variety (eight out of twenty-three sectors), which are more present in industry compared to service sectors. They conclude that the effects of (un)related variety differ significantly across sectors. Looking at Table 8.6, it is observed two positive signs for related variety (RV) out of twenty-three two-digit sectors for manufacturing employment within cities thought at 10% significant, which are driven by their technological relatedness. The medical, precision and optical instruments, watches and clocks (33 code) industry is positively influenced by $RVHMH$ (L.5-6), and the recycling (37 code) industry take advantage of $RVMLL$ (L.7-8). Two negative signs out of twenty-three two-digit sectors are found for RV, one in cities and one in regencies though the latter at 10% significant, which are both driven by $RVMLL$ (L.1-2 and M.5-6). The only radio, television and communication equipment and apparatus (32 code) industry shows a divergent sign of relatedness ($RVMLL$) between cities and regencies (L.4 and M.6). This is the only evidence found for employment expansion to support the conceptualization that the same two-digit sector localized within the two diverse administrative units have different propensity to exploit agglomeration externalities. Instead, it is not found any positive evidence for UV on employment, and the recycling (37 code) industry within cities seems to be negatively affected by the localisation of heterogeneous industrial configuration where this industry is more responsive to the role of RV and $RVMLL$ though at 10% significant (L.7-8).

Bering in mind that taking into account employment does not fully explain manufacturing growth in Indonesia, Table 8.7 and Table 8.8 report the influence of (un)related variety on value added of two-digit sectors within cities and regencies respectively [46]. Almost all interconnected varieties (RV, $RVHMH$, and $RVMLL$), that are statistically significant, hold positive signs within urban areas with an exception of the fabricated metal products, except machinery and equipment (28 code) industry, which is negatively influenced by $RVMLL$ thought at 10% significant (N.8). In particular, this industry shows a divergent influence of $RVMLL$ between cities and regencies (N.8 and O.8). This is the only divergent evidence found for value added to support the notion that the same sector localised within diverse local industrial composition differently exploit inter-industry knowledge spillover. Whereas, industrial relatedness seems to be less effective within regencies as shown by several negative estimates with particular regard to $RVHMH$ and $RVMLL$. The predominant functional role of related variety within urban dense proximity in comparison of regency is also confirmed for labour productivity (see Table 8.9 and Table 8.10 in Appendix 8.A). For instance, the food products and beverages (15 code), and the machinery and equipment n.e.c. (29 code) industries benefit from having higher localization of related variety (RV) within cities, which is driven by $RVMLL$ and $RVHMH$ respectively (N.1-2 and N.9-10 for value added, and P.1-2 and P.14 for labour productivity reported in Appendix 8.A) due to an increase of their technological relatedness. In fact, the majority of two-digit sectors are positively responsive to the localisation of their technological relatedness for employment (Table 8.6), value added (Table 8.7 and Table 8.8), and labour productivity (see Table 8.9, and Table 8.10 in Appendix 8.A), though some exceptions are notable. For instance for the value added estimations, the chemicals and chemical products (24 code), which is a medium-high technology intensity industry, is positively affected by the localization of $RVMLL$ within cities and $RVHMH$ is not significant (N.6).

Disaggregating related variety based on technology intensity industries provide further insights for the functional role of relatedness on growth of two-digit industries. For instance, the fabricated metal products, except machinery and equipment (28 code) and the recycling (37 code) industries are positively affected by the presence of RV within regencies (O.7 and O.15), which stems from the role of $RVMLL$ (O.8 and O.16) due to an increase of their technological relatedness. The estimates of related variety (RV) for the medical, precision and optical instruments, watches and clocks (33 code) industry are not significant indiscriminately by locations (N.13 and O.9), though when it is disaggregated into $RVHMH$ and $RVMLL$, the former plays a positive role within cities and regencies, and the latter negatively affects its value added within regencies (N.14 and O.10). The positive effect of $RVHMH$ for this industry is further confirmed for employment growth within cities (Table 8.6) and labour productivity within regencies (see Table 8.10 in Appendix 8.A). Since an increase of its technological relatedness is beneficial for its expansion. Other industries where $RVHMH$ plays a positive role are the electrical machinery and apparatus n.e.c. (31 code) and

46. It is reported only sectors that are statistically significance at 10% level for unrelated and related varieties in Table 8.6, Table 8.7, and Table 8.8, as well as for labour productivity within cities and regencies reported in Table 8.9, and Table 8.10 in Appendix 8.A.

the other transport equipment (35 code) industries within cities and regencies respectively, though RV's coefficients are not statistically significant (N.11-12 and O.12-13). The motor vehicles, trailers and semi-trailers (34 code) industry seems to be negatively influenced by related variety (RV) within regencies, which is driven by the localization of their non-technological relatedness ($RVMLL$) industries (O.11-O.12). Also, the value added of the rubber and plastics products (25 code) and the basic metals (27 code) industries is negatively related to the localization of their non-technological relatedness ($RVHMH$) within regencies (O.4 and O.6). Whereas, little evidence are found for UV on sectoral value added, where the only food products and beverages (15 code) is positively affected by unlinked variety within regencies (O.1-2). The lack of evidence for unrelated variety (UV) is further confirmed for employment (Table 8.6) and labour productivity (see Table 8.9, and Table 8.10 in Appendix 8.A). This suggests that the role of heterogeneous industrial structure is more operative at the higher level of analysis rather than at the lower level, since the effect of local resilience and balanced growth are more effective and detectable considering the industrial aggregation rather than single two-digit sector. However, this argumentation is contrast with the outcomes of Bishop and Gripaios (2010), which find more significant evidence for unrelated variety than related variety for two-digit manufacturing sectors.

Table 8.6: The influence of (un)related variety on employment by two-digit sectors within cities and regencies between 2000 and 2009.

	Cities								**Regencies**					
	16		**32**		**33**		**37**		**18**		**19**		**32**	
Variables	**L.1**	**L.2**	**L.3**	**L.4**	**L.5**	**L.6**	**L.7**	**L.8**	**M.1**	**M.2**	**M.3**	**M.4**	**M.5**	**M.6**
LQ	0.088	0.088	0.027	0.004	-0.188	-0.126	-0.339	-0.337	0.090	0.092	0.332***	0.358***	0.291^	0.290^
	(0.140)	(0.145)	(0.220)	(0.215)	(0.203)	(0.183)	(0.222)	(0.230)	(0.065)	(0.064)	(0.082)	(0.085)	(0.156)	(0.156)
COMP	-0.200	-0.200	0.147	0.115	-0.330	-0.253	-0.364	-0.353	0.014	0.013	0.256*	0.272**	0.413	0.412
	(0.152)	(0.154)	(0.312)	(0.303)	(0.211)	(0.184)	(0.272)	(0.265)	(0.086)	(0.086)	(0.103)	(0.100)	(0.256)	(0.254)
POPDEN	6.835^	6.829^	41.443*	43.513*	56.270^	63.441^	21.690	22.016	1.915*	1.922*	-0.460	-0.572	7.103**	7.001**
	(3.516)	(3.530)	(16.135)	(15.743)	(32.247)	(33.307)	(13.723)	(14.245)	(0.825)	(0.822)	(1.430)	(1.476)	(2.396)	(2.301)
HUMCAP	-3.405*	-3.404*	-25.749**	-26.431**	-25.565^	-27.071*	-8.018	-8.110	0.440	0.419	0.141	0.116	-3.334**	-3.283**
	(1.369)	(1.385)	(8.378)	(8.219)	(12.556)	(12.684)	(6.568)	(6.823)	(0.373)	(0.368)	(0.536)	(0.558)	(1.069)	(1.018)
UV	0.155	0.154	-1.773	-1.493	0.052	-1.097	-1.612^	-1.526^	-0.338	-0.397^	0.142	0.047	1.203	1.230
	(0.143)	(0.153)	(1.754)	(1.634)	(0.762)	(0.807)	(0.764)	(0.813)	(0.216)	(0.216)	(0.224)	(0.225)	(0.850)	(0.864)
RV	-0.467*		1.765		0.764^		1.499^		0.091		-0.216		-1.115^	
	(0.184)		(1.070)		(0.408)		(0.716)		(0.202)		(0.239)		(0.578)	
RVHMH		-0.485		0.176		3.757*		0.894		1.832*		2.417^		-1.278
		(0.733)		(1.584)		(1.473)		(1.287)		(0.828)		(1.280)		(1.565)
RVMLL		-0.463*		2.170^		-0.125		1.652^		0.076		-0.283		-1.155^
		(0.186)		(1.228)		(0.673)		(0.849)		(0.201)		(0.244)		(0.577)
Constant	-4.160	-4.135	9.084	1.389	-103.425	-132.405	-53.523*	-55.032*	-6.087^	-5.906^	6.235	6.946	3.891	3.881
	(13.221)	(13.334)	(29.343)	(29.381)	(86.424)	(90.971)	(23.720)	(24.326)	(3.321)	(3.412)	(5.511)	(5.356)	(6.234)	(6.674)
Industry fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observations	151	151	85	85	53	53	58	58	610	610	511	511	123	123
F (p-value)	4.056	3.444	3.038	3.720	12.693	31.551	3.000	3.025	2.919	3.808	3.160	3.015	3.472	3.406
	0.007	0.011	0.039	0.015	0.000	0.000	0.048	0.041	0.016	0.002	0.010	0.009	0.012	0.010

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses. For the denomination of two-digit sectors see Table 6.1.

Table 8.7: The influence of (un)related variety on value added by two-digit sectors within cities between 2000 and 2009.

	15		**17**		**24**		**28**		**29**		**31**		**33**	
Variables	**N.1**	**N.2**	**N.3**	**N.4**	**N.5**	**N.6**	**N.7**	**N.8**	**N.9**	**N.10**	**N.11**	**N.12**	**N.13**	**N.14**
LQ	0.245***	0.242***	0.243ˆ	0.241ˆ	0.152	0.136	0.162	0.162	-0.141	-0.136	0.123	0.093	0.157	0.321
	(0.067)	(0.067)	(0.127)	(0.126)	(0.232)	(0.235)	(0.129)	(0.128)	(0.222)	(0.222)	(0.265)	(0.257)	(0.520)	(0.416)
COMP	-0.151	-0.151	0.276	0.273	0.309	0.285	0.160	0.155	-0.362	-0.362	-0.203	-0.190	0.122	0.258
	(0.105)	(0.105)	(0.168)	(0.169)	(0.245)	(0.245)	(0.137)	(0.137)	(0.347)	(0.347)	(0.352)	(0.345)	(0.484)	(0.439)
POPDEN	-1.116	-0.981	-5.585*	-5.611*	2.415	2.520	-12.699*	-12.976*	-10.915	-12.054	0.796	1.222	-7.459	18.262
	(1.582)	(1.557)	(2.489)	(2.486)	(4.399)	(4.383)	(5.684)	(5.673)	(8.298)	(7.780)	(8.248)	(7.909)	(24.652)	(26.382)
HUMCAP	3.591***	3.511***	4.681***	4.682***	3.005	3.030	9.899***	9.940***	9.745*	9.959*	3.177	2.542	-2.681	-8.396
	(0.738)	(0.726)	(1.344)	(1.361)	(1.978)	(1.977)	(2.803)	(2.798)	(4.124)	(3.922)	(4.456)	(4.294)	(9.286)	(11.423)
UV	-0.231*	-0.179	0.036	0.002	-0.665	-0.457	0.516	0.402	-0.028	-0.617	-0.073	-0.849	3.843	-0.539
	(0.105)	(0.110)	(0.272)	(0.293)	(0.435)	(0.483)	(0.403)	(0.441)	(0.652)	(0.672)	(0.630)	(0.751)	(2.557)	(1.437)
RV	0.413**		0.491		0.481		-0.523		1.734*		-0.501		3.060	
	(0.157)		(0.300)		(0.300)		(0.391)		(0.839)		(0.671)		(2.526)	
RVHMH		-0.600		0.843		-1.056		0.442		4.891*		3.245*		13.582*
		(0.593)		(1.542)		(1.124)		(1.142)		(2.190)		(1.420)		(4.845)
RVMLL		0.461**		0.498ˆ		0.580ˆ		-0.677ˆ		1.197		-1.144		0.811
		(0.159)		(0.298)		(0.315)		(0.407)		(0.853)		(0.764)		(1.599)
Constant	-13.981**	-14.067**	2.445	2.648	-30.175*	-31.425**	-7.108	-5.427	-18.584	-11.481	-22.863ˆ	-16.535	78.785	-21.988
	(4.585)	(4.579)	(8.967)	(9.157)	(11.699)	(11.692)	(11.531)	(11.443)	(18.860)	(17.569)	(13.432)	(13.143)	(77.818)	(63.252)
Industry fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observations	2,344	2,344	751	751	752	752	785	785	330	330	240	240	47	47
F (p-value)	25.288	23.383	2.888	2.539	5.792	5.168	8.254	7.260	3.575	3.097	3.824	4.292	7.820	124.849
	0.000	0.000	0.015	0.022	0.000	0.000	0.000	0.000	0.005	0.007	0.004	0.001	0.000	0.000

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ˆ 10%. Robust standard errors of the coefficients are given in parentheses. For the denomination of two-digit sectors see Table 6.1.

Table 8.8: The influence of (un)related variety on value added by two-digit sectors within regencies between 2000 and 2009.

	15		**25**		**27**		**28**		**33**		**34**		**35**		**37**	
Variables	**O.1**	**O.2**	**O.3**	**O.4**	**O.5**	**O.6**	**O.7**	**O.8**	**O.9**	**O.10**	**O.11**	**O.12**	**O.13**	**O.14**	**O.15**	**O.16**
LQ	0.273***	0.272***	0.252*	0.229*	-0.267	-0.301	0.046	0.041	0.366	0.534	-0.190	-0.195	0.619ˆ	0.617*	0.034	0.035
	(0.045)	(0.045)	(0.100)	(0.099)	(0.224)	(0.231)	(0.112)	(0.112)	(0.415)	(0.394)	(0.246)	(0.252)	(0.321)	(0.300)	(0.191)	(0.194)
COMP	0.081	0.079	0.160	0.142	-0.294	-0.338	-0.241	-0.247	0.270	0.324	-0.498	-0.496	0.417	0.404	-0.441	-0.436
	(0.060)	(0.060)	(0.131)	(0.128)	(0.341)	(0.347)	(0.160)	(0.160)	(0.377)	(0.313)	(0.349)	(0.354)	(0.467)	(0.425)	(0.267)	(0.273)
POPDEN	-2.585***	-2.578***	-4.099***	-4.148***	-7.275	-6.282	-3.688ˆ	-3.614ˆ	-1.745	-12.976ˆ	-1.754	-1.606	5.814	5.756	-3.879	-3.917
	(0.454)	(0.454)	(0.833)	(0.819)	(4.529)	(4.602)	(2.128)	(2.124)	(4.267)	(6.800)	(4.441)	(4.479)	(4.419)	(4.179)	(4.125)	(4.213)
HUMCAP	3.632***	3.639***	3.874***	3.957***	5.218***	4.813**	3.220***	3.215***	3.462*	6.774**	4.034**	3.982**	2.238	2.192	4.734**	4.760**
	(0.192)	(0.192)	(0.437)	(0.435)	(1.491)	(1.504)	(0.730)	(0.728)	(1.306)	(2.139)	(1.309)	(1.316)	(1.616)	(1.517)	(1.595)	(1.639)
UV	0.224**	0.230**	0.095	0.189	1.499	2.422*	-0.107	-0.036	-0.731	-3.343ˆ	0.447	0.380	-0.022	-0.271	0.500	0.516
	(0.076)	(0.077)	(0.191)	(0.198)	(1.305)	(1.213)	(0.326)	(0.344)	(2.531)	(1.793)	(0.437)	(0.471)	(0.775)	(0.781)	(0.413)	(0.424)
RV	0.166ˆ		0.103		-1.519		0.994**		-1.212		-1.287ˆ		-0.276		0.861ˆ	
	(0.088)		(0.175)		(1.685)		(0.342)		(0.853)		(0.643)		(0.474)		(0.464)	
RVHMH		-0.243		-2.083*		-5.404*		0.379		14.817*		0.013		6.302ˆ		0.514
		(0.557)		(0.832)		(2.446)		(1.298)		(5.913)		(1.491)		(3.188)		(1.455)
RVMLL		0.172ˆ		0.180		-1.050		1.032**		-1.635*		-1.368*		-0.412		0.867ˆ
		(0.088)		(0.178)		(1.786)		(0.357)		(0.743)		(0.675)		(0.441)		(0.466)
Constant	-10.126***	-10.209***	-5.241	-5.851ˆ	-3.648	-7.071	-1.229	-1.658	-8.419	15.558	-15.130	-15.242	-32.175**	-31.813***	-18.274	-18.377
	(1.658)	(1.654)	(3.468)	(3.462)	(11.131)	(10.974)	(5.901)	(5.936)	(12.834)	(13.736)	(11.398)	(11.306)	(9.375)	(9.087)	(17.433)	(17.453)
Industry fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observ.	5,191	5,191	1,321	1,321	260	260	956	956	58	58	217	217	242	242	125	125
F (p-value)	78.739	67.891	15.340	14.303	5.847	6.972	9.174	7.876	5.361	6.605	7.104	6.370	9.530	13.560	14.598	12.347
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ˆ 10%. Robust standard errors of the coefficients are given in parentheses. For the denomination of two-digit sectors see Table 6.1.

