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MEASURING EFFICIENCY CONVERGENCE IN ISLAMIC AND CONVENTIONAL BANKS: CROSS-COUNTRY EVIDENCE

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Overview

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1. Introduction
2. Literature review
3. Methodology
4. Sample data and models
5. Results
6. Conclusion

Introduction
What is efficiency convergence?

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- We borrow concepts from the economic growth literature
- β-convergence: is growth in efficiency between periods $t-1$ and t related to efficiency in period $t-1$?
- *Absolute* β-convergence assumes each bank is moving towards the same steady state efficiency
- *Conditional* β-convergence assumes each bank converges to its own steady-state efficiency level which is conditional on differences in initial characteristics

Introduction
What is efficiency convergence?

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- σ-convergence: how does dispersion in efficiency amongst banks change over time?
- If β-convergence measures real convergence (rather than being the result of measurement errors and random shocks) then it must coincide with σ-convergence (Fung 2006)

Introduction
Why are bank efficiency and convergence interesting?

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Micro-level

- Efficiency studies provide benchmarking information which bank managers and policy-makers can use
- Evidence of significant efficiency gap between IBs & CBs
- Competitive advantage: firm-efficiency view within resource-based theory argues that efficiency differences can cause differences in profitability
- In a competitive framework efficiency convergence should ensure that efficiency gaps are removed
- BUT uncertain imitability might lead to differences in convergence and steady state efficiency

Introduction
Why are bank efficiency and convergence interesting?

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Macro-level

- Bank sector efficiency is related to economic growth
- Islamic banking typically has a large share of the banking sector in countries which are developing
- Evidence that IBs have significant lower levels of efficiency than CBs (for example, Johnes *et al* 2014)
- Financial integration likely to increase worldwide through common regulatory frameworks, trade and monetary unions and ever-increasing global banking presence
- Increasing financial and economic integration should lead to bank efficiency convergence

Introduction
Purpose of paper

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- *Do Islamic and conventional banks have different **steady state efficiency** levels?*
- *Do Islamic and conventional banks have different **rates of efficiency convergence**?*
- **First stage**: obtain efficiency scores using an output distance function (ODF) estimated using SFA
- **Second stage**: estimate a conditional β-convergence model using a) pooled OLS; b) RE; c) System-GMM two-step; and d) a random parameter model (RPM)
- **Third stage**: use classification trees to identify clubs of banks based on efficiency steady state and convergence

Introduction
Contribution of paper

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- First study to examine and compare efficiency dynamics (i.e. efficiency steady states and convergence rates) in Islamic and conventional banks.
- The random parameter model in the second stage is novel in this context and allows for increased heterogeneity in the efficiency steady states and convergence rates across banks.
- Country classification of the two bank types by efficiency convergence and steady state efficiency. Thus we answer the fundamental question as to whether the Islamic and conventional banking models do really differ.

Literature review
Efficiency

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- Vast literature looking at bank efficiency
- In IB context there are mixed findings:
  - No significant difference between IBs and CBs (El-Gamal & Inanoglu 2005; Grigorian & Manole 2005; Mokhtar *et al* 2006; Bader 2008; Mohamad *et al* 2008; Hassan *et al* 2009)
  - IBs are significantly more efficient than CBs (Al-Jarrah & Molyneux 2006; Al-Muharrami 2008; Olson & Zoubi 2008)
  - IBs are significantly less efficient than CBs (Mokhtar et al 2007; Abdul-Majid *et al* 2008; Mokhtar *et al* 2008; Abdul-Majid *et al* 2010; Srairi 2010; Abdul-Majid *et al* 2011a; 2011b; Kamaruding *et al* 2014; Mobarek & Kalonov 2014)

Literature review
Empirical evidence

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- No study of banking efficiency convergence in IB context
- Estimates of β:
  - EU: from -0.37 (1993-2003) to -0.85 (2004-2010) (Casu & Girardone 2010; Weill 2009; Andries & Capraru 2014)
  - USA: -0.55 (Fung 2006)
  - Indonesia: from -0.82 to -1.83 depending on the examined period (Zhang & Matthews 2012)
- Mix of DEA and SFA to estimate efficiency
- Classification trees used in banking context (Durlauf & Johnson1995; Emrounzejad & Anouze 2010)
- Little interest in estimate of steady state efficiency