8.4.4 Robustness check: Endogeneity

A potential problem of interpretation of estimates is the presence of endogenity, which is a common issue facing in regional growth studies. The assumption of panel data approach is that the covariates need to be strictly exogenous, otherwise they can be correlated with the error term making the estimation bias. Specifically, cities and regencies that experience high manufacturing growth attracted more agents due to path-dependency mechanism, as much as denser localization of inhabitants and firms fosters manufacturing growth. In addition, several authors (Boschma et al., 2013; Hidalgo et al., 2007; Neffke, Henning, & Boschma, 2011) have demonstrated that related variety generates regional branching through diversification fostering the localization of varieties. Thus, the causality modelled could be subjected to reverse causality where manufacturing growth could affect the covariates.

An econometric approach commonly employed in order to deal with endogeneity is the use of external instrumental variables, which are correlated with the predictors and uncorrelated with the predicted variable. As aforementioned in Chapter 7, instrumental variables are often unavailable on regional growth studies (Henderson, 2003) as the case of this research. In similar works employing short panel data (large N and small T), the general method of moment (GMM) approach (see, for instance, Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998) is commonly employed to deal with endogeneity, with particular regard due to unavailability of good external instruments. First-differenced equations are estimated in order to remove unobservable and time-invariant effects, and using suitable lags of explanatory variables as internal instruments within first-differenced equations. This study attempted to employ GMM procedure to estimate the influence of agglomeration externalities on manufacturing growth within Indonesian locations thought the coefficients were unstable. In fact, GMM approach can easily generate invalid estimates due to its complexity (Roodman, 2009), and its employability is highly due to the correlation strength between lagged instruments and first-differenced regressors. This can explain why GMM procedure generated unstable estimators due to the small covariation between the instrumental lags and the first differences, which is less than 10%.

The conceptualization of path-dependency is modelled including all continuous explanatory variables two years before manufacturing expansion is observed. Assuming that the variability of agglomeration externalities affect the performance of economic activities subsequently on time. The majority of explanatory variables (population density, human capital, and the set of varieties) are measured at the location level, whereas the explained variables are computed at the location-industry and firm levels. In addition, an increase of employment, value added and labour productivity at the sectoral and firm-level can have a consequence on population density and human capital, thought it is expected with lower magnitude in comparison of the modelled causality.

Since, medium and large manufacturing activities accounts for less than 40% and 60% of the total manufacturing employment and value added respectively (see Figure 6.1), and around 5% and 15% respectively within the overall economy (see Table 5.4) making the simultaneity a less problematic issues. Unobservable characteristics are also controlled introducing time dummy variables with regard to the estimations of sectors and firms, and the broader industrial classification of two-digit sectors is also introduced for firms. This allows to purge unmodeled sources out from the error term, which may cause inconsistent parameters. The presence of endogeneity needs to have some empirical foundations, and in the case of the present study, endogeneity can be seen as a weak issue in comparison with the modelled causality. Similar argumentations in a growth study are also proposed by Neffke, Henning, Boschma, et al. (2011).

8.5 Conclusions

This chapter investigated the influence of agglomeration externalities on employment, value added and labour productivity of five-digit manufacturing sectors and firms within Indonesian locations employing a panel data analysis from 2000 to 2009. Agglomeration externalities are tested on three dimensions of manufacturing growth, which allow a more accurate investigation. Since considering only employment, manufacturing expansion in Indonesia was not properly captured. This explains why the majority of coefficients for sectors and firms are insignificant and some of them are negatively related to employment expansion.

Evidence revealed that specialized clusters are the preponderant source for manufacturing development confirming the assumption of the MAR model (Glaeser et al., 1992). Localization economies foster growth through intra-industry knowledge transfer, sharing facilities and infrastructures, availability of large and skilled labour pools, large and heterogeneous suppliers, better matching between agents (Duranton & Puga, 2003). These advantages to produce in proximity increase the propensity of economic activities to be in the cluster rather than isolated facilitating their growth and supporting the emergence phase of new activities. The effect of interconnected sectors seems to be more effective within urban dense economic proximity rather than larger geographical scale (regencies) where the economic distribution can be more dispersed. Although interconnected varieties are mainly negatively related to firms' expansion within regencies, evidence revealed that they are beneficial for sectoral industrial structure growth with particular reference to value added and labour productivity within cities. This positive impact of relatedness on manufacturing development can play a crucial role to enhance specialised clusters' competitiveness, which brings new insights for policy design as argued in Chapter 3.

Considering the entire manufacturing structure emerges the divergent influence of high and medium-high, and medium-low and low technology intensity related industries for the three dimensions of manufacturing growth at the sectoral and firms levels. The localization of $RVHMH$ fosters job creation within regencies, which can be associated with their ability to form high-qualified workers increasing spin-off and mobility of labour where the local industrial configuration affects this process. New venture creation and flow of labour within regencies are likely to be embedded within a pre-existing configuration of medium-low and low technology intensity industries. This increases their learning capabilities, which can contribute to explain the predominant positive role of $RVMLL$ for sectoral value added and labour productivity indiscriminately by locations. Disaggregating manufacturing based on the degree of technology intensity industries allows assessing the impact of agglomeration externalities more accurately. It emerged that the negative effect of high and medium-high technology intensity related industries for value added (considering the entire industrial structure) is driven by their non-technological related activities (medium-low and low). In particular, H-MH and ML-L industries are positively affected by an increase of their technological relatedness ($RVHMH$ and $RVMLL$ respectively). This argumentation is further confirmed for two-digit sectors though several exceptions are notable. Little evidence has been found to support the conceptualization that the same two-digit sector located within cities and regencies diversely exploit inter-industry knowledge spillovers.

It is also observed that unrelated variety plays an antithetic effect within cities and regencies for sectors. Since the former is characterised by economic density and diversity, and an increase of industrial heterogeneity has a negative impact on sectoral growth due to an increase of agglomeration costs; whereas the localized activities within the latter benefit to have a more industrial diversification due to its high specialization, which enhances resilience and more balanced growth. It also interesting to note the decreasing role of unrelated variety when industries are disaggregated based on technology intensity and two-digit sectors, which suggests that the benefits of heterogeneous industrial configurations (resilience and balanced growth) are more operative and detectable at the higher level aggregation rather than at the lower level. The idiosyncratic effects highlighted for (un)linked variety could not be capture considering general variety without any sectoral linkages, and decomposing it based on the Indonesian industrial classification and the technology intensity classification provide more accurate insights for the role of industrial relatedness and heterogeneity. In addition to this, taking into account indiscriminately all country, the divergent influence of agglomeration externalities between cities and regencies were not properly evaluated leading to erroneous inference and policy relevance (e.g. the divergent effect of unrelated variety between cities and regencies).

The overall findings suggest promoting specialized clusters, though this raises policymakers' challenges of which cluster needs to be selected in order to develop policy initiatives. The discovery process needs to be carefully evaluated, which should be based on cluster's contribution to the overall manufacturing structure rather than assessing cluster's potentiality a-context. Indonesian policymakers should promote key clusters with large sectoral linkages stimulating local growth and diversification, which allow reducing the risks of lock-in effect within a cluster and a lack of resilience within a location. This implies the selection of a cluster characterised by strong local ties, and avoids sectors (even if embedded) that show non-temporary changes in their competitive paradigms and customers' preferences. Scholars have focused their investigation on the role of interconnected variety due to its novelty for growth. However, the present study argues that the identification of local heterogeneous degree provides as well valuable information for policy strategies to increase embedded relatedness and/or further diversification. Policymakers often ignore this relationship between growth and stability for regional economic development. Evidence suggests that Indonesian policymakers should promote heterogeneous configuration within regencies enhancing their diversification; and they should encourage relatedness within urban centres rather than a further economic diversity. In addition, evidence suggests that policymakers should stimulate the formation of human capital, which emerged as a crucial driver for manufacturing revitalization in Indonesia. However, the formation of skilled workers cannot be fully achieved without increasing the localization of more technologically advanced industries, which can absorb human capital and contribute to its formation. Thus, policymakers should also develop initiatives to encourage the establishment and growth of these industries. The next chapter aims to further investigate agglomeration externalities identifying spatial clustering of large and medium manufacturing activities within Indonesian locations between 2000 and 2009 shedding the light on the role of key embedded specialised clusters on growth.

Appendix

8.A Appendix: The impact of (un)related variety on labour productivity of two-digit sectors.

The influence of (un)related variety on labour productivity disaggregated by two-digit sectors is presented in Table 8.9 for cities and Table 8.10 for regencies.

Table 8.9: The impact of (un)related variety on labour productivity by two-digit sectors within cities between 2000 and 2009.

	15		16		17		20		24		27		29	
Variables	**P.1**	**P.2**	**P.3**	**P.4**	**P.5**	**P.6**	**P.7**	**P.8**	**P.9**	**P.10**	**P.11**	**P.12**	**P.13**	**P.14**
LQ	0.061	0.059	0.666**	0.725**	0.104^	0.100	0.117	0.114	0.140	0.131	-0.133	-0.160	-0.026	-0.021
	(0.046)	(0.046)	(0.216)	(0.198)	(0.063)	(0.063)	(0.079)	(0.079)	(0.169)	(0.171)	(0.170)	(0.153)	(0.152)	(0.151)
COMP	-0.075	-0.076	0.308	0.327	0.141	0.135	-0.039	-0.046	0.343^	0.330	-0.385^	-0.406^	-0.085	-0.084
	(0.075)	(0.076)	(0.272)	(0.243)	(0.087)	(0.088)	(0.115)	(0.116)	(0.204)	(0.207)	(0.220)	(0.205)	(0.213)	(0.208)
POPDEN	-0.738	-0.634	-4.383	-3.997	-6.072***	-6.087***	-3.942	-4.328^	3.400	3.468	-9.846	-9.163	-12.546*	-13.576**
	(1.698)	(1.677)	(7.359)	(6.976)	(1.455)	(1.458)	(2.437)	(2.343)	(3.689)	(3.701)	(9.732)	(9.619)	(5.088)	(4.780)
HUMCAP	3.525***	3.463***	3.788	3.950	5.361***	5.334***	4.344**	4.585***	2.564	2.572	7.904^	8.136^	9.841***	10.043***
	(0.773)	(0.764)	(2.532)	(2.353)	(0.813)	(0.812)	(1.364)	(1.316)	(1.617)	(1.621)	(4.685)	(4.617)	(2.787)	(2.691)
UV	-0.142^	-0.102	-0.208	-0.461	0.264	0.205	0.036	-0.010	-0.552	-0.441	-0.078	0.734	-0.074	-0.577
	(0.082)	(0.084)	(0.472)	(0.498)	(0.210)	(0.233)	(0.139)	(0.142)	(0.377)	(0.414)	(0.593)	(0.714)	(0.403)	(0.417)
RV	0.435***		-0.671^		0.358^		-0.023		0.478^		-0.342		0.707	
	(0.111)		(0.360)		(0.188)		(0.173)		(0.255)		(0.734)		(0.519)	
RVHMH		-0.344		5.664**		0.991		2.064*		-0.342		-3.267^		3.425*
		(0.531)		(1.903)		(0.914)		(0.937)		(1.071)		(1.669)		(1.428)
RVMLL		0.469***		-0.838*		0.344^		-0.047		0.532*		0.441		0.242
		(0.110)		(0.370)		(0.187)		(0.173)		(0.259)		(0.830)		(0.516)
Constant	-20.721***	-20.783***	2.122	-1.708	-7.407^	-6.940	-9.848*	-10.078*	-37.581***	-38.273***	-7.952	-17.512	-11.819	-5.589
	(4.044)	(4.025)	(27.152)	(25.835)	(4.263)	(4.346)	(4.428)	(4.382)	(10.068)	(10.058)	(18.455)	(18.926)	(9.126)	(8.066)
Industry fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observations	2,344	2,344	132	132	751	751	565	565	752	752	203	203	330	330
F (p-value)	34.563	31.112	2.139	5.977	12.005	10.526	8.399	9.028	8.707	7.945	4.213	4.900	4.859	4.613
	0.000	0.000	0.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses. For the denomination of two-digit sectors see Table 6.1.

Table 8.10: The impact of (un)related variety on labour productivity by two-digit sectors within regencies between 2000 and 2009.

	21		**25**		**27**		**28**		**33**		**35**	
Variables	**Q.1**	**Q.2**	**Q.3**	**Q.4**	**Q.5**	**Q.6**	**Q.7**	**Q.8**	**Q.9**	**Q.10**	**Q.11**	**Q.12**
LQ	-0.029	-0.037	0.188*	0.171*	-0.165	-0.189	-0.048	-0.061	0.613	0.797*	0.310	0.310
	(0.107)	(0.107)	(0.076)	(0.075)	(0.208)	(0.216)	(0.085)	(0.084)	(0.373)	(0.337)	(0.238)	(0.227)
COMP	-0.036	-0.037	0.256*	0.242*	-0.019	-0.049	-0.115	-0.130	0.571^	0.629*	0.224	0.216
	(0.131)	(0.130)	(0.104)	(0.102)	(0.243)	(0.251)	(0.109)	(0.107)	(0.291)	(0.286)	(0.332)	(0.310)
POPDEN	-6.016***	-6.030***	-5.335***	-5.372***	-5.814^	-5.083	-3.858**	-3.738**	-4.193	-16.444*	2.093	2.023
	(1.632)	(1.630)	(0.604)	(0.595)	(3.103)	(3.253)	(1.285)	(1.272)	(7.296)	(7.218)	(3.024)	(2.904)
HUMCAP	3.492***	3.582***	4.334***	4.396***	5.055***	4.754***	2.871***	2.880***	3.998	7.618**	3.574**	3.563**
	(0.691)	(0.685)	(0.338)	(0.332)	(1.137)	(1.203)	(0.469)	(0.460)	(2.470)	(2.186)	(1.195)	(1.161)
UV	0.032	0.201	-0.044	0.025	1.572^	2.219**	-0.192	-0.025	-0.949	-3.798*	0.063	-0.072
	(0.315)	(0.308)	(0.155)	(0.162)	(0.834)	(0.797)	(0.253)	(0.257)	(2.252)	(1.607)	(0.567)	(0.577)
RV	-0.161		0.012		-0.470		0.779**		-0.291		-0.776*	
	(0.286)		(0.151)		(1.055)		(0.240)		(1.066)		(0.388)	
RVHMH		-2.069^		-1.588**		-3.139^		-0.754		17.127**		2.780
		(1.168)		(0.603)		(1.755)		(0.946)		(6.076)		(2.301)
RVMLL		-0.082		0.067		-0.123		0.868***		-0.770		-0.862*
		(0.289)		(0.156)		(1.130)		(0.249)		(0.729)		(0.368)
Constant	3.716	2.624	-9.703***	-10.150***	-16.951*	-19.388**	-1.129	-2.084	-8.635	17.495	-33.660***	-33.421***
	(4.178)	(4.516)	(2.509)	(2.478)	(7.080)	(6.958)	(4.077)	(4.062)	(17.001)	(16.336)	(6.136)	(5.772)
Industry fixed effects	No	No	No	No	No	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. observations	493	493	1,321	1,321	260	260	956	956	58	58	242	242
F (p-value)	4.840	4.456	31.297	29.709	11.825	13.632	12.922	11.627	2.213	4.351	14.699	15.665
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.088	0.004	0.000	0.000

Notes: Level of statistical significant: *** 0.1%; ** 1%; * 5%; ^ 10%. Robust standard errors of the coefficients are given in parentheses. For the denomination of two-digit sectors see Table 6.1.

9 Key embedded specialised clusters as drivers for growth

9.1 Introduction

In Chapter 7 and Chapter 8, inter and intra-industry knowledge spillovers emerged as important forces affecting the performance of localized manufacturing activities within cities and regencies. Specialization positively influences the entire manufacturing development, since it is a crucial element for the emergent phase and growth of new economic activities. However, specialization is negatively related to the performance of established economic activities since their knowledge similarity is reduced over time due to their constant interactions within the same sector. It emerged that established activities are positively influenced by the flow of complementary knowledge, which is external to the cluster rather than know-how internal to the same sector. In this framework, the localization of industrial relatedness come to light as an important driver for manufacturing revitalisation in Indonesia, which can reduce the risk of lock-in effect through external knowledge flow, and the exposure to economic shocks through the generation of sectoral branches. Specialization and relatedness are often analysed separately to unfold which is more predominant for growth leading to an inclusive academic debate (see, for instance, De Groot et al., 2009; De Groot, Poot, & Smit, 2015). Evidence of the present work highlighted that they are both determinant on growth, though different economic activities exploit them with diverse intensity based on, for instance, their life cycle stage, technology intensity degree, and the local availability.

It is argued that inter and intra-industry knowledge spillovers should be considered as complementary externalities for local development, where the former fosters the latter and vice versa. Thus, policymakers should combine the notion of specialisation and relatedness within a unified policy framework to design more effective public initiatives towards balanced growth, competitive advantages of clusters in the view of Porter (1990), where inter-industry knowledge spillovers foster localization externalities as argued by Jacobs (1969). The conceptualisation of key embedded specialised clusters encases these two notions identifying local specialised sectors that show high growth potential in a broader local prospective of their contributions to related economic activities, which can foster the overall manufacturing expansion. Discovering key embedded specialised clusters could be assessed by the historical clusters' performance, their local specialisation and relatedness dimensions, and an in-depth investigation of cluster's competitiveness, which allow identifying potential successful sectors contributing to manufacturing development. This also permit to stay away from sectors that are destined to fail due to non-temporary negative changes of their competitive paradigms. As emerged in Chapter 5 and Chapter 6, low technology intensity industries witnessed a drastic reduction of their growth and manufacturing contribution due to the decrease of their past competitive advantages (e.g. labour costs). Thus, the promotion of low technology intensity industries needs to be carefully assessed, and however, policies towards these sectors need to be combined with specific initiatives to enhance their competitive advantages aiming to avoid rivalry merely based on labour costs. For instance, fostering the adoption of more advanced technologies, the formation of skilled workers in order to enhance their sophistication of goods. This becomes particular relevant considering the increasing of domestic and international competition by countries (e.g. Vietnam and Cambodia) with lower cost of productions in comparison of Indonesia.

In the discovering process of key embedded specialised clusters, local industrial portfolio diversification also needs to be assessed. Since this allows policymakers to select certain key embedded specialised clusters that can also contribute to the local industrial diversification aiming to reduce the negative impact of industry-specific effect on local stability. Underpinning the development of highly localised embedded sectors within a location is not recommended, since this can increase the industrial unbalanced growth with negative repercussions on local resilience. Scholars have focused their attention on the economic role of related variety due to its novelty for growth, though identifying local heterogeneous configuration can provide useful information as well in order to design *tailor-made* policies aiming to modify the local economic diversity towards more or less industrial connectivity. As emerged in Chapter 7 and Chapter 8, cities are economically dense and diverse and a further increase of unrelated variety is counterproductive for their localised economic activities due to the raise of agglomeration costs; whereas, they take advantage due to an increase of sectoral interconnectivity. Regencies that are more specialised and less concentrated, an increase of industrial heterogeneity is beneficial for their businesses, which reduces the negative exposure to industry-specific effect increasing local stability and more balanced growth.

This chapter is devoted to investigate the spatial economic agglomerations and their evolution over time within and across Indonesian locations between 2000 and 2009. This is especially conducted shedding the light on the role of key embedded specialised clusters on growth useful to design more effective policy strategies. The presence of persistent clusters are identified in Indonesia combining discrete-space measures with continuous-space statistics such as the Moran's I index, the Moran scatterplots and local indicators of spatial association (LISA) as defined and discussed in Chapter 4. Evidence reveals that numerous locations outside Java growth faster than places in Java between 2000 and 2009.

This has been also favoured by the recent policies based on clusters and regional approaches aiming to develop less agglomerated locations (i.e. the National Long Term Development Plan 2005–2025 and the Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025). The trend of decentralization of growth generates the emergence of new economic centres, which can represent new business opportunities for manufacturing growth and more in general for the whole economy. However, locations in Java Island that are characterised by denser economic concentration show less volatility of growth than less economically agglomerated places out of Java, which are more subjected to economic fluctuations. This condition has generated two stable agglomeration bells around the main concentrated centres in Java island between 2000 and 2009 such as Jakarta-Bandung-Bekasi-Bogor denominated as cluster JB; and Gresik-Surabaya-Pasuruan named as cluster GSP. It also emerges that high and medium-high technology intensity related industries show propensity to produce in proximity with particular regard to the cluster JB, which is characterised by the presence of numerous hotspots of human capital. Since qualified labour is a fundamental driver for the development of these industries, which can generate a reciprocal positive effect on human capital expansion due to their capabilities to train workforce. Although sectoral specialisation does not cluster in space due to the process of spatial diversification in the country between 2000 and 2009, Indonesian locations witnessed a substantial increase of their specialisation and relatedness between 2000 and 2009.

The industrial structure of Eastern Jakarta is adopted as a case study to unfold the role of key embedded specialised clusters on local industrial growth. The main motive behind the selection of Eastern Jakarta refers to the preponderant role of high and medium-high technology intensity industries, which can lead to industrial changes in the country due to spatial sprawl and interaction. The Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025 (MP3EI) also attributes a main role of Jakarta in leading the development of Java corridor for industry and service provisions in the country. The historical industrial development of specialisation and relatedness of Eastern Jakarta is assessed between 2000 and 2009 identifying key embedded specialised clusters, which can contribute to the future manufacturing growth of Eastern Jakarta. However, this needs to be further extended by an in-depth investigation of sectoral competitiveness, which requires more data that is not currently available in the datasets employed. In addition, the local development of large economic centres (e.g. Eastern Jakarta, Surabaya) can affect the growth of other locations, in particular, their industrial changes towards knowledge-based productions can lead to industrial transformation within their neighbours. It is noted the clusters JB and GSP are formed around large economic centres, and they witnessed an increase of their dimensions over time incorporating new hotspots locations leading to the development of their regions. This suggest that policymakers should embrace a spatial prospective to pursue regional development though this requires designing coherent and coordinate policies across places in order to exploit more effectively spatial positive industrial synergies across locations.

This chapter is organised as follows. In Section 9.2, data construction and descriptive statistics are explored highlighting the spatial distribution of large and medium operations in Indonesia. In Section 9.3, the persistent presence of hotspots are identified in 2000 and 2009. In Section 9.4, the focus is placed on the notion of key embedded specialised clusters as contributors to growth, where the industrial structure of Eastern Jakarta is analysed. In Section 9.5, spatial industrial development is investigated, which becomes particular relevant considering the persistent agglomeration patters in Indonesia. Finally, conclusions are provided in Section 9.6.

9.2 Data construction and descriptive statistics

The annual survey of large and medium manufacturing enterprises between 2000 and 2009 and the population census in 2000 and 2010 are employed, which are collected through the Indonesian Statistic Office and the University of Minnesota's Population Center (Minnesota Population Center, 2014) as described in Section 6.2. The same denominations and computations of variables at the location level are adopted (UV, RV, $RVHMH$, $RVMLL$, $POPDEN$, and $HUMCAP$) as illustrated in Table 8.1. Whereas, other variables are recalculated at the location level within 64 cities and 172 regencies with a total of 236 Indonesian locations as follows. Employment and value added are aggregated within locations for the respective years ($LEMP$ and LVA respectively), and the average annual employment and value added growth are computed for locations between 2000 and 2009 ($LEMPGROWTH$ and $LVAGROWTH$ respectively) based on the same structure of equation 7.1 and equation 7.2. Specialization of five-digit sectors is calculated as the average of location quotient within cities and regencies (ALQ). Table 9.1 shows the descriptive statistics and the independent samples t-test of these variables computed at the location level. It is notable that although regencies have higher means than cities in terms of average annual employment and value added growth ($LEMPGROWTH$ and $LVAGROWTH$), they are not statistically different between these two administrative units. Whereas, it is found significant higher means differences of employment and value added within cities in comparison of those in regencies, and significant lower means differences of specialization within urban places than regencies, which are in line with the results illustrated in Table 6.4.

Figure 9.1 shows the spatial distribution of employment and value added and their average annual growth rates between 2000 and 2009. Spatial inequality in Indonesia can be observed for large and medium manufacturing enterprises between locations in and out of Java Island in 2000. This condition persists in 2009 though numerous locations outside Java growth faster than places in Java as shown by the average annual employment and value added growth of large

Table 9.1: Nomenclature, descriptive statistics and the independent samples t-test of local aggregated variables.

Variables	Description	Cities		Regencies		Independent Samples t-test
		Mean	SD	Mean	SD	t-value
LEMP (log)	Location employment during 2000 and 2009.	8.47	2.05	8.11	1.82	3.56***
LVA (log)	Location value added during 2000 and 2009.	19.27	2.82	18.72	2.32	3.87***
LEMPGROWTH	Location employment growth between 2000 and 2009.	2.38	8.45	2.72	12.88	-0.22
LVAGROWTH	Location value added growth between 2000 and 2009.	18.45	13.71	20.27	18.15	-0.79
ALQ (log)	Average of five-digit specialization within locations between 2000 and 2009.	2.45	1.52	2.81	1.45	-5.05***

Source: Author's computation based on the large and medium manufacturing enterprises survey.
Notes: *** denotes the level of statistical significant at 0.1%.

and medium manufacturing enterprises between 2000 and 2009. This economic unbalanced is also observable considering other variables such as population density and human capital, as also emerged in Section 5.4. More than 85% of large and medium manufacturing employment and value added, and more than 65% of population and human capital are located in Java in 2000. The distribution of these variables does not substantially change in 2009 between locations in and out of Java with an exception of value added, which increased by 6% share of locations outside Java between 2000 and 2009. This can represent new manufacturing opportunities leading to further localization of firms rebalancing the economic distribution in Indonesia.

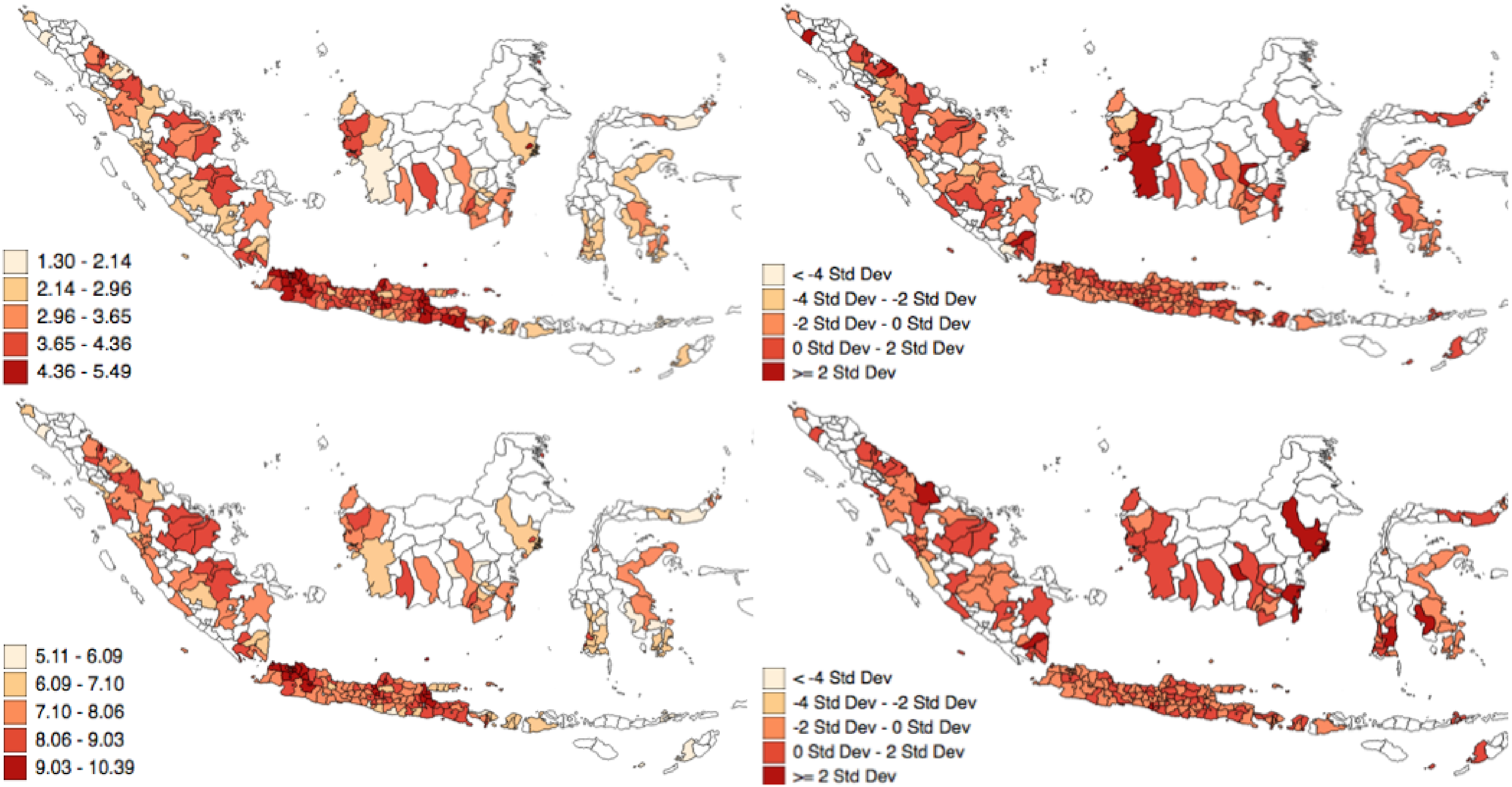

Figure 9.1: Employment and value added distribution in 2000 (top-left and bottom-left respectively), the standard deviation of average annual employment and value added growth between 2000 and 2009 (top-right and bottom-right respectively).

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: Locations with white colour and locations that are not included in the map refer to the data that is not available.

Figure 9.2 and Figure 9.3 show the average annual growth of employment and value added of cities and regencies respectively in and out of Java. It is observable that locations outside Java have higher linear relationship between employment growth and value added growth (0.72 for cities and 0.76 for regencies) than locations inside Java (0.65 for cities and 0.59 for regencies) between 2000 and 2009. Numerous locations out of Java have an outstanding performance such as Palangka Raya and Kupang (cities), and Asahan (regencies); while others witnessed a remarkable decline such as Gorontalo and Samarinda (cities), and Landak and Karo (regencies). On the other hand, the average annual employment and value added growth of the majority of locations in Java clustered between ±15%, and between 5% and 25% respectively. However, several locations in Java over-performed such as Tangerang, Cilegon, and Depok (cities), and Kulon Progo (regency); and others under-performed such as Madiun and South Jakarta (cities), and Lebak (regencies). It is relevant to observed locations in Java Island that are characterised by denser economic concentration show less variability than less economically agglomerated places out of Java, where this latter is more subjected to economic fluctuations. This led to the formation of persistent agglomeration patterns in Java between 2000 and 2009, as emerged in the next section.