Methodology
First stage: theoretical measurement of banking efficiency

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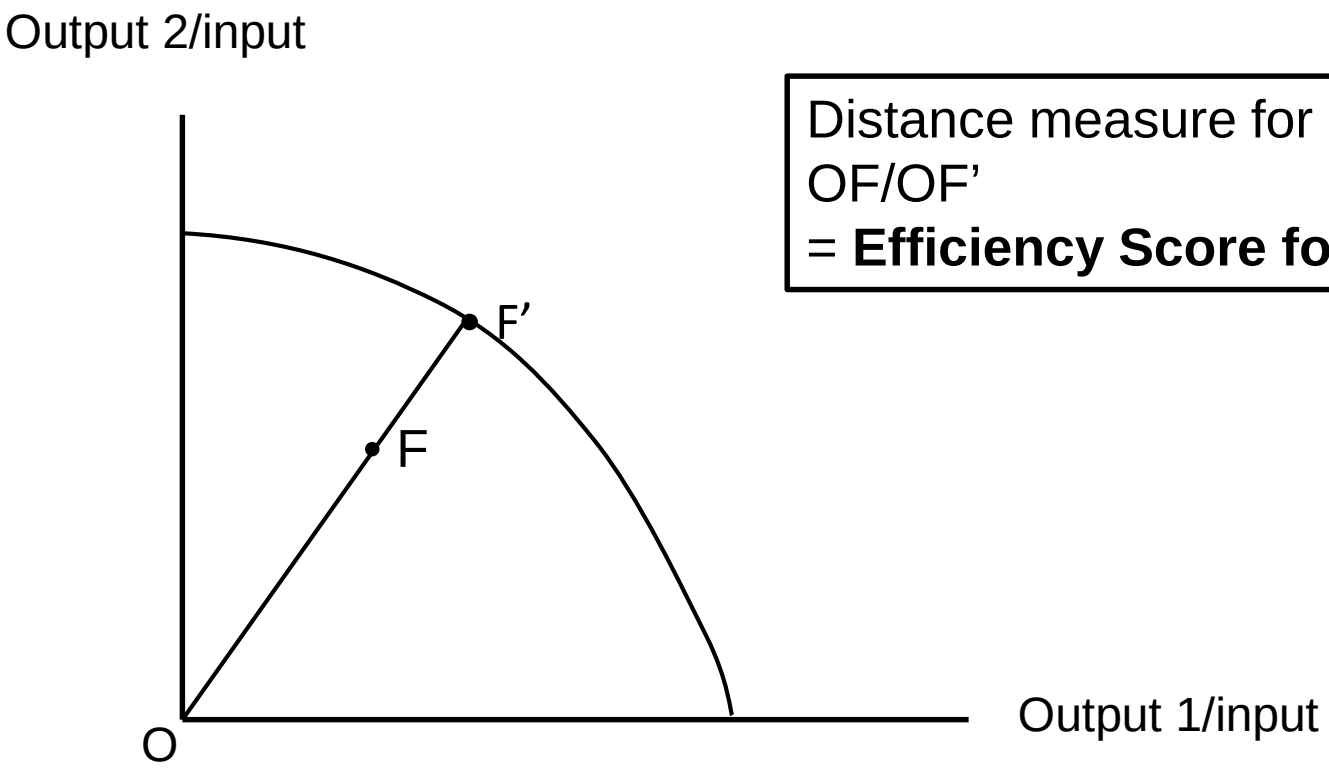

Distance measure for bank F is OF/OF'
= **Efficiency Score for bank F**

Methodology
First stage: empirical estimation of banking efficiency

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- We use a translog output distance function as follows
- Assume N HEIs using inputs x_k $(k = 1, \dots, K)$ to produce outputs y_m $(m = 1, \dots, M)$:

$$\ln D_{it}(x, y) = \alpha_0 + \sum_{m=1}^{M} \alpha_m \ln y_{mit} + \frac{1}{2} \sum_{m=1}^{M} \sum_{n=1}^{M} \alpha_{mm} \ln y_{mit} \ln y_{nit} + \sum_{k=1}^{K} \beta_k \ln x_{kit} + \frac{1}{2} \sum_{k=1}^{K} \sum_{l=1}^{K} \beta_{kl} \ln x_{kit} \ln x_{lit} + \sum_{k=1}^{K} \sum_{m=1}^{M} \delta_{km} \ln x_{kit} \ln y_{mit}$$

$$i = 1,2, \dots, N$$

- We assume: a) homogeneity of degree +1 in outputs
  b) symmetry

Methodology
First stage: empirical estimation of banking efficiency

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$$-\ln y_{Mit} = \alpha_0 + \sum_{m=1}^{M-1} \alpha_m \ln\left(\frac{y_{mit}}{y_{Mit}}\right) + \frac{1}{2}\sum_{m=1}^{M-1}\sum_{n=1}^{M-1} \alpha_{mn} \ln\left(\frac{y_{mit}}{y_{Mit}}\right) \ln\left(\frac{y_{nit}}{y_{Mit}}\right) +$$
$$\sum_{k=1}^{K} \beta_k \ln x_{kit} + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K} \beta_{kl} \ln x_{kit} \ln x_{lit} + \sum_{k=1}^{K}\sum_{m=1}^{M-1} \delta_{km} \ln x_{kit} \ln\left(\frac{y_{mit}}{y_{Mit}}\right) + \varepsilon_{it}$$
$$i = 1,2,\ldots,N$$

- Where $\varepsilon_{it} = -\ln D_{it}(x, y)$
- SFA assumes $\varepsilon_{it} = v_{it} - u_{it}$ where $v_{it} \sim N(0, \sigma_v^2)$ and $u_{it} \sim N^+(\mu, \sigma^2)$

Methodology
Second stage: Convergence

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Absolute β-convergence

- **Model 1**: $\ln(u_{i,t}) - \ln(u_{i,t-1}) = \alpha + \beta \ln(u_{i,t-1})$

Conditional β-convergence

- **Model 2**: $\ln(u_{i,t}) - \ln(u_{i,t-1}) = \alpha + \beta \ln(u_{i,t-1}) + \gamma \mathrm{TYPE}_{i,t} + \delta \mathrm{TYPE} * \ln(u_{i,t-1}) + \varepsilon_{i,t}$
- **Model 3**:As Model 2 but with country shift and slope dummies and year dummies

Methodology
Second stage: Convergence

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Conditional β-convergence

- For robustness, we use a variety of estimation methods for models 1 to 3 including OLS, RE and system-GMM

Model 4: $\ln(u_{i,t}) - \ln(u_{i,t-1}) = \alpha_i + \beta_i \ln(u_{i,t-1}) + \varepsilon_{i,t}$

- The parameter β *varies for each bank* in the sample. Thus *each bank has a different rate of convergence*
- It is therefore possible to examine differences between banks in the β parameter
- The parameter α *varies for each bank* in the sample and so allows *each bank* to converge *to a different steady state efficiency*.