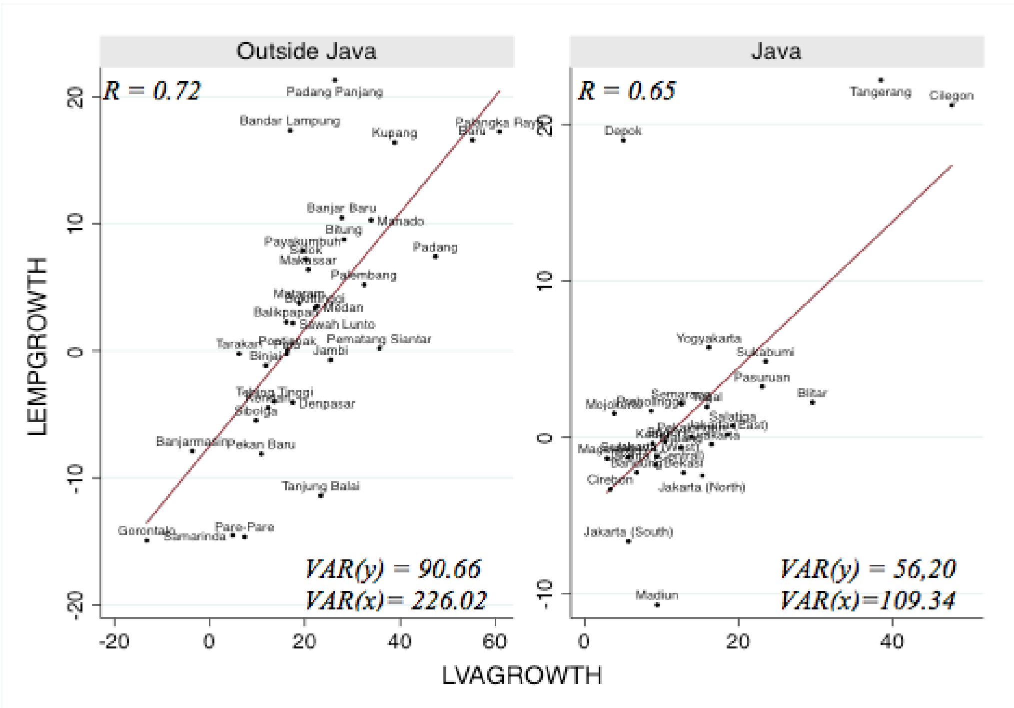

Figure 9.2: Average annual employment and value added growth within cities in and out of Java.

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: $VAR(y)$ and $VAR(x)$ denote the variance of the location average annual employment growth ($LEMPGROWTH$) and the location average annual value added growth ($LVAGROWTH$) respectively.

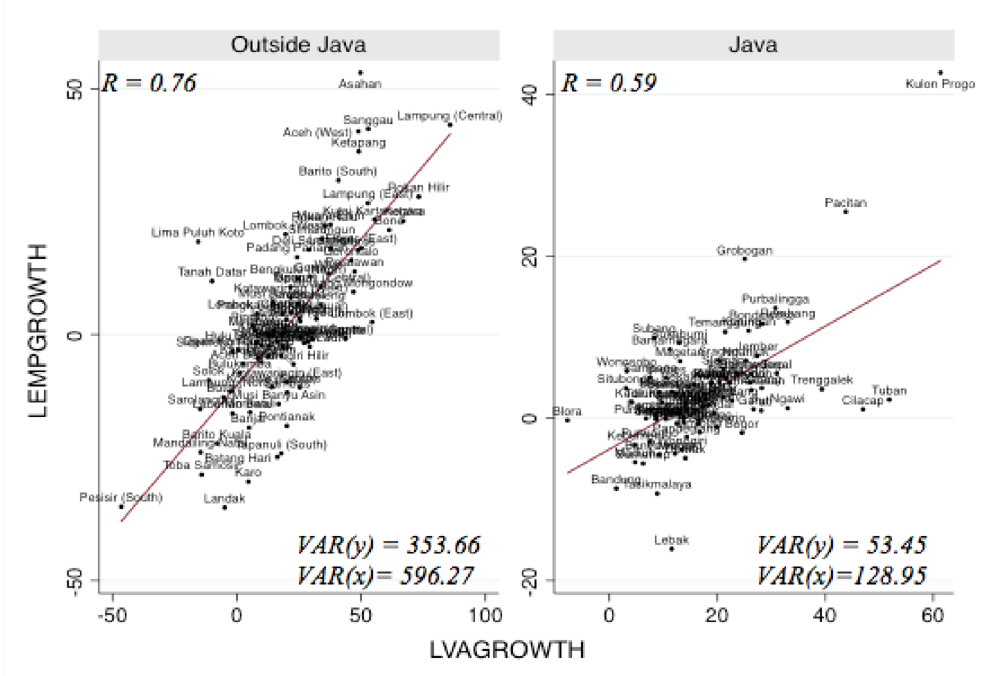

Figure 9.3: Average annual employment and value added growth within regencies in and out of Java.
Source: Author's computation based on the large and medium manufacturing enterprises survey.
Notes: $VAR(y)$ and $VAR(x)$ denote the variance of the location average annual employment growth ($LEMPGROWTH$) and the location average annual value added growth ($LVAGROWTH$) respectively.

9.3 The persistent presence of hotspots

This section is devoted to identify the persistent present of hotspot locations in Indonesia between 2000 and 2009 combining discrete-space indicators with continuous-space statistics (the global Moran's I and the LISA statistics) in 2000 and 2009 (see Chapter 4). This allows identifying spatial clustering of similar values where the attention is placed on spatial distribution of high-value locations surrounding by high-value places (High-High or hotspots) that are constantly present in 2000 and 2009. It is conducted through running the univariate global and local Moran's I in 2000 and 2009 for each variable, and the hotspots identified within these two periods are matched selecting high-high values places that are present in both years. Figure 9.4 shows the persistent presence of hotspot clusters, which highlights that the only locations in Java are characterised by high-high value places between 2000 and 2009 with an exception of specialization. Large and medium manufacturing operations, population density, and human capital persistently tend to cluster around large economic centres in Java such as Jakarta, Bandung, Bekasi and Bogor, which is named cluster JB[47]; and Gresik,

47. All locations within the cluster JB in Figure 9.4 are selected including: Bandung, Bekasi, Bogor, Cianjur, Garut, Karawang, Bandung (city), Bekasi (city), Bogor (city), Depok (city), West Jakarta (city), Central Jakarta (city), South Jakarta (city), East Jakarta (city), North Jakarta (city), Lebak, Purwakarta, Serang, Subang, Sukabumi, Sumedang, Tangerang (city), and Tangerang. The city term between brackets is reported in order to distinguish cities and regencies.

Surabaya, Pasuruan, which is called cluster GSP[48]. These two clusters[49]represent the large majority of job creation and value added generation of large and medium manufacturing operations in Java Island with more than 70%.

Employment and value added show numerous hotspots within these two clusters, which are also characterised by the presence of numerous high-high values of varieties (RV, $RVHMH$, and $RVMLL$) with particular regard to unrelated variety (UV). The Moran's I is relatively high in almost all variables in 2000 and 2009, with an exception of medium-low and low technology intensity related industries with a coefficient of 0.12 in 2000, though it substantially increased to 0.37 in 2009. This industry tended to cluster within GSP between 2000 and 2009. Whereas, high and medium-high technology intensity related industries are mainly grouped within the cluster JB characterised by relative high spatial autocorrelation in 2000 and 2009 highlighting their tendency to produce in proximity. Since they mainly compete by innovation, which is favoured within dense economic environment due to know-how exchange through linkages within the same and across sectors. However, spatial autocorrelation of $RVHMH$ is reduced in 2009 (from 0.57 in 2000 to 0.47 in 2009). Since high and medium-high technology intensity related industries witnessed considerable growth in the country (see Chapter 5 and Chapter 6), which increased their distribution across locations reducing their spatial autocorrelation. It is relevant to observe that human capital tends to cluster within $RVHMH$ hotspots, since locations characterised by more technologically advanced industries demand more skilled workers, and in the same time, they train new professionals leading to further development of human capital. RV shows numerous hotspots within the cluster GSP and few high-high values are identified within the cluster JB. Disaggregating RV into $RVHMH$ and $RVMLL$, high-high values clusters of RV within GSP are driven by $RVMLL$ due to the preponderant localization of medium-low and low technology intensity industries in the country. Whereas, few persistent specialized hotspots are observed, which are located in Sulawesi Island. Specialised clusters are more volatile due to industry-specific effects such as technological paradigm changes, variability of demand and supply, and also considering the process of industrial diversification in Indonesia where the overrepresentation of sectors within locations substantially changed between 2000 and 2009.

48. All locations within the cluster GSP in Figure 9.4 are selected including: Gresik, Jombang, Surabaya (city), Lamongan, Lumajang, Malang, Mojokerto, Pasuruan, Probolinggo, Sidoarjo, and Banyuwangi. The city term between brackets is reported in order to distinguish cities and regencies.
49. The hotspots in central Java (CJ) identified in Figure 9.4 are omitted from the analysis showing few high-high values clustering.

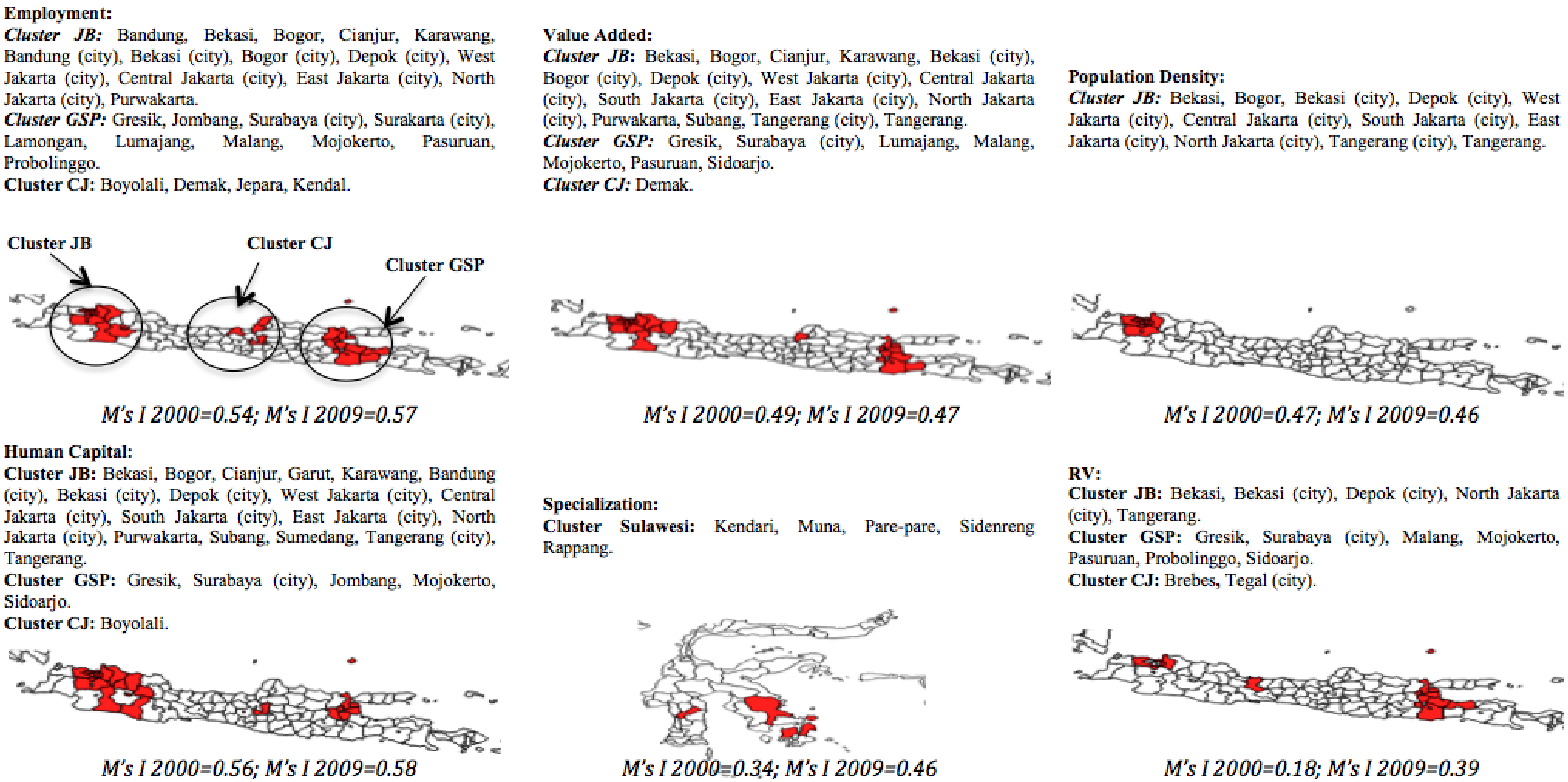

Figure 9.4: The persistent presence of hotspots clusters (High-High values) between 2000 and 2009.

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: 14 isolated islands are excluded from the computation. The statistical significant of identified cluster is at 5% level. Cluster JB denotes the area around Jakarta-Bandung-Bekasi-Bogor, Cluster GSP refers to the area around to Gresik-Surabaya-Pasuruan. Cluster CJ denotes hotspots in central Java. Several cities and regencies are identically denominated, thus, the city term between brackets is reported in order to distinguish cities and regencies. M's I denotes the global Moran's I in 2000 and 2009. $LEMPGROWTH$ and $LVAGROWTH$ are omitted since they did not show significant high-high values patterns.

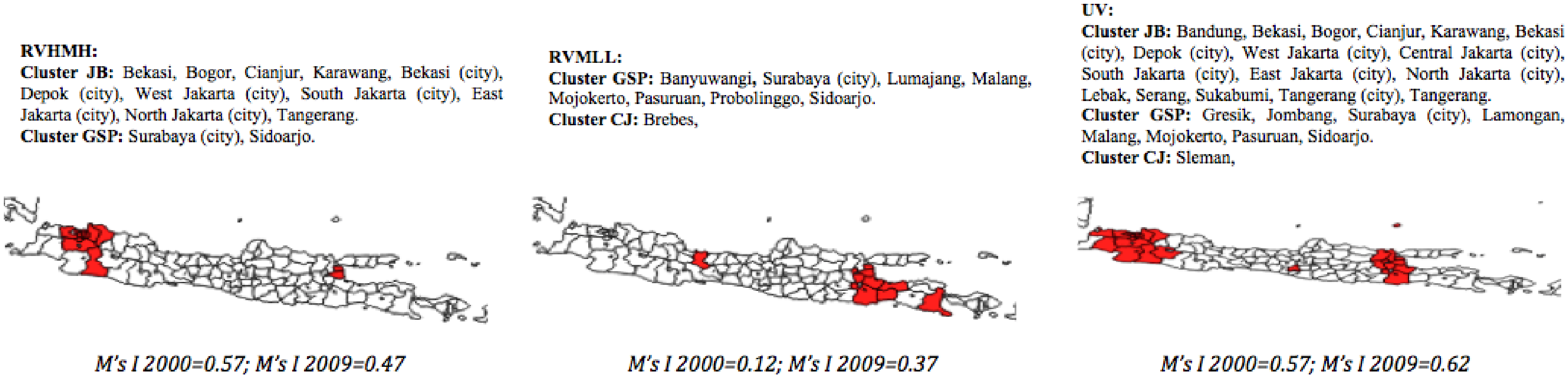

Figure 9.4: Continued.

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: 14 isolated islands are excluded from the computation. The statistical significant of identified cluster is at 5% level. Cluster JB denotes the area around Jakarta-Bandung-Bekasi-Bogor, Cluster GSP refers to the area around to Gresik-Surabaya-Pasuruan. Cluster CJ denotes hotspots in central Java. Several cities and regencies are identically denominated, thus, the city term between brackets is reported in order to distinguish cities from regencies. M's I denotes the global Moran's I in 2000 and 2009. $LEMPGROWTH$ and $LVAGROWTH$ are omitted since they did not show significant high-high values patterns.

Although locations within the clusters JB and GSP grew with lower intensity than numerous locations less concentrated in terms of employment and value added, they show persistent agglomeration patterns between 2000 and 2009. It is notable in Figure 9.5 that few locations within the cluster GSP have negative employment growth, since their industrial structure is characterised by labour intensive industries demanding large quantity of workforce though they produce low value added goods. By contrast, numerous locations within the cluster JB have negative employment growth since their industrial configurations are more denoted by the localization of technological advanced industries, which require less workforce though they produce high value added goods. These differences in industrial structures can explain the diverse linear relationship between employment and value added growth between these two clusters (0.74 for the cluster GSP and 0.39 for the cluster JB). The next section aims to unfold the industrial structure of Eastern Jakarta adopted as a case study in order to explore the role of specialisation and relatedness within the local configuration providing policy recommendations for the future industrial development. This is also assessed in a spatial prospective in order to explain the formation of clusters JB and GSP, which can generate a spatial snowball mechanism where the effect of industrial development of these two clusters can be spread across other locations in Java Island.