Methodology
Second stage: Convergence

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- $\beta < 0$ => efficiency convergence
- $\beta > 0$ => efficiency divergence
- The larger is $|\beta|$ the faster the speed of convergence (or divergence)
  Models 1 to 3:
- If $\gamma \neq 0$ then Islamic and conventional banks have different steady states
- If $\delta \neq 0$ then Islamic and conventional banks have different convergence rates

Methodology
Second stage: Convergence

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- In order to be sure that the β-coefficient signifies real convergence (rather than regression towards the mean) it must coincide with significant σ-convergence (Fung 2006)
- We estimate σ-convergence as follows:
  $\Delta w_{i,t} = \gamma + \sigma w_{i,t-1} + \varepsilon_{i,t}$
- Where $w_{i,t} = \ln(u_{i,t}) - \ln(\bar{u}_t)$ and $\Delta w_{i,t} = w_{i,t} - w_{i,t-1}$

Methodology
Third stage: Classification trees

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- We use non-parametric classification tree methodology to identify groups of banking sectors (by country) with similar α or β as estimated by RPM
- We use classification trees to predict α (β) using control variables (here: banking business model and country); the starting point is that all banks belong to one group
- Classification trees differ from the parametric regression trees approach: in the latter both the number of potential groups and the membership are governed by the algorithm; in the former, the number of groups is pre-defined and only membership is determined by the algorithm

Sample data and models

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- 1999 to 2014
- Unbalanced panel of IBs and CBs (4864 observations)
- Of which 1089 IBs and 3775 CBs
- 23 countries: United Arab Emirates, Bangladesh, Bahrain, Brunei, Egypt, Indonesia, Iran, Jordan, Kuwait, Lebanon, Mauritania, Malaysia, Oman, Philippines, Pakistan, Qatar, Saudi Arabia, Sudan, Singapore, Syria, Tunisia, Turkey, and Yemen
- Results are computed with and without winsorising at 1st and 99th percentiles; results reported here are without winsorising

Sample data and models
First stage: SFA model

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- Intermediation approach

Outputs:

- Total loans ($y1$)
- Other earning assets ($y2$)

Inputs

- Fixed assets ($x1$)
- General and administrative expenses ($x2$)
- Equity ($x3$)
- Deposits and short-term funding ($x4$)

All variables are in real values (based to 2005)

Sample data and models
Descriptive statistics

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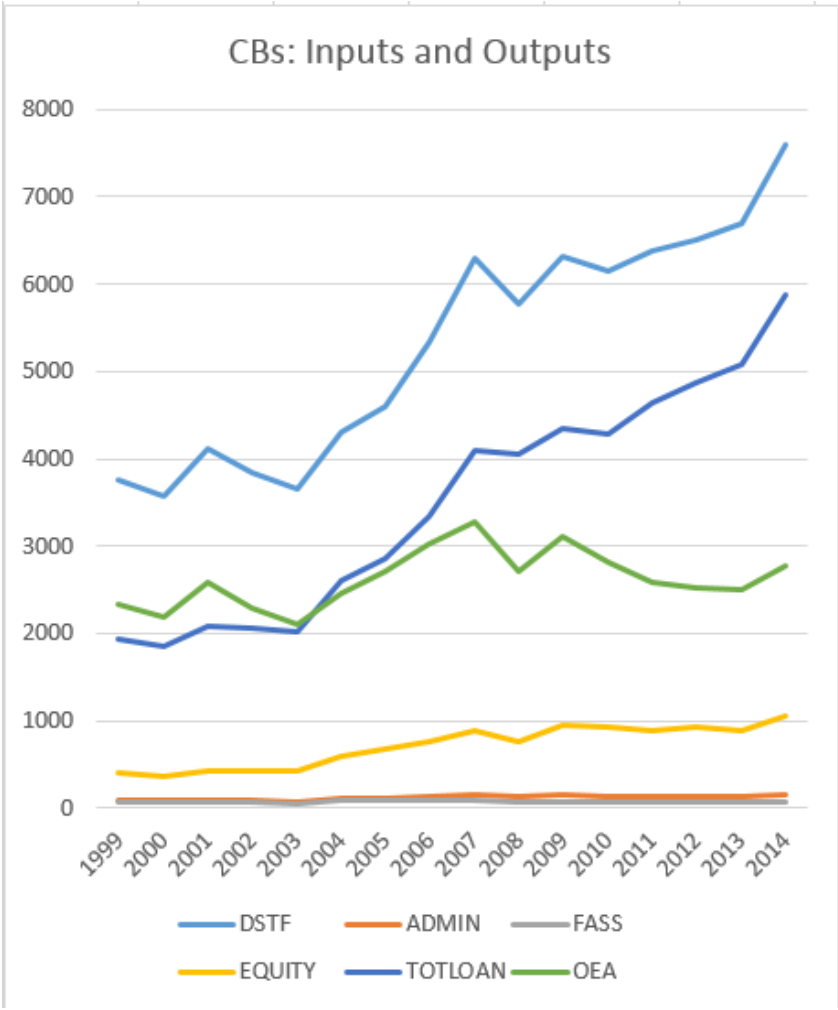