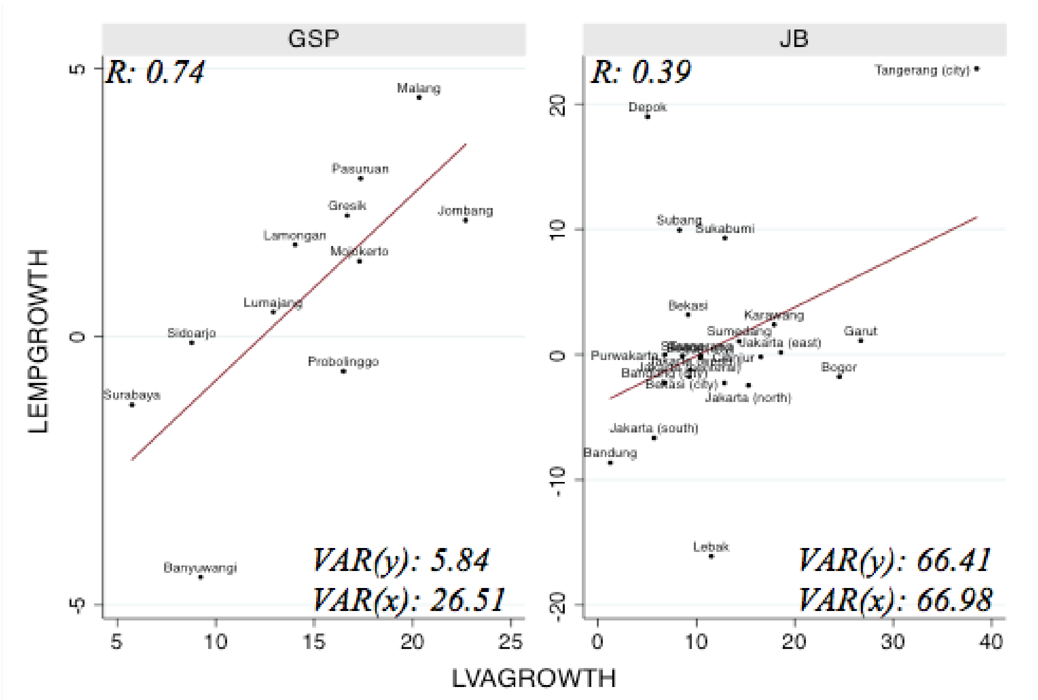

Figure 9.5: Local annual average of employment and value added growth within the clusters GSP and JB.

Source: Author's computation based on the large and medium manufacturing enterprises survey.
Notes: $VAR(y)$ and $VAR(x)$ denote the variance of the location average annual employment growth ($LEMPGROWTH$) and the location average annual value added growth ($LVAGROWTH$) respectively.

9.4 Discovering key embedded specialized clusters in Eastern Jakarta

This section is devoted to analyse the industrial configuration of Eastern Jakarta between 2000 and 2009 in order to identify local key embedded specialised clusters, which can contribute to its future industrial development. The selection of this location is not casual for two main reasons. First, the local industrial configuration of Eastern Jakarta strongly moved towards high and medium-high technology intensity industries overcoming 50% of the local employment share in 2009. As emerged in Chapter 5 and Chapter 6, this industrial reconfiguration is also the trend of the entire country switching from a manufacturing structure mainly based on labour-intensive industries to knowledge-based production activities. In particular, industrial changes often occur within dense economic centres (e.g. Eastern Jakarta) and they might be spread across locations. Thus, the increase of high and medium-high technology intensity industries within Eastern Jakarta - among other large Indonesian economic centres such as Bekasi (regency), and Surabaya (city) - might contribute to lead to the industrial evolution of the entire country towards more technologically advanced industries. Second, the MP3EI sets a specialised economic corridor in Java Island aiming to drive industry and service provisions in the country (see Figure 5.5). The MP3EI attributes to Jakarta the main role for the development of Java corridor setting important investments to enhance its logistics networking (e.g. seaports, airway and railway infrastructures) aiming to increase interconnectivity between Jakarta and other locations in and out of Java and worldwide, which strengthen domestic and international trades with positive repercussions on regional industrial development (Coordinating Ministry for Economic Affairs et al., 2011).

Discovering key embedded specialised clusters requires identifying sectors that are overrepresented within a location in comparison of their national aggregation (specialisation) that show high growth potential (key) in a broader local prospective of related linkages within a local pre-existing industrial configuration (embedded). The present work defines interconnectivity between sectors based on the Indonesian industrial classification (KBLI 2005) and the technology intensity classification proposed by OECD (2011). However, the potentiality of a sector should be extended through an in-depth investigation of sectoral competitiveness. Discovering key embedded specialised clusters should be also conducted assessing industrial portfolio configuration in order to enhance local resilience. For instance, the chemicals and chemical products industry (24 code) in Eastern Jakarta substantially grew and it significantly contributed to the industrial development between 2000 and 2009 (see Table 9.2). Thus, policies should be focused on alternative key embedded specialised sectors in order to increase local industrial portfolio diversification rather than further unbalanced growth.

Table 9.2 shows the industrial configuration of Eastern Jakarta and its evolution between 2000 and 2009. It is relevant to notice that two-digit sectors in absence of five-digit specialization in 2000, and practicably unchanged in 2009, witnessed a drastic reduction of employment and value added. For instance, the wood and products of wood except furniture and plaiting materials (20 code), the paper and paper products (21 code), the radio, television and communication equipment and apparatus (32 code) industries. In particular, this latter had the highest reduction of employment and value added growth of 60% reducing substantially its economic contribution. The absence of five-digit specialisation especially affects negatively employment growth in comparison of value added growth within two-digit sectors. Since knowledge transfer and firms' cooperation is less effective in absence of specialisation due to small-scale of localised economic activities within the same sector, where employment is mostly influenced due to the lack of sectoral growth. However, several two-digit sectors even in absence of five-digit specialization between 2000 and 2009 increased their value added, though they witnessed a reduction of their employment such as the wearing apparel (18 code) and the tanning and dressing of leather (19 code) industries. On the other hand, two-digit sectors, that increased their five-digit specialisation, witnessed a remarkable performance with particular reference to value added between 2000 and 2009. An increase of five-digit specialisation especially augmented value added in comparison of employment, and vice versa in absence of specialisation as aforementioned. Since the close firms' proximity within the same sectors increases knowledge exchange and networking fostering their growth, and the accumulation of know-how and established linkages amplify firms' value added. In addition, related variety can magnify the effect of localization externalities due to inter-industry knowledge spillover, which can reduce the risk of lock-in effect. Numerous two-digit industries, that increased their five-digit specialization, witnessed an increase of their relatedness experiencing significant growth. For instance, the food products and beverages (15 code), the chemicals and chemical products (24 code), the basic metals (27 code), and the machinery and equipment n.e.c. (29 code) industries.

Eastern Jakarta is changing its industrial structure towards higher technology intensity industries. All high and medium-high technology intensity industries substantially increased their employment and value added between 2000 and 2009, with an exception of the radio, television and communication equipment and apparatus industry (32 code), which drastically reduced its industrial contribution. Whereas, numerous low technology intensity industries substantially reduced their employment and value added such as the wood and products of wood except furniture and plaiting materials (20 code), and the paper and paper products (21 code) industries. However, the food products and beverages (15 code), and the publishing, printing and reproduction of recorded media (22 code) industries had an outstanding performance with particular regard to value added. It is notable that just two industries accounted for more than 30% of the total local employment such as the chemicals and chemical products (24 code) and the wearing apparel (18 code) industries holding more than 20% and 10% respectively of employment share in 2000. However, the former continued to growth on annual average in terms of employment and value added of 3% and 12% respectively between 2000 and 2009, and the latter witnessed a reduction of employment of 6% albeit its value added increased by 4% on annual average. The high concentration of few industries inevitably exposes Eastern Jakarta to external industry-specific shocks, thought an increase of portfolio diversification is observable towards knowledge-based production activities, which may be due to the important economic role of the chemicals and chemical products industry (24 code). Since the substantial growth of this activity could be beneficial for the development of high and medium-high technology intensity related industries. The expansion of knowledge-based production activities is highly recommended in Indonesia, as highlighted in Chapter 5 and Chapter 6, contributing to industrial diversification and economic growth due to their high productivity and innovation propensity generating incremental and radical changes, which can be also adopted by unrelated activities such as medium-low and low technology intensity industries fostering their competitiveness.

The two-digit industrial configuration of Eastern Jakarta and its evolution between 2000 and 2009 exposed in Table 9.2 can be disaggregated by five-digit sectors in 2000 and 2009, which is illustrated in Figure 9.6 and Figure 9.7 respectively. This allows identifying five-digit sectors that can contribute to the development of two-digit industry and the overall industrial structure of Eastern Jakarta. Policymakers should especially consider underpinning the development of the machinery and equipment n.e.c. (29 code), which substantially increases five-digit specialised clusters and relatedness within its two digit sector. Particular attention should be placed on the machine tools for wood working (29222 code), the non electrical stove and heater for commercial purpose (29141 code), and the textile machineries (29263 code) sectors, which show the highest specialisation within the two-digit industry (Figure 9.7). The expansion of these sectors can foster the growth of specialised and non-specialised relatedness within the machinery and equipment n.e.c. industry, which can contribute to the development of high and medium-high technology intensity industries. The motor vehicles, trailers and semi-trailers (34 code), and the transport equipment (35 code) industries substantially grew with particular reference to value added, which can contribute to the industrial development and resilience of Eastern Jakarta. Within these two industries, the motorcycles (35911 code), and the motor vehicles (34100 code) sectors emerge as potential activities to promote, which show high specialisation between 2000 and 2009 though they are lack of related variety within their two-digit industries (Figure 9.7). Promoting these industries, policymakers should also incentives the proliferation of their relatedness in order to support specialised clusters in the view of Porter (1990). In addition, the basic metals (27 code) and the fabricated metal products, except machinery and equipment (28 code) show numerous specialised clusters and relatedness in 2009, and they substantially growth between 2000 and 2009. However, the latter witnessed a reduction of its employment of almost 5% on annual average. The attention of policymakers should be placed on the non-ferrous metal basic industries (27101 code), the iron and steel smelting industry (27310 code), and the products of metal n.e.c. (28992 code), which show the highest specialisation within their two-digit industries in 2009 (Figure 9.7).

Whereas, the selection of low technology intensity industries needs to be assessed carefully in terms of their future industrial contribution, and however, industrial policies should be strongly accompanied by specific initiatives to increase their competitiveness. The food products and beverages (15 code) industry shows the largest numbers of specialised clusters and relatedness within its two-digit industry, and it witnessed a substantial increase of employment and value added between 2000 and 2009. The two important specialised clusters refer to the powdered, condensed and preserved milk (15211 code), and the malt liquors and malt (15530 code) sectors (Figure 9.7). Policymakers should also consider revitalising the textiles industry (17 code), which increases its five-digit specialisation and relatedness between 2000 and 2009 though its employment is drastically reduced by 15%, which can be due to the adoption of advanced technologies where value added just decreased by less than 1%. Policymakers' attention should be placed on specialised sectors of the carpets and rugs (17220 code), and the gunny bags (17214 code). They can contribute to revitalise their linked sectors within two-digit industry and favouring the development of the textile machineries (29263 code) sector generating industrial synergies (Figure 9.7). In particular, the textiles industry is identified by the MP3EI (Coordinating Ministry for Economic Affairs et al., 2011) as one of the main important activity for the development of the Java corridor due to its high localisation in the region (see Table 9.3). In addition, the majority of industries identified in Eastern Jakarta, they are also recognised by the MP3EI as main activities to underpin for regional development in Java such as food and beverage, the transportation and equipment, and the steel industries. However, the investigation is further extended unfolding specialized five-digit sectors that can potentially foster the entire manufacturing development.

The local industrial structure of Eastern Jakarta is moving towards specialisation and relatedness, and the key embedded specialised clusters identified can be considered as the main sectors to prioritize for its future development. However, the evaluation of which sectors to support should be extended through an in-depth investigation of their competitiveness in order to fully unfold their potentiality of growth. Besides this, the recombination of dissimilar competences between unrelated varieties cannot be excluded, which might generate related branches through radical innovations as shown by Castaldi et al. (2014). In particular, policymakers should carefully assess the emergence of new branches that show growth potential though they are not embedded within the industrial configuration at the initial stage. Since new sectors can lead to the formation of relatedness through spin-off and new ventures creation, and industrial adaptation of unrelated variety into relatedness driven by business opportunities. For instance, mobile phone and automotive industries (that change the way to communicate and commute) were lack of related businesses in their introduction phases, and afterwards their relatedness increased over time due to the exponential growth and industrial potentiality of these new businesses. In addition, policymakers should embrace a geographical prospective in order to develop regional industrial initiatives more effectively. Since local industrial development, with particular reference to large economic centres, might spread across places affecting their industrial configuration and growth. This is particular relevance considering Figure 9.4 where two persistent agglomeration bells in Java emerged, which are formed around large economic centres and the positive effects of industrial development are spread across locations generating numerous contiguity hotspots over time. This spatial development is likely to continue in the future generating new surrounding hotspots enlarging the clusters JB and GSP. This suggests that policymakers should embrace a spatial prospective in order to develop regional policies towards these two important clusters in Java, which allow exploiting spatial industrial synergies among locations.

Table 9.2: The two-digit industrial configuration of Eastern Jakarta and its evolution between 2000 and 2009.

Two-digit	LEMPGROWTH	LVAGROWTH	Share 2000**	Share change**	Linkages KBLI 2000 (2009)	Five-digit LQ>1 2000 (2009)
15	1.74	13.31	8.36	1.28	13 (19)	1(11)
17	-15.43	-0.85	6.04	-4.55	7 (5)	0 (2)
18	-6.37	4.31	10.19	-4.53	1 (1)	0 (0)
19	-3.87	2.91	0.44	-0.13	2 (3)	0 (0)
20	-9.57	-9.79	1.13	-0.66	4 (3)	0 (0)
21	-24.32	-17.25	3.84	-3.42	3 (1)	0 (0)
22	2.58	17.32	4.90	1.19	6 (4)	1 (4)
24	2.29	11.53	22.64	4.77	8 (13)	2 (8)
25	-0.13	5.71	2.78	-0.07	6 (8)	0 (1)
26	0.29	19.10	3.53	0.04	2 (4)	1 (4)
27	4.18	21.93	3.02	1.31	3 (7)	0 (7)
28	-4.55	12.10	6.64	-2.29	11 (13)	1 (8)
29	16.46	40.16	1.81	6.05	5 (10)	2 (10)
31	3.71	5.81	3.08	1.16	4 (6)	0 (6)
32	-60.62	-58.59	5.50	-4.48	2 (1)	0 (0)
33	N/A*	N/A*	N/A*	0.35	N/A* (3)	N/A* (3)
34	4.54	34.45	5.13	2.48	3 (3)	0 (3)
35	2.56	24.29	6.84	1.65	4 (2)	1 (2)
36	1.84	-2.90	4.14	0.67	4 (7)	0 (5)
37	N/A*	N/A*	N/A*	0.19	N/A* (1)	N/A* (1)
Average	**-4.70**	**6.86**	**5.56**	**0.00**	**5 (6)**	**1 (4)**

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: The 33 and 37 codes are not present in 2000, and the 16, 23 and 30 codes are omitted, as they are not present between 2000 and 2009. ** The share in 2000 and its change between 2000 and 2009 refer to the employment share. The numbers of linkages within KBLI refer to the number of five-digit sectors within the respective two-digit code in 2000 and 2009.The five-digit sectors with LQ>1 represents the number of specialized clusters within two-digits sectors. See Table 6.1 for the denomination of two-digit sectors and their technology intensity classification based on OECD (2011).