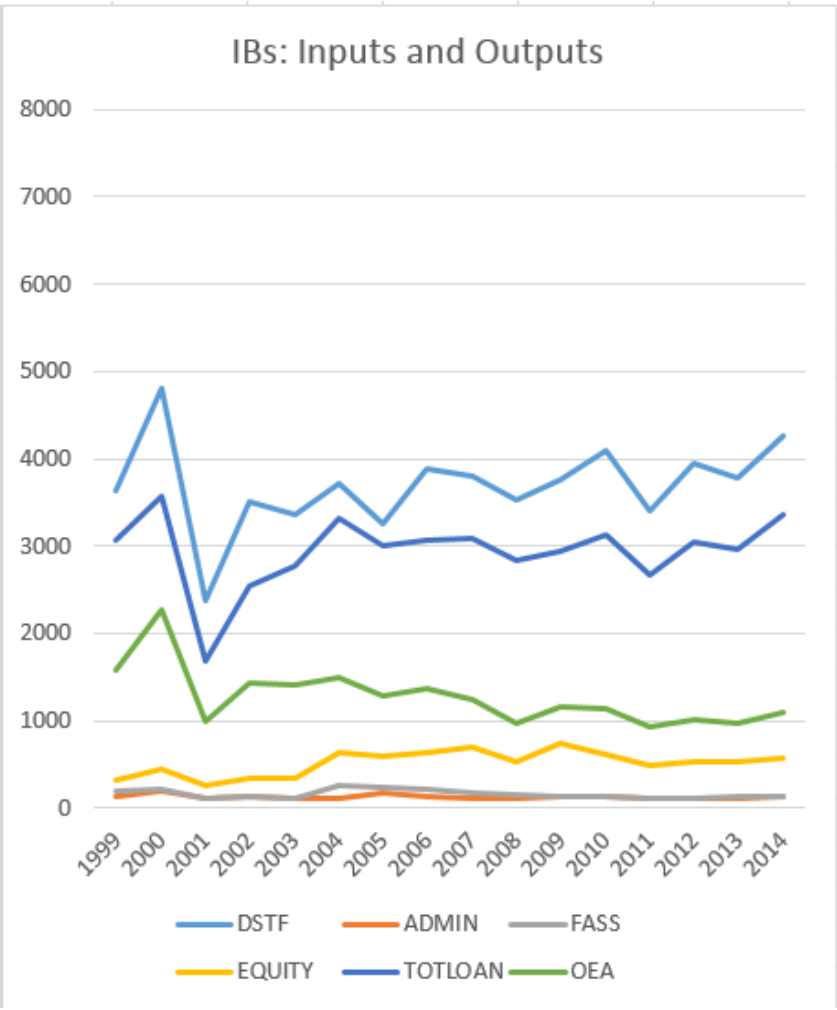

Sample data and models

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First stage: translog SFA model

- $-\ln y_{2it} = \alpha_0 + \alpha_1 \ln\left(\frac{y_{1it}}{y_{2it}}\right) + \frac{1}{2}\alpha_{11} \ln\left(\frac{y_{1it}}{y_{2it}}\right) \ln\left(\frac{y_{1it}}{y_{2it}}\right) + \sum_{k=1}^{4} \beta_k \ln x_{kit} + \frac{1}{2}\sum_{k=1}^{4}\sum_{l=1}^{4} \beta_{kl} \ln x_{kit} \ln x_{lit} + \sum_{k=1}^{4} \delta_{k1} \ln(x_{kit}) \ln\left(\frac{y_{1it}}{y_{2it}}\right) + v_{it} - u_{it}$

- $i = 1,2, \ldots, N$

- The numeraire is y_2 = Other earning assets

Results
Mean efficiencies over time

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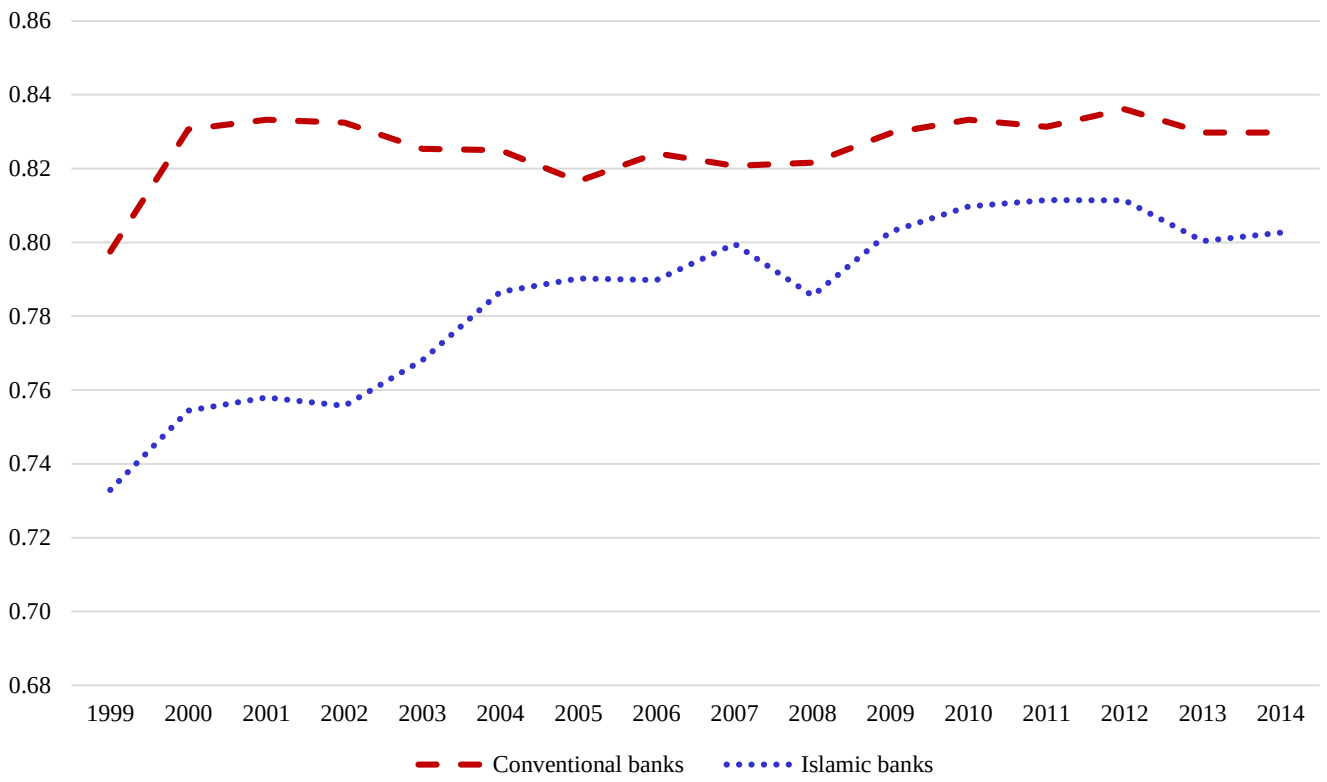

Results
Second stage: convergence

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Method	RE robust			System-GMM two-step robust		
	Absolute β-convergence	Conditional β-convergence	Conditional β-convergence	Absolute β-convergence	Conditional β-convergence	Conditional β-convergence
β coefficient	-0.363	-0.378	-0.402	-0.442	-0.473	-0.489
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.606)
TYPE		-0.010	-0.019		-0.006	0.015
		(0.415)	(0.210)		(0.806)	(0.831)
TYPE $\times \ln(u_{i,t-1})$		0.020	-0.014		0.059	0.161
		(0.742)	(0.850)		(0.646)	(0.612)
Constant	-0.071	-0.070	-0.070	-0.082	-0.086	-0.088
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.611)
Country shift dummies	No	No	Yes	No	No	Yes
Year shift dummies	No	No	Yes	No	No	Yes
Country slope dummies	No	No	Yes	No	No	Yes
Year slope dummies	No	No	No	No	No	No
m1 p-value				0.000	0.000	0.000
m2 p-value				0.533	0.507	0.465
Sargan/Hansen p-value				0.092	0.194	0.574
R^2	0.205	0.209	0.256			

Results
Steady state efficiency by country

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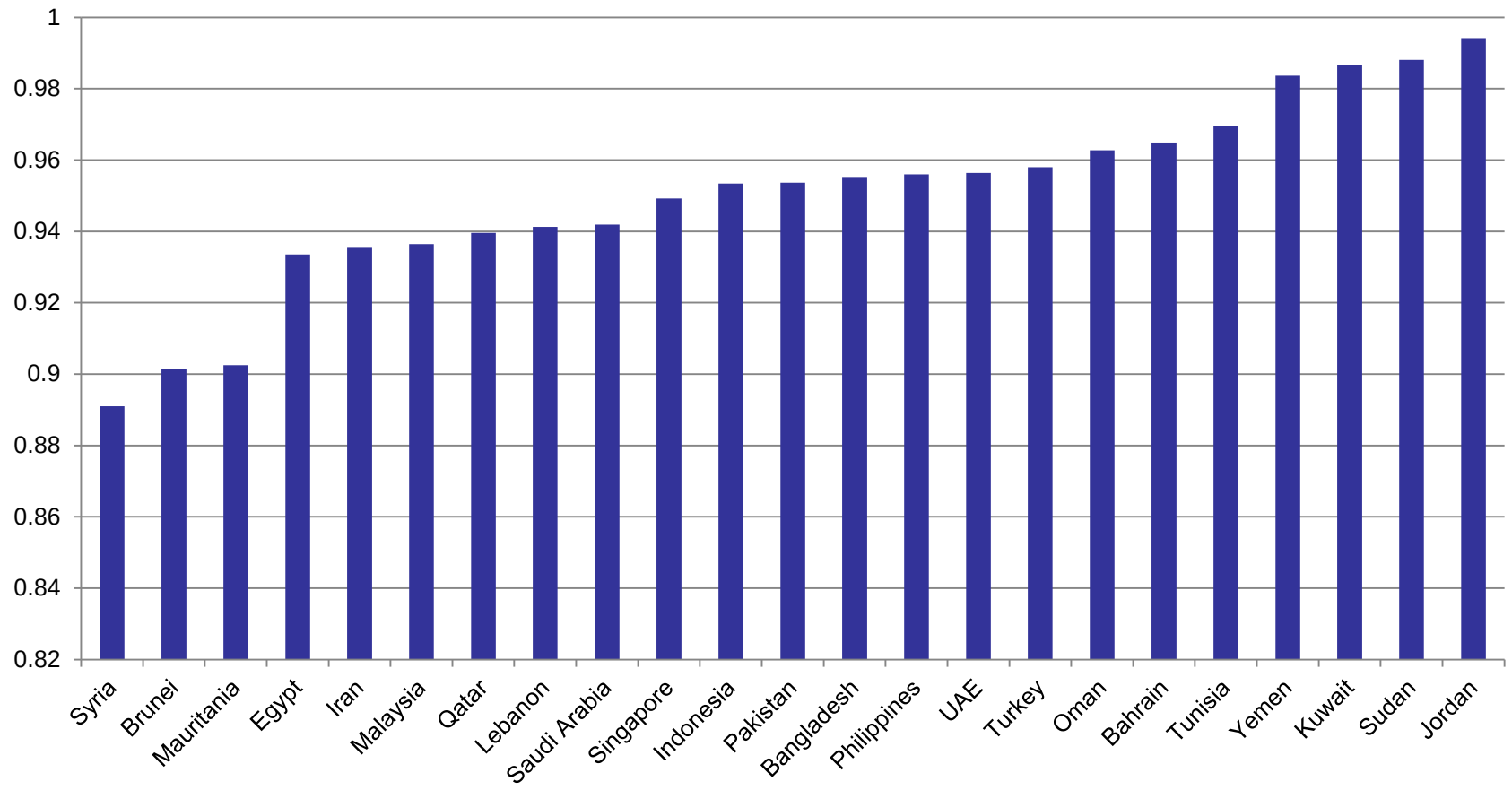