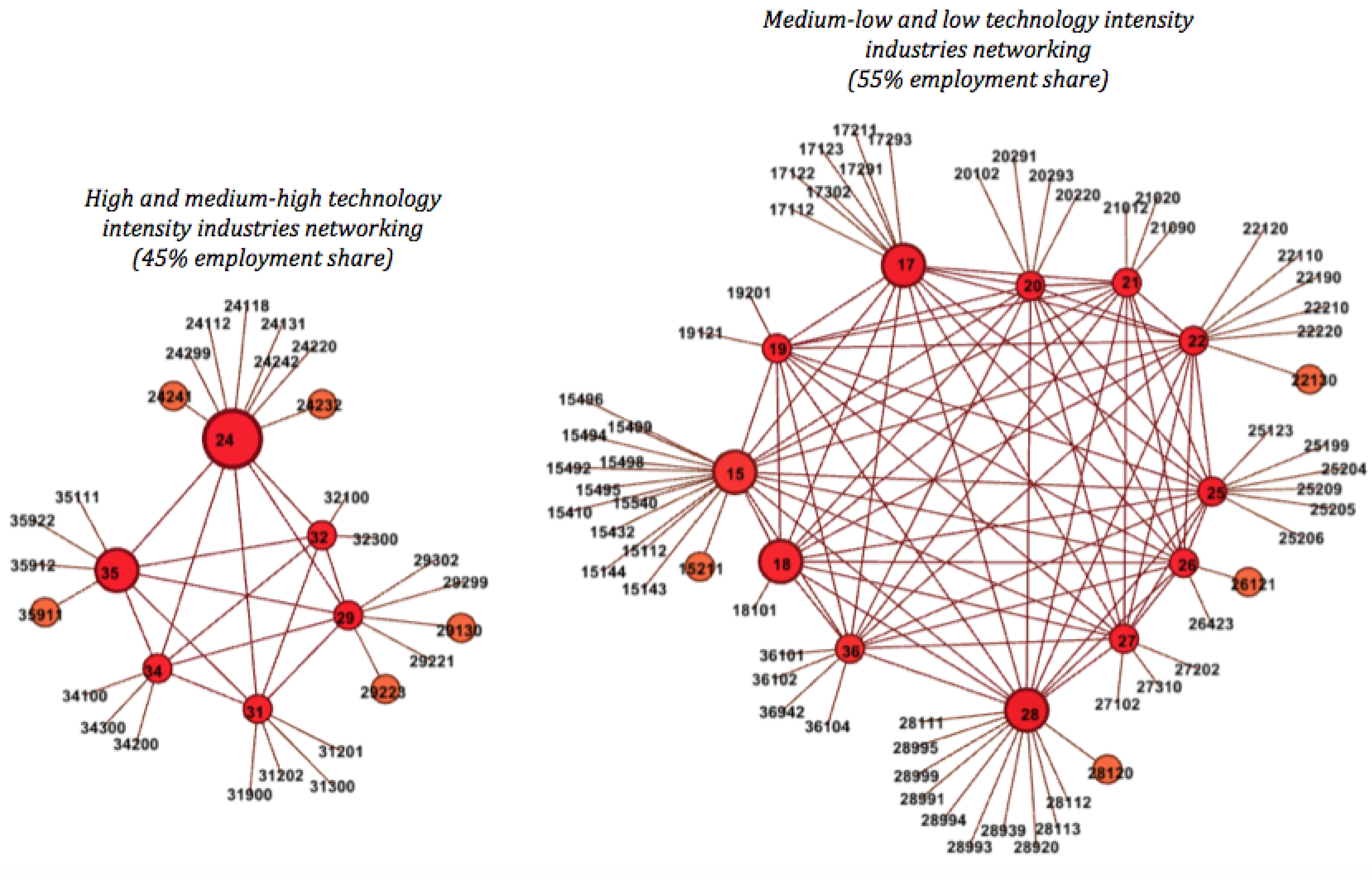

Figure 9.6: Five-digit industrial configuration of Eastern Jakarta in 2000.

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: The red circle indicates the two-digit industry and its dimension indicates the employment share of two-digit sectors in Eastern Jakarta. The orange circle denotes specialized clusters (LQ>1) and its dimension indicates the level of specialization. For the denomination of two-digit and five-digit sectors see Table 6.1 and Appendix 9.1 respectively.

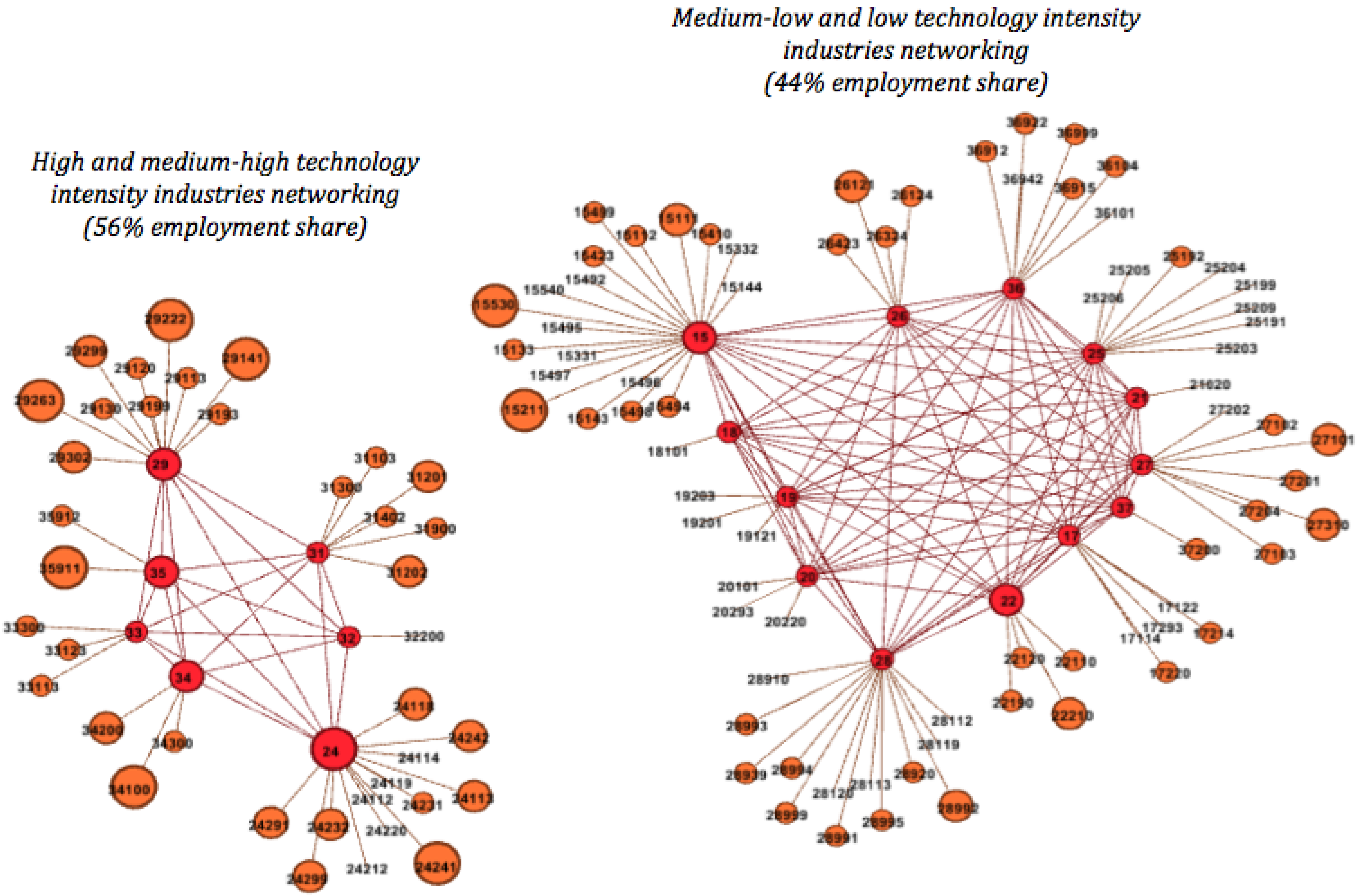

Figure 9.7: Five-digit industrial configuration of Eastern Jakarta in 2009.

Source: Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: The red circle indicates the two-digit industry and its dimension indicates the employment share of two-digit sectors in Eastern Jakarta. The orange circle denotes specialized clusters (LQ>1) and its dimension indicates the level of specialization. For the denomination of two-digit and five-digit sectors see Table 6.1 and Appendix 9.1 respectively.

9.5 Spatial clustering of industrial development

The positive effect of industrial development within locations can spread across their neighbours. With reference to East Jakarta, its industrial development can principally influence sectors and their relatedness within the cluster JB, which can generate a spatial snowball effects. The same conceptualisation can be also applied to the cluster GSP due to the important role of Surabaya, among other large economic centres. Spatial rebalancing is also an important objective set by the Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025 (MP3EI) aiming to sprawl business activities located within the main economic centres to other less concentrated locations with particular regard to the further development of the Jabodetabek area[50], which generates 60% of national import and export activities (Coordinating Ministry for Economic Affairs et al., 2011).

Looking at Table 9.3, the industrial structures of clusters JB and GSP reflect the country industrial configuration characterised by the prevalent presence of medium-low and low technology intensity industries. However, high and medium-high technology intensity industries increased their importance with particular reference to the cluster JB, which grew by 7% between 2000 and 2009. Almost all two-digit industries substantially increased their specialization and relatedness between 2000 and 2009. The employment of numerous two-digit industries decreased though the value added of all two-digit industries increased with an exception of the publishing, printing and reproduction of recorded media (22 code) within the cluster GSP. The two-digit industries that stand out among all within the cluster JB are the machinery and equipment n.e.c. (29 code), and the office, accounting and computing machinery (30 code) industries, which witnessed an increase of employment of more than 10% and 20% respectively, and their value added expanded by almost 25% and 45% respectively between 2000 and 2009. The former activity has been also identified as one of the most important industry to enhance manufacturing growth in Eastern Jakarta, which can also generate spatial synergies within the cluster JB. With regard to the cluster GSP, the coal, refined petroleum products and nuclear fuel (23 code), the radio, television and communication equipment and apparatus (31 code) had a remarkable growth in terms of employment and value added. It is notable that the publishing, printing and reproduction of recorded media (22 code) industry within the cluster GSP witnessed the highest reduction of employment and value added, though the same industry had an opposite performance within the cluster JB with particular reference to value added.

Given the persistent spatial patterns in Java, policymakers should elaborate initiatives to pursue regional manufacturing development taking into account for the spatial economic interaction and sprawl across places. In the case

50. The Jabodetabek area covers three provinces (DKI Jakarta, Banten and West Java) and 12 regencies and cities, where the cluster JB belongs to this important area for the national industrial development in Indonesia.

of Eastern Jakarta, the economic activities identified as drivers for its future development substantially grew in the cluster JB, thus, spatial synergies can be exploited. In particular, the numerous high and medium-high technology intensity industries identified in Eastern Jakarta can be especially beneficial for the future development of surrounding locations within the cluster JB increasing manufacturing diversification and growth. However, regional policies require the development of coherent and coordinate initiatives within the national and local policy framework to increase their effectiveness on regional industrial development. Figure 9.8 shows the bivariate of local Moran's I of specialisation (LQ) in 2000 and the spatial lag of related variety (RV) in 2009, and high and medium-high technology intensity related industry ($RVHMH$) in 2000 and the spatial lag of general variety ($VARIETY$) in 2009. This allows to detect if agglomeration externalities within a location at the initial time (2000) can be considered as sources for the generation of other agglomeration externalities in the contiguity locations in 2009. Clusters JB and GSP became more specialised accompanied by an increase of relatedness. Despite this, five-digit specialisation in 2000 within locations does not affect the development of related variety within their neighbours in 2009 showing few hotspots, and the Moran's I is denoted by negative coefficient of 0.23[51]. Numerous low-high values are identified in Java, and high-low values in locations outside Java. This can be interpreted as places characterised by low specialisation in 2000 are surrounded by high value locations of related variety in 2009 within Java, and vice versa for places outside Java.

The present work highlighted the importance of the development of high and medium-high technology intensity industries for manufacturing revitalisation in Indonesia, which increase industrial diversification, productivity, innovation, and the formation of human capital. This can be also beneficial for their unrelated industries since innovation can also be adopted by medium-low and low technology intensity industries, which underpin their competitiveness and growth. It is also argued that the current industrial changes towards knowledge-based productions within large economic centres can lead to manufacturing transformation and revitalisation in the country. Considering the bivariate of local Moran's I of high and medium-high technology intensity related industries ($RVHMH$) in 2000 and the spatial lag of general variety ($VARIETY$) in 2009 (see Figure 9.8), it shows a positive spatial autocorrelation between these two variables with a relative high Moran's I coefficient of 0.43. This can be interpreted as high and medium-high technology intensity related industries can generate the industrial development of locations nearby, where 23 hotspots are identified within the clusters JB and GSP. Although in Figure 9.4 few persistent hotspots were identified for $RVHMH$ within the cluster GSP, numerous high-high value locations are identified within the cluster GSP in Figure 9.8 taking into account for the effect of high and medium-high technology intensity related industries

51. Figure 9.8 reports the bivariate of location quotient in 2000 and the spatial lag of related variety in 2009, other combinations have been employed for the specialisation variable though this does not improve the analysis.

in 2000 on the localisation of general variety within neighbours in 2009. This suggests that knowledge-based production activities can drive the industrial development of locations nearby. In addition, it is interesting to note that adopting a dynamic time frame, the numerous hotspots identified in Figure 9.8 are the results of historical spatial interactions among locations. Since considering $RVHMH$ in 2000 and the spatial lag of $VARIETY$ in the subsequently years (2001, 2002, 2003, until 2009), it emerges few hotspots in the early years, which are formed around large economic centres (e.g. Jakarta, Surabaya), and they became more numerous over time expanding the industrial development of clusters JB and GSP. Besides this, it is relevant to notice several high-low values around the clusters JB and GSP, which can be considered the future candidates of hotspot locations enlarging the two agglomeration bells.

Table 9.3: Two-digit average annual employment and value added growth, employment share, industrial linkages, and five-digit specialization within the clusters JB and GSP.

	Cluster JB						Cluster GSP					
Two-digit	**LEMPGROWTH**	**LVAGROWTH**	**Share 2000****	**Share change****	**Linkages KBLI 2000 (2009)**	**Five-digit LQ>1 2000 (2009)**	**LEMPGROWTH**	**LVAGROWTH**	**Share 2000****	**Share change****	**Linkages KBLI 2000 (2009)**	**Five-digit LQ>1 2000 (2009)**
15	1.44	12.35	6.62	0.84	241 (300)	18 (145)	1.20	12.19	17.96	0.86	180 (205)	19 (123)
16	N/A*	N/A*	N/A*	0.02	N/A*(6)	N/A* (1)	2.08	8.44	10.22	1.38	15 (21)	3 (10)
17	-6.82	6.32	23.63	-10.96	177 (195)	13 (109)	2.95	8.95	4.03	0.91	50 (76)	4 (33)
18	-0.24	13.27	18.78	-0.58	36 (37)	1 (27)	-4.51	9.20	3.86	-1.44	18 (21)	1 (4)
19	0.45	10.78	9.27	0.29	61 (73)	2 (44)	-6.95	4.43	11.86	-5.89	26 (39)	0 (24)
20	-3.34	4.70	1.64	-0.44	79 (82)	2 (17)	-0.92	13.64	6.86	-0.92	63 (70)	6 (40)
21	1.20	16.42	2.45	0.25	63 (62)	5 (30)	5.40	23.48	3.52	1.86	30 (36)	5 (22)
22	4.59	20.83	1.01	0.50	44 (58)	6 (36)	-10.19	-17.55	3.49	-2.18	20 (20)	3 (11)
23	3.63	11.39	0.10	0.04	12 (13)	4 (11)	10.54	52.62	0.08	0.12	4 (11)	1 (9)
24	2.85	21.93	5.05	1.42	146 (183)	24 (116)	1.80	15.43	5.57	0.59	71 (108)	11 (69)
25	3.64	14.33	5.28	1.98	136 (149)	9 (78)	0.88	16.57	7.85	0.14	56 (64)	2 (29)
26	2.92	14.62	3.33	0.96	84 (124)	13 (75)	4.21	14.95	3.98	1.49	53 (72)	6 (47)
27	-4.13	9.46	1.48	-0.47	46 (49)	6 (26)	-0.74	5.44	2.11	-0.25	23 (31)	1 (16)
28	2.95	11.23	3.14	0.92	154 (180)	14 (109)	0.82	17.51	4.00	0.05	55 (69)	3 (37)
29	10.98	24.72	1.05	1.75	74 (113)	12 (90)	7.75	30.61	0.52	0.46	11 (33)	3 (24)
30	20.29	42.83	0.03	0.13	2 (4)	1 (1)	N/A*	N/A*	N/A*	0.00	N/A* (1)	N/A* (0)
31	2.98	18.56	2.63	0.78	64 (76)	8 (58)	7.55	24.57	0.82	0.70	13 (23)	0 (10)
32	-2.79	4.72	4.42	-1.01	31 (28)	2 (11)	-7.72	10.73	0.93	-0.50	6 (8)	0 (1)
33	16.15	32.01	0.11	0.35	13 (21)	5 (17)	-10.71	3.52	0.23	-0.15	3 (6)	1 (4)
34	6.91	16.10	2.18	1.85	35 (32)	1 (19)	0.69	18.42	1.02	0.00	9 (12)	0 (3)
35	6.51	13.60	1.72	1.34	34 (35)	3 (21)	-6.90	13.52	1.56	-0.77	15 (20)	2 (10)
36	0.13	11.99	6.01	0.01	112 (134)	8 (68)	4.15	15.94	9.35	3.43	61 (74)	1 (40)
37	6.93	20.29	0.06	0.05	7 (17)	1 (9)	4.85	24.34	0.19	0.09	4 (14)	1 (12)
Average	**3.51**	**16.02**	**4.55**	**0.00**	**72 (89)**	**7 (49)**	**0.28**	**14.86**	**4.55**	**0.00**	**34 (47)**	**3 (26)**

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: * the data of 16 code for cluster JB and 30 code for cluster GSP are not present in 2000. ** The share in 2000 and its change between 2000 and 2009 refers to the employment share. The numbers of linkages within KBLI refer to the number of five-digit sector within the respective two-digit code in 2000 and 2009. The five-digit with LQ>1 represents the number of specialized clusters within two-digits sectors in 2000 and 2009. See Table 6.1 for the denomination of two-digit sectors and their technology intensity classification based on OECD (2011).