Results
Efficiency convergence by country

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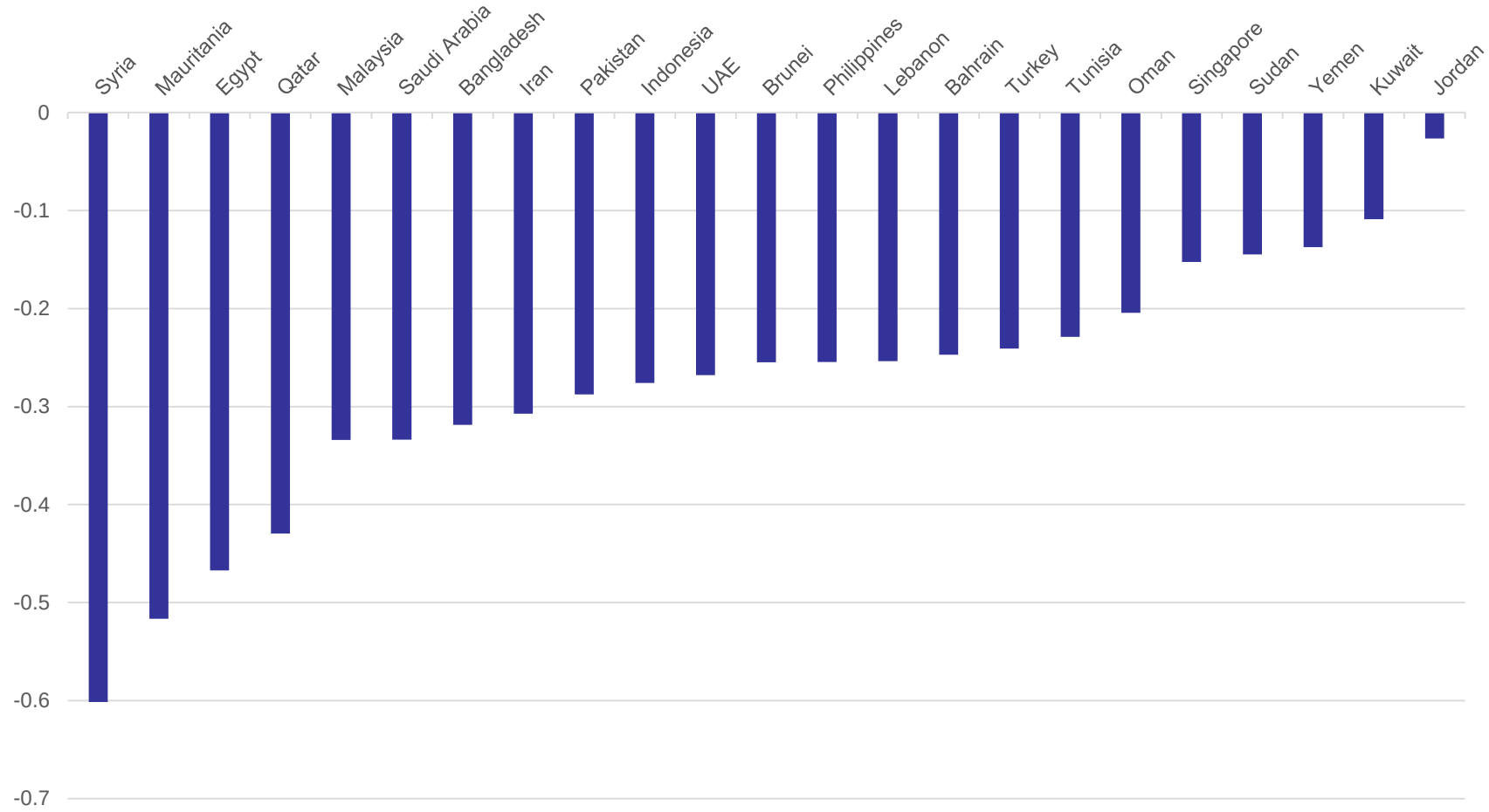

Results
Steady state efficiency over time

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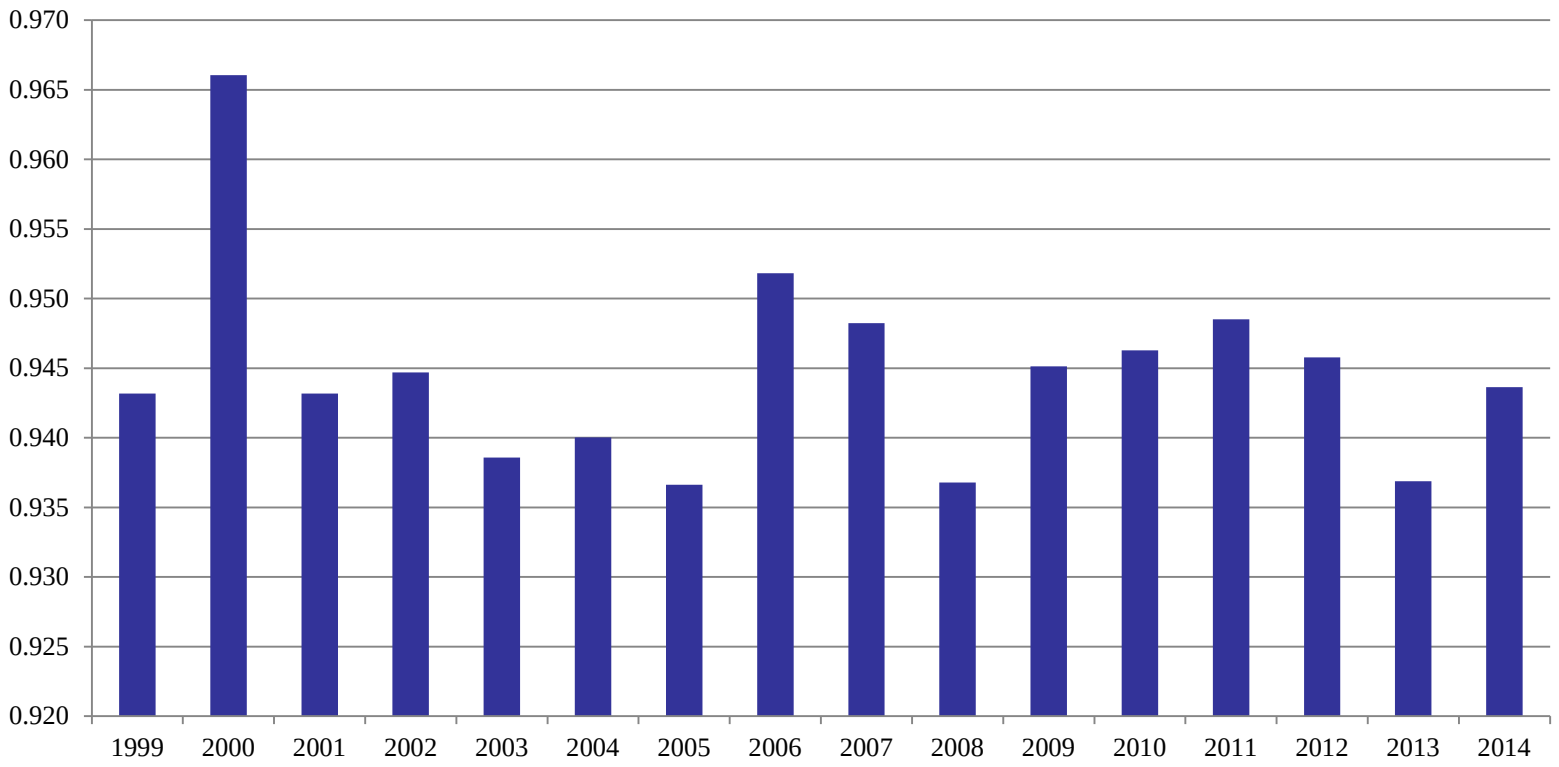

Results
Second stage: RPM convergence

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	All
β	-0.554 (0.000)
α	-0.105 (0.000)
N	3955
No of groups	436
Chi-sq	315.47 (0.000)

Results
Second stage: RPM convergence

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	All	Islamic	Conventional	p-value
β	-0.554 (0.000)	-0.525	-0.564	0.209
α	-0.105 (0.000)	-0.112	-0.102	0.175
N	3955	84	304	
No of groups	436			
Chi-sq	315.47 (0.000)			

The p-value column reports the results of the Wald tests for the equality of the convergence rates (β) and steady states (α) between Islamic and conventional banks.

Results
Classification trees

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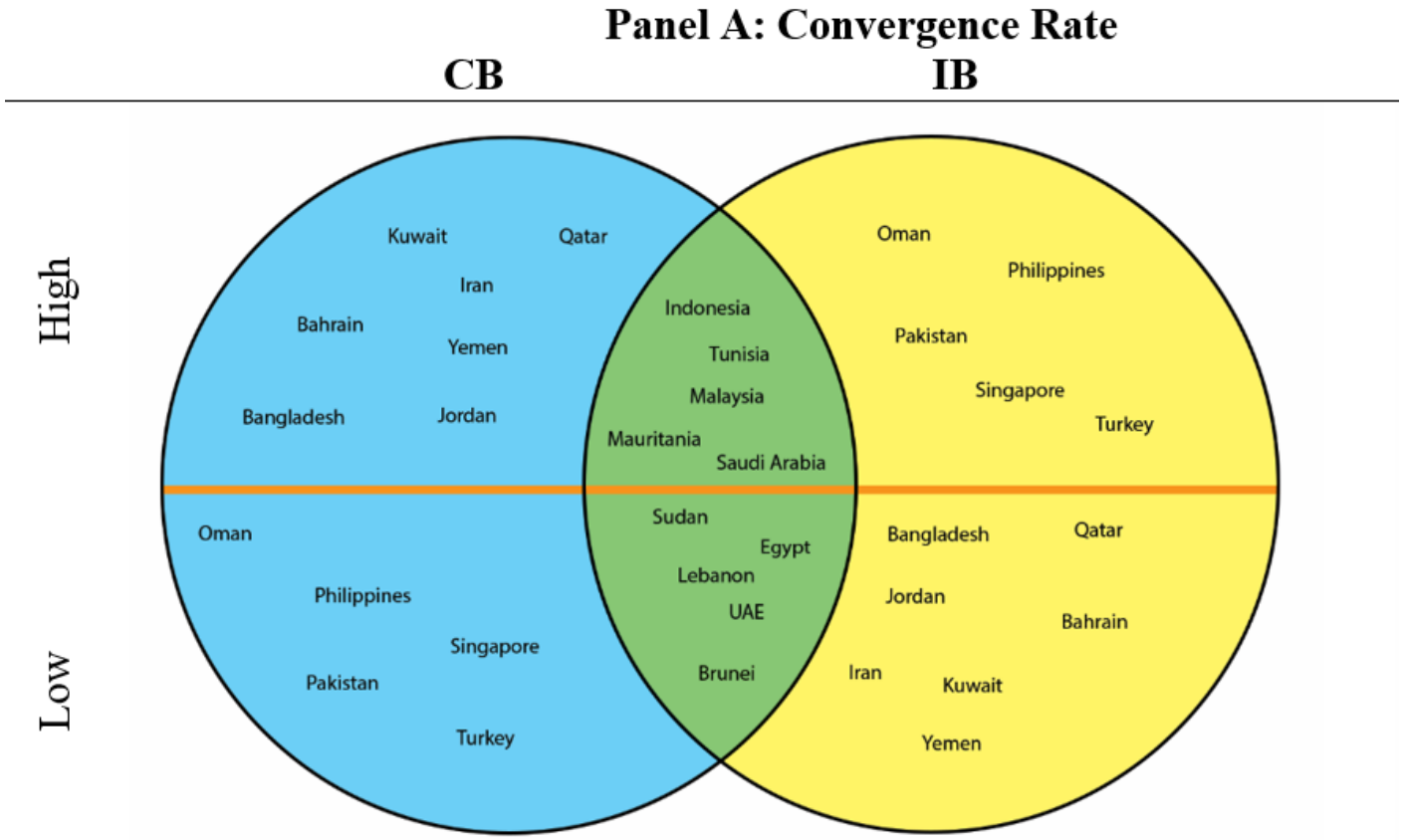