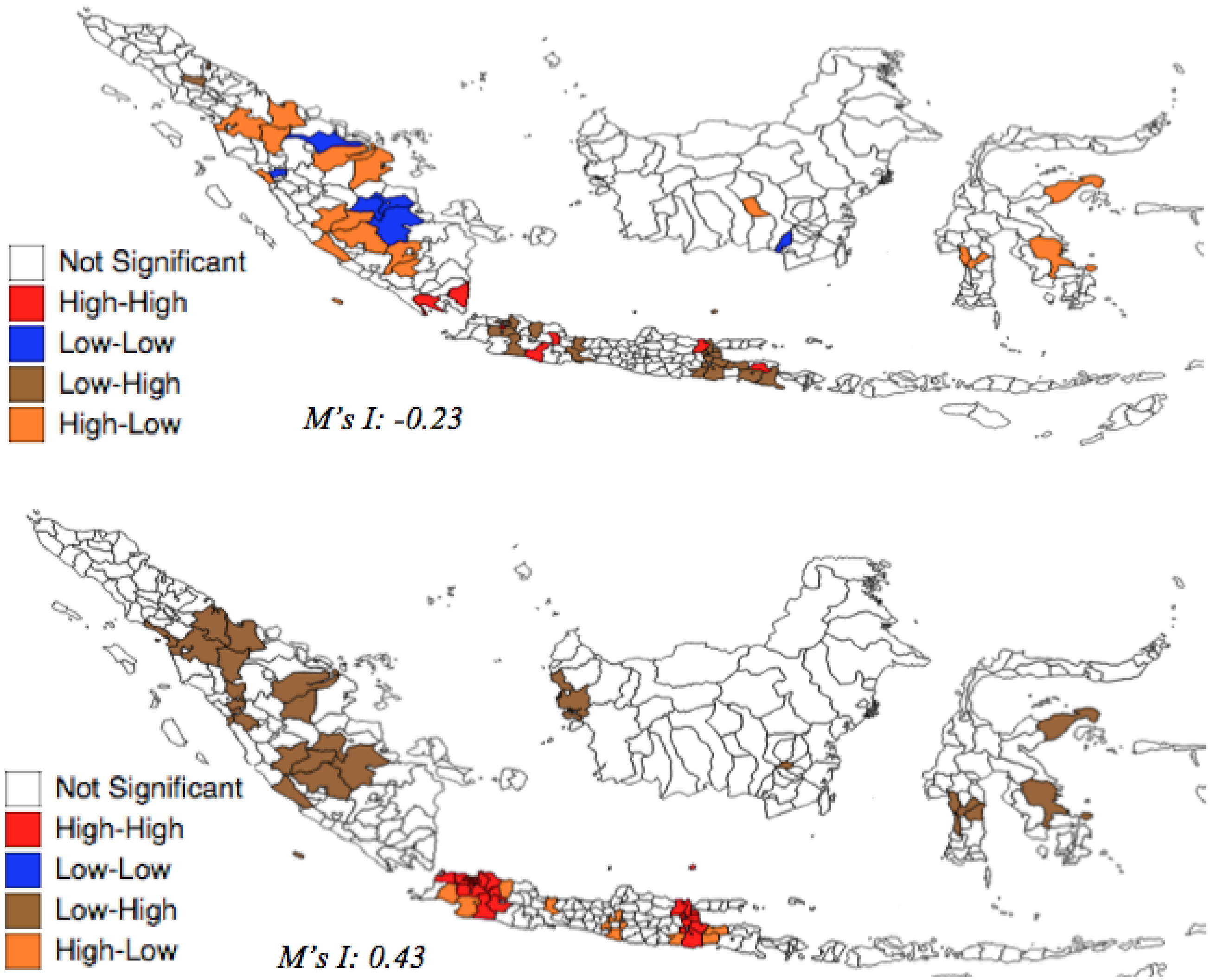

Figure 9.8: Bivariate LISA statistics of LQ in 2000 and the spatial lag of RV in 2009 (top), and $RVHMH$ in 2000 and the spatial lag of $VARIETY$ in 2009 (bottom).

Source: Author's computation based on the large and medium manufacturing enterprises survey. Notes: 14 isolated islands are excluded from the computation. The statistical significant of identified clusters is at 5% level. M's *I* refers to the global Moran's *I*.

9.6 Conclusions

This chapter investigated spatial inequality between locations in and out of Java highlighting the persistent present of hotspots around large economic centres in Java, which determine two agglomeration bells between 2000 and 2009. The industrial configuration of Eastern Jakarta has been used as a case study to unfold the role of key embedded specialised clusters on manufacturing growth. It emerged that two-digit sectors in absence of five-digit specialization witnessed a drastic reduction of employment and value added; and two-digit sectors that experienced an increase of their five-digit specialisation witnessed a remarkable performance with particular regard to value added. Although this supports the conceptualization of MAR externalities (Glaeser et al., 1992), this notion should be extended by the conceptualisation of relatedness in order to increase the competitiveness of clusters, reduce the risk of lock-in effect and weak local resilience. It is observed that numerous two-digit industries that increased their five-digit specialization and their relatedness substantially growth between 2000 and 2009. Since the role of relatedness can amplify localisation externalities through inter-industry knowledge spillover as argued by Jacobs (1969).

The decision of which sector to promote should be also based on industrial portfolio considerations aiming to increase local resilience. For instance, the promotion of the chemicals and chemical products industry (24 code) is not recommended in order to avoid further local unbalanced growth due to its high expansion and contribution to the local structure. However, the predominant role of this industry in Eastern Jakarta contributed to explain the preponderant development of high and medium-high technology intensity industries. Several economic activities are identified for the future industrial development of Eastern Jakarta. Within these industries, five-digit sectors emerged based on their specialisation and relatedness, which can be considered as potential drivers for the growth of their two-digit industries and the overall industrial development. However, the discovering process of key embedded specialised clusters should be extended by an in-depth investigation of their competitiveness in order to fully unfold their potentiality on growth, which allow avoiding decline clusters and/or those that show non-temporary competitiveness weaknesses, even if embedded economic activities.

The preponderant role of knowledge-based production activities is highlighted in Eastern Jakarta, which can lead to the country transformation. Since industrial changes within large economic centres are likely to be spread across locations affecting their industrial development. In particular, the expansion of high and medium-high technology intensity related industries in a location can influence the industrial development across locations due to their high productivity and propensity to innovate, which can be also beneficial for unrelated activities. Considering the initial status (2000) of high and medium-high technology intensity related industries within a location, it is observed that they can affect the future localisation of industries within neighbours. Besides this and considering the two agglomeration bells in Java, policymakers should embrace a spatial prospective in order to develop regional initiatives aiming to exploit spatial industrial synergies with particular reference to the clusters JB and GSP. The development of knowledge-based production activities is highly recommended in Indonesia contributing to industrial diversification and economic growth within and across locations. On the other hand, the selection of labour intensive industries should be carefully assessed in terms of their domestic and international competitiveness. Since these industries witnessed a reduction of their competitive advantages due to the raise of labour costs accompanied by the increase of domestic and international competitions. However currently, manufacturing growth in Indonesia cannot be achieved without a substantial growth of labour-intensity industries, which should be pursued by *ad hoc* initiatives to enhance their competitiveness.

Appendix

9.A Appendix: Sectors of Eastern Jakarta in 2000 and 2009

Table 9.4: Five-digit denominations reported in Figure 9.6 and Figure 9.7

Five-digit sectors	Description	Five-digit sectors	Description
15111	Slaughtering	21012	Cultural papers
15112	Processing and preserving of meat	21020	Boxes made of paper and cardboard
15133	Pulverized fruits and vegetables	21090	Paper products n.e.c
15143	Cooking oil made of coconut oil	22110	Publishing book, brochure, music book and other publication
15144	Cooking oil made of palm oil	22120	Publishing news paper, journal and magazine
15211	Powdered, condensed and preserved milk	22130	Publishing on recorded media
15331	Prepared animal feeds	22190	Other publishing
15332	Concentrate animal feeds	22210	Printing
15410	Bakery products	22220	Supporting service for printing industries
15423	Other kinds of sugar	24112	Basic inorganic chemicals industrial gas
15432	Food made of chocolate and sugar confectionery	24113	Basic inorganic chemicals pigment
15492	Ice cube	24114	Basic inorganic chemicals n.e.c
15494	Tempe	24118	Basic organic chemicals resulting special chemicals
15495	Other food made of soy a bean/other nuts	24119	Basic chemicals n.e.c
15496	All kinds of chip and similar to chips (emping, ceriping, karak, etc)	24131	Synthetic resins
15497	Prepared food spices and food seasoning	24212	Pesticides
15498	Cake, pastry and similar products	24220	Paints, varnishes and lacquers
15499	Other food products	24231	Pharmaceutical preparation
15530	Malt liquors and malt	24232	Drugs and medicines
15540	Soft drink	24241	Soap and cleaning preparations, including tooth paste
17112	Spinning mills	24242	Cosmetics
17114	Weaving mills except gunny and other sacks	24291	Adhesive
17122	Finished textiles	24299	Chemicals n.e.c
17123	Printed textiles	25123	Crumb rubber
17211	Madeup textile article except wearing apparels	25191	Products of rubber for household purposes
17214	Gunny bags	25192	Products of rubber for industrial purposes
17220	Carpets and rugs	25199	Products of rubber n.e.c
17291	Narrow fabric	25203	Plastic records
17293	Embroidery	25204	Household ware (excluding furniture)
17302	Knit wear	25205	Plastics bags, containers
18101	Wearing apparel made of textile (garments)	25206	Products of plastics for technical/industrial purposes
19121	Products of leather and substitutes for personal use	25209	Plastic products n.e.c
19201	Footwear for daily use	26121	Glass products for household purposes
19203	Shoes for industrial purposes	26124	Glass containers
20101	Sawmills	26324	Structural clay product other than brick and tiles
20102	Preserved wood	26423	Other products of cement and lime plaster for constructions
20220	Molding and building components	27101	Iron and steel basic industries
20291	Plaits made of rattan and bamboo	27102	Steel rolling industry
20293	Wood carving except furniture	27103	Metal pipe and pipe fitting

Continued on next page.

Table 9.4: Continued.

Five-digit sectors	Description	Five-digit sectors	Description
27201	Non ferrous metal basic industries	31103	Transformer, rectifier and voltage stabilizers
27202	Non ferrous metal rolling industry	31201	Electric panel and switch gear
27204	Pipes non ferro metal	31202	Electric control apparatus
27310	Iron and steel smelting industry	31300	Electric and telephone cables
28111	Fabricated structural metal products other than aluminum	31402	Electrical accumulator
28112	Fabricated structural aluminum products	31900	Other electrical apparatus and components
28113	Fabricated structural steel products	32100	Electronic valve and tube and other electronic component
28119	Fabricated metal products n.e.c	32200	Communication equipments
28120	Pressure vessel and steel tank	32300	Radio and TV receiver, sound and video recording and associates goods
28910	Forging, pressing, stamping, and roll forming of metal	33113	Medical, dental orthopedic appliance
28920	Supporting services for processing of metal	33123	Electronic instrument and appliance for measuring, navigating and testing
28939	Other tools made of metal	33300	Watches and clocks
28991	Kitchen ware	34100	Motor vehicles
28992	Fixture made of metal, excluding furniture	34200	Motor vehicle bodies
28993	Nail, screw and bolts	34300	Motor vehicle component and apparatus
28994	All kind of metal containers	35111	Ships / boats
28995	Wire and products made of wire	35911	Motorcycles
28999	Products of metal n.e.c	35912	Motorcycle component and apparatus
29113	Components and parts of prime movers	35922	Bicycle and tricycles components
29120	Pump and compressor	36101	Wood furniture
29130	Mechanical power transmission equipment	36102	Rattan and / or bamboo furniture
29141	Non electrical stove and heater for commercial purpose	36104	Metal furniture
29193	Refrigerating machine for commercial purposes	36912	Personal adornment made of precious metal
29199	Other general purpose machine	36915	Non personal adornment made of non precious metal
29221	Machine tools for metal working	36922	Non traditional musical instruments
29222	Machine tools for wood working	36942	Toys
29223	Machine tools for other than metal and wood working	36999	Other manufacturing industries n.e.c
29263	Textile machineries	37200	Recycling of non metal waste and scrap
29299	Other special purpose machinery		
29302	Household with electronic appliances		

Notes: The five-digit codes refer to KBLI 2005 elaborated by BPS, and they are sorted based on the industrial code. Not elsewhere classified is denoted by n.e.c.

10 Conclusions, policy implications, and new research agenda

10.1 Introduction

Diverse outcomes emerged in Chapter 7 and Chapter 8 with regard to, for instance, intra-industry knowledge spillover, population density and human capital. The contradicting findings supporting different theoretical conceptualization are often justified with the use of unlike methodologies, measures, and the level of analysis (i.e. geographical scales and economic aggregations) leading to an inconclusive academic debate of which agglomeration externality is more predominant on growth (Bishop & Gripaios, 2010; Neffke, Henning, Boschma, et al., 2011; Paci & Usai, 1999; Van Oort, 2004). However, the present study employed the same conceptualizations, measures, and levels of analysis (five-digit sectors and firms, cities and regencies) for established activities (Chapter 7) and the overall manufacturing structure (Chapter 8) assuming the dynamic nature of agglomeration externalities between 2000 and 2009. The diverse empirical outcomes are not irreconcilable but they are complementary for the growth of established activities on one side and the overall manufacturing structure on the other side, which can be merged into a unified framework aiming to develop initiatives for manufacturing revitalization in Indonesia. The rest of this chapter is organised as follows. In Section 10.2, the main findings and policy implications are discussed. In Section 10.3, recommendations for manufacturing revitalisation are provided, which are embedded within the current Indonesian policy framework. Finally, limitations and agenda for further research are exposed in Section 10.4.

10.2 Main findings and policy implications

In this section, the main findings are analysed and discussed in terms of the effect of population density, human capital, competition, intra and inter-industry knowledge spillovers, and portfolio diversification for established economic activities that are constantly present in 2000 and 2009, and the overall manufacturing structure considering all firms and sectors from 2000 to 2009.

Competition and specialization. Weak evidence has been found to support the conceptualization of the Darwinian selection and adaptation of economic activities, which can increase the aggregation performance. Competition fosters employment expansion of established sectors within regencies and it reduces their labour productivity indiscriminately by locations. Considering the entire manufacturing structure, competition is not statistically significant for sectors. Looking at firm-level, higher competition slow down firms' growth with an exception for labour productivity within cities (considering the entire manufacturing), which positively influences firms. The negative effect of rivalry on firms' growth lead to smart selection within manufacturing where the less competitive and innovative activities are pushed out of the market, and others characterized by higher competitiveness survived. This inevitably increases the efficiency and performance of their aggregation. Although competition harms firms' growth due to an increase of rivalry for market and factors of productions, public policies should encourage sectoral competition in order to enhance manufacturing competitiveness and efficiency through the selection of firms.