Results
Classification trees

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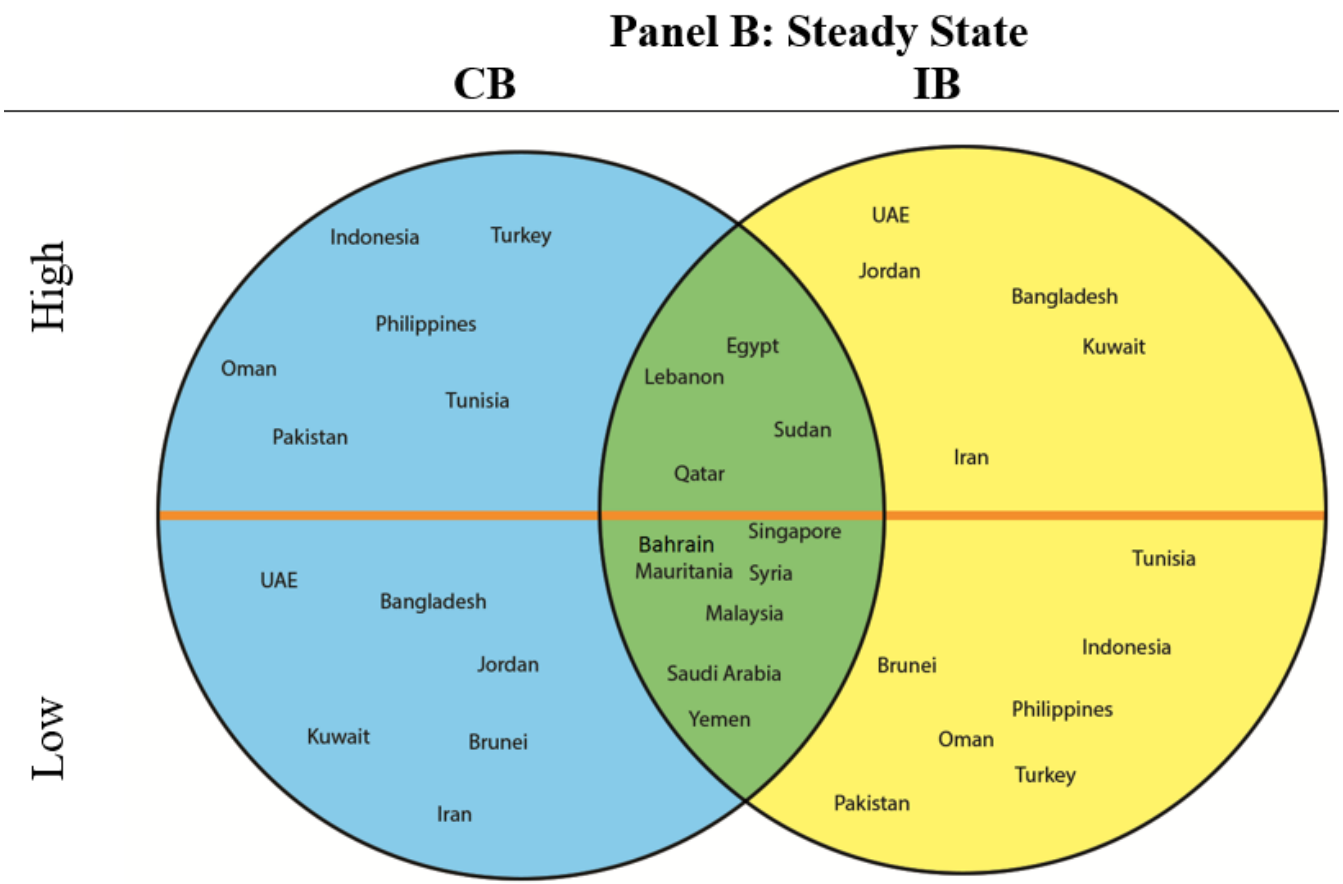

Conclusions

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First stage results

- Islamic banks typically have lower efficiency than conventional banks as calculated by the static year by year ODFs

Conclusions

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Second stage convergence

- Estimates of the β-convergence model using OLS, RE and system-GMM suggest convergence in efficiency (β is around -0.4 to -0.5 depending on estimation method and model; α is around 0.91 to 0.92)
- Estimates of the β-convergence model using OLS, RE and system-GMM find no significant differences between IBs and CBs in (a) steady state efficiency and (b) efficiency convergence rate
- The RPM confirms these findings
- Short-term differences in steady state efficiency found at the first stage are merely transitory

Conclusions

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Third stage results

- Classification trees reveal that differences between IBs and CBs in in efficiency convergence rates and steady states vary across countries
- In some countries IBs and CBs are distinct (in terms of long run efficiency and/or speed of convergence)
- In some countries IBs and CBs are not distinct (in terms of long run efficiency and/or speed of convergence)
- In the case of the latter this may be caused by a mimicking behaviour by Islamic banks or by the nature of the products and regulations specific to those countries
- Regulators and jurisdiction authorities in those countries may need to devise mechanisms and platforms that respect the identity of the two banking models