Specialization emerged as a preponderant source for the overall manufacturing expansion, thought it negatively affects the growth of established sectors and firms. These diverse outcomes can be justified since localization externalities are crucial sources for the emergent phase of new activities supporting their genesis and development, and this also increases their likelihood to survive. The localization of firms within the same sector accrues their benefits to produce in proximity such as the availability of labour and more qualified workers, better matching between agents, and learning through knowledge exchange; which increase their propensity to be in the cluster rather than isolated. However, established activities that are already embedded within the cluster and location are more responsive to external complementary knowledge rather than know-how stemming from the same sector. Since their persistent interactions over time within the cluster reduced their diversity making their learning processes less effective. Indonesian policymakers should support specialized clusters characterised by large interconnectedness increasing inter-industry knowledge spillovers within a location, and intra-industry knowledge spillover within a cluster. Since new external complementary know-how can flow within a cluster, which can also lead to the generation of (un)related branches through the recombination and accumulation of interconnected competences. These effects associated with the role of relatedness enhance the competitiveness and growth of clusters as supported by Porter (1990).

Relatedness. Evidence revealed the positive role of relatedness with particular regard to urban centres where the economic proximity is denser than regencies facilitating the establishment of inter-sectoral linkages, and consequently flow of knowledge. The preponderant and positive role of related variety computed based on KBLI 2005, and high and medium-high technology intensity related industries based on OECD's classification (2011) on established activities emerged indiscriminately by locations. In particular, the performance of established activities is boosted by the availability of external related knowledge where the increasing of specialization has a negative effect on their growth. Considering the entire manufacturing, related variety is beneficial for sectoral growth within cities, and it is observed an antithetic influence of high and medium-high, and medium-low and low technology intensity related industries. Medium-low and low technology intensity related industries foster manufacturing expansion indiscriminately by types of locations, which stem from their high localization in the country generating large part of employment and value added within manufacturing. More than two-thirds of manufacturing structure is constituted by ML-L industries making knowledge spillovers highly probable among these industries, though it is expected to be less intense than high and medium-high technology intensity related industries. High and medium-high technology intensity related industries is negatively associated to the development of manufacturing structure (with an exception of employment), though this is confined within regencies. Disaggregating the industrial structure based on technological relatedness (H-MH and ML-L), it is observed that this negative impact is driven by ML-L industries, which are not technologically related. The role of technological relatedness becomes evident disaggregating the industrial structure based on two-digit sectors, since they take advantage to be in places characterised by higher presence of their technological relatedness. Considering employment expansion, high and medium-high technology intensity related industries play a positive role within regencies, which can be conducted to their ability to form human capital favouring spin-off and labour mobility where the pre-existing industrial configuration of regencies affects this process.

This evidence suggests supporting sectors with large intersectoral linkages with particular regard to cities reducing the risks of lock-in effect and lack of economic resilience, which underpin clusters' competitiveness in the view of Porter (1990). New external knowledge can flow across interconnected sectors reinvigorates their know-how enhancing their innovation capabilities, which can also generated a diversification process through the creation of regional branches making a location less exposed to industry-specific circumstances. Recent empirical works support this positive economic role of related variety on growth (see, for instance, Bishop & Gripaios, 2010; Boschma & Iammarino, 2009; Boschma et al., 2012; Frenken et al., 2007; Hartog et al., 2012; Quatraro, 2010). Re-conceptualizing economic variety based on sectoral linkages can provide valuable insights for Indonesian policymakers to support manufacturing growth and its transformation within urban areas and regencies.

Population density and industrial heterogeneity. Population density and industrial diversity go hand in hand in Indonesia where the level of urbanization generated the level of heterogeneous industries due to diverse customers' needs within large local market. This determined antithetic impacts of these two measures between cities and regencies. Cities are characterized by high level of urbanization and economic diversity, and an increase of population and industrial heterogeneity negatively impact the performance of economic activities due to an increase of agglomeration costs. On the other hand, regencies are denoted by low levels of urbanisation and economic diversity though they growth faster than urban areas. Economic activities within regencies take advantage to have larger markets and industrial diversification, which arise agglomeration benefits such as business opportunities where the competition is not tough as in cities, and this reduces industry-specific negative effects steaming from their high specialization.

Although this positive role of unrelated variety is observed for established economic activities and the entire manufacturing structure, the positive impact of population density is confined for established economic activities. Since considering the entire manufacturing, population density negatively impacts firms and sectors indiscriminately by locations. It is observed that the overall manufacturing structure takes advantage of localization externalities rather than urbanization externalities. This can be justified as intra-industry knowledge spillover supports knowledge exchange, which is a crucial element for the emergent phase of new activities rather than the market size. This is underpinned by the argumentation proposed by Henderson (1986) as local development and growth can be explained by intra-industry knowledge spillovers rather than local demand. Although the negative effect of urbanization externalities on the entire manufacturing structure, Indonesian policymakers should encourage population expansion and more economic diversity within regencies creating new urban centres and increasing their resilience to external industry-specific shock. On the other side, policymakers should disincentive further population expansion and economic diversity within cities, where their urban policies should be focused on fostering interconnectivity within the same and across sectors. Technological externalities are more operative in closed proximity rather than within a more dispersed environment, where economic activities within urban areas are more responsive to the role of relatedness rather than a further increase of industrial heterogeneity.

It also interesting to note the decreasing role of unrelated variety when manufacturing structure is disaggregated based on technology intensity and two-digit sectors. Suggesting that the benefits of heterogeneous industrial configurations (resilience and balanced growth) are more operative and detectable at the higher level of aggregation rather than at the lower level. Thus, the impact of economic diversity on growth should be assessed on aggregation since its benefits spread across activities rather than within a specific industry. However, this argumentation is in contrast with the outcomes of Bishop and Gripaios (2010).

Human capital and knowledge-based productions. Human capital increases the performance of established economic activities within cities due to the high demand of skilled workers, which stems from the high presence of technologically advanced industries. They mainly compete on innovation where human capital is a fundamental driver to create and diffuse know-how within and across activities.

By contrast, an increase of skilled workers negatively affects established activities located within regencies characterized by labour-intensive industries, since they demand mainly unqualified workers. The industrial structure in Indonesia can also explain the negative role of human capital on employment considering the entire manufacturing, where the predominant presence of labor-intensive industries undermines the absorption and creation of qualified jobs. Despite this, it emerges that skilled labour play a crucial role for manufacturing development. Locations with higher level of human capital experience higher expansion in terms of value added and labour productivity. Since the presence of skilled workers fosters knowledge transfer, spin-off and the creation of sectoral branches.

Although evidence reveals some negative effects of human capital (e.g. for established activities within regencies and for employment expansion of the entire manufacturing), qualified labour emerges as an important component to support manufacturing transformation towards knowledge-based productions, and more in general, manufacturing competitiveness in Indonesia. Policymakers should strongly support the development of skilled workers in a medium and long run prospective to revitalise manufacturing. However, this also requires policies to support the genesis and development of technologically advanced industries, which can play an important role in the absorption and formation of human capital. This also increases manufacturing resilience and innovation capability, which are currently undermined by the substantial important of few labour-intensive industries within Indonesian manufacturing.

Regional policies in Java Island. Regional policies are particular relevant in Java since economic activities tend to cluster in dense economic places forming two persistent agglomeration bells between 2000 and 2009. Whereas, the economic concentration out of Java does not show significant hotspots in terms of growth and agents' localisation. This dichotomy was mainly due to the less volatility of growth of locations in Java than places out of Java. The persistent agglomeration patterns in Java emerged around large economic centres, and they are spread as "wildfire" over time affecting the industrial development of locations nearby. It is likely to continue on the future enlarging the dimension of these agglomeration bells, which raises the necessity to develop regional policies in order to exploit spatial industrial synergies, and their expansion can generate spatial snowball effects.

The development of high and medium-high technology intensity industries are identified as crucial elements to lead further industrialisation and diversification in Indonesia. This becomes particular relevant within the cluster JB and GSP, since the localisation of high and medium-high technology intensity industries can generate the establishment of (un)related industries within neighbours location. This effect can be explained in terms of their important contributions on productivity, training human capital, and propensity to cluster generating innovations, which can be also adopted by medium-low and low technology intensity industries underpinning their competitiveness. In addition, promoting knowledge-based productions within large economic centres with particular reference to clusters JB and GSP can lead manufacturing transformation in Indonesia due to their capabilities to affect the industrial development of locations nearby. Thus, regional policies are recommended in Java, though this requires designing coherent and coordinate policies within the national and local framework in order to exploit spatial industrial synergies increasing policy effectiveness on regional manufacturing development. Th MP3EI sets regional policies with particular reference to Jabodetabek area for the development of the Java corridor (Coordinating Ministry for Economic Affairs et al., 2011). However, regional initiatives should be extended to the east part of Java referring to the cluster GSP characterised by the persistent presence of numerous hotspots, which can substantially contribute to the development and transformation of manufacturing in Java.

10.3 Policy framework for manufacturing revitalization

The overall findings suggest a series of recommendations to enhance manufacturing competitiveness, and support the genesis and development of knowledge-based production activities within Indonesian cities and regencies. This should be designed and implemented within the current Indonesian policy framework. The policy recommendations are summarised as follows:

- Supporting key embedded specialized clusters indiscriminately by locations that show potential growth and substantial contribution to local manufacturing development.

- Encouraging population growth and industrial diversity within regencies increasing resilience, and discouraging their further expansion within cities reducing the risk of over congestion.

- Underpinning the formation of human capital, and the development of technologically advanced industries indiscriminately by locations, which increases manufacturing resilience, and the absorption and creation of high-qualified jobs.

- Enhancing sectoral rivalry indiscriminately by locations, which increases the overall manufacturing competitiveness in domestic and international contexts through firms' selection.

- Developing regional policies in Java Island with particular regard to the clusters JB and GSP, which allows exploiting spatial industrial development across locations. Especially, promoting regional growth of high and medium-high technology intensity industries leading to manufacturing transformation and industrialisation across locations.

These recommendations can be embedded within recent Indonesian policies (see Chapter 5), which began to prioritize key industries based on cluster and regional approaches recognizing the importance of local specificities and agglomeration externalities as contributors to growth. The more refine and innovative policies strategies were dictated by the negative impact of AFC and the difficulties of Indonesian economy to recover, where manufacturing has seen a significant deceleration (see Chapter 5 and Chapter 6). Manufacturing composition is mainly characterized by labour-intensive industries and a reduction of their competitiveness undermined the overall manufacturing growth generating industrial composition change with particular regard to knowledge-based productions. In this framework conditions, these recommendations can provide important insights to design *tailor made* policies to revitalize manufacturing in Indonesia, which particular regard to the novelty provided by the economic variety sectoral decomposition.

The importance of specialized clusters on growth is highly recognized by scholars and policymakers though the discovering process should be based on their contributions to the local industrial structure rather than merely assessing clusters' potentiality a-context. Since promoting key embedded specialised clusters can reduce the risk of lock-in and increase manufacturing resilience, which are typical drawbacks of highly specialization. Also, inter-industry knowledge spillovers amplify the magnitude of localization economies as argued by Jacobs (1969), and related varieties underpins the competitive advantage and growth of clusters as professed by Porter (1990). Indonesian policymakers should develop initiatives favouring manufacture transformation supporting largely interconnected knowledge-based production activities due to their important role on manufacturing growth within and across locations. Although numerous labour-intensive industries show a drastic reduction of their industrial contributions due to the decline of their competitiveness, currently, manufacturing growth in Indonesia cannot be achieved without a substantial growth of these industries due to their high localization in the country. Thus, it is also recommended to develop initiatives towards key embedded specialised labour-intensive sectors, which need to be accompanied by policies to enhance their competitiveness aiming to avoid rivalry merely based on labour costs.

The discovering process of relatedness highlights two main policymakers' challenges. First, the difficulties to assess a cluster' potentiality since its future success is unpredictable; and the complexity of forecasting is augmented due to the local embeddedness considerations (linkages). This requires a careful evaluation of cluster's contribution to the industrial structure, and monitoring its evolution during the policy implementations. However, policymakers should avoid promoting industries that are not actually (or potentially) connected to the regional configuration, and they should stay away from supporting stagnant and decline clusters (even if regional embedded) that show non-temporary changes in their competitive paradigms and customers' preferences. Second, the definition and identification of cognitive proximity linkages between sectors can be seen as a further problematic issue in order to design *ad-hoc* policies. For instance, this study employs the Indonesian industrial classification and the technology intensity classification (OECD, 2011) though the cognitive proximity between clusters can be defined in a variety of ways such as the same regulatory framework, and the use of the same infrastructures, among others.

Scholars have focused their attention on interconnected variety due to its novelty for growth, though this research argues that the identification of local heterogeneous degree provides as well valuable information for policy strategies. In particular, an increase of industrial heterogeneity within regencies should be favoured, and discouraging it within cities. This can also be applied to population growth due to the diverse urbanization and economic density levels of these two types of administrative units. However, less developed places growth faster than more concentrated environments in terms of population and economic diversity generating new urban centres, which can represent new manufacturing opportunities (see chapter 5). Indonesian policymakers should support the growth of population and economic diversity within less developed locations, where the past urbanization challenges within numerous cities can be used as a lesson to cope with similar related urbanization issues within new business centres. This become particular relevant considering that Indonesia did not gain from urban development as much as other Asian countries characterized by similar urbanization tendencies (World Bank, 2012). Instead, public policies should foster connectivity within urban places rather than a further expansion of population and economic diversity in order to reduce the risk of over congestion and more in general agglomeration costs.

In this context where inter and intra-industry knowledge spillovers emerge as crucial drivers to revitalize Indonesian manufacturing, the development of human capital come to light as an essential element to build a conductive innovation environment. However, the substantial importance of few labour-intensive industries constrained knowledge spillover, high-qualified jobs creation, and manufacturing resilience explaining the current negative manufacturing trajectory. Supporting human capital, public policies should also encourage the development of more advanced technological industries, which can absorb and form skilled workers, and this also increases manufacturing resilience. Although recent policies in Indonesia aim to support critical drivers for manufacturing growth such as innovation, human capital and spatial inequalities, it emerges that the Indonesian Government should increase its efforts on research and development activities in terms of public and private expenditures, and the number of researchers employed, which can foster innovation capabilities and the localization of more technologically advanced industries. The overall policy recommendations can allow regaining manufacturing competitiveness of traditional sectors, and supporting manufacturing mutation towards more technology intensity industries in order to revitalise manufacturing. This is particular relevant considering that the country aims to become a high-income nation, the world's 10th economy by 2025, and the 6th largest economy by 2050 as targeted by the Master Plan for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025 (MP3EI), which cannot be achieved without a substantial growth of manufacturing.

10.4 Limitations and agenda for further research

Six main shortcomings of the present work can be identified. First, the present study assessed the influence of agglomeration externalities discriminating cities and regencies in order to infer more accurately within these two diverse administrative units. Since their agents' localization heterogeneity generate agglomeration externalities differentials, which determine diverse performance of their localized economic activities. The antithetic influence (e.g.population density and unrelated variety) between cities and regencies could not be captured considering the entire country leading to erroneous policy design. However, employing a smaller geographical scale (e.g. villages) might lead to diverse results. Since the level of aggregation matter in leading to diverse results, where the most disaggregated level generates the most consistent economic theories. Second, this research measured industrial relatedness based on the Indonesia industrial classification (KBLI 2005) and the technology intensity classification (OECD, 2011) without considering other possible elements that might capture sectoral interconnectedness such as common regulatory frameworks, the use of the same infrastructures and sources, among others. Employing alternative classifications, the relatedness and industrial heterogeneous degrees of locations can substantially change leading to diverse policy implications.

Third, the impact of agglomeration economies on manufacturing growth is tested without considering different stages of sectors and firms' life cycles. Since agglomeration forces may have diverse roles based on their development phases as argued by Neffke, Henning, Boschma, et al. (2011). Industries absorb and respond differently to agglomeration externalities based on their stage of life cycle due to changes of their needs over time in terms of competition, innovation intensity, and learning process. Fourth, spatial econometric techniques can be employed in order to take into account for spatial autocorrelation with particular regard at the location level. Since disaggregating the industrial structure based on two-digit sectors, spatial autocorrelation is substantially reduced making the spatial parameters non significant. Fifth, the discovering of key embedded specialised clusters should be further addressed by an in-depth investigation of sectoral competitiveness in order to fully unfold their potentiality of growth. Since this allows avoiding sectors that are destined to fail showing non-temporary competitiveness weaknesses. Sixth, it emerged that densely locations in Java experienced less volatility than less concentrated locations outside Java. Thus, the role of (un)rleated variety on local stability should be further tested, which can be conducted, for instance, in the fashion proposed by Essletzbichler (2007) assessing the variance of annual regional employment growth rates, as a measured for stability/volatility (interpreted as opposite concepts), on agglomeration externalities. These shortcomings represent directions for the extension of the present study.

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