HIGHER SCHOOL OF ECONOMICS
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Technical efficiency of the global systemically important financial institutions (SIFIs)

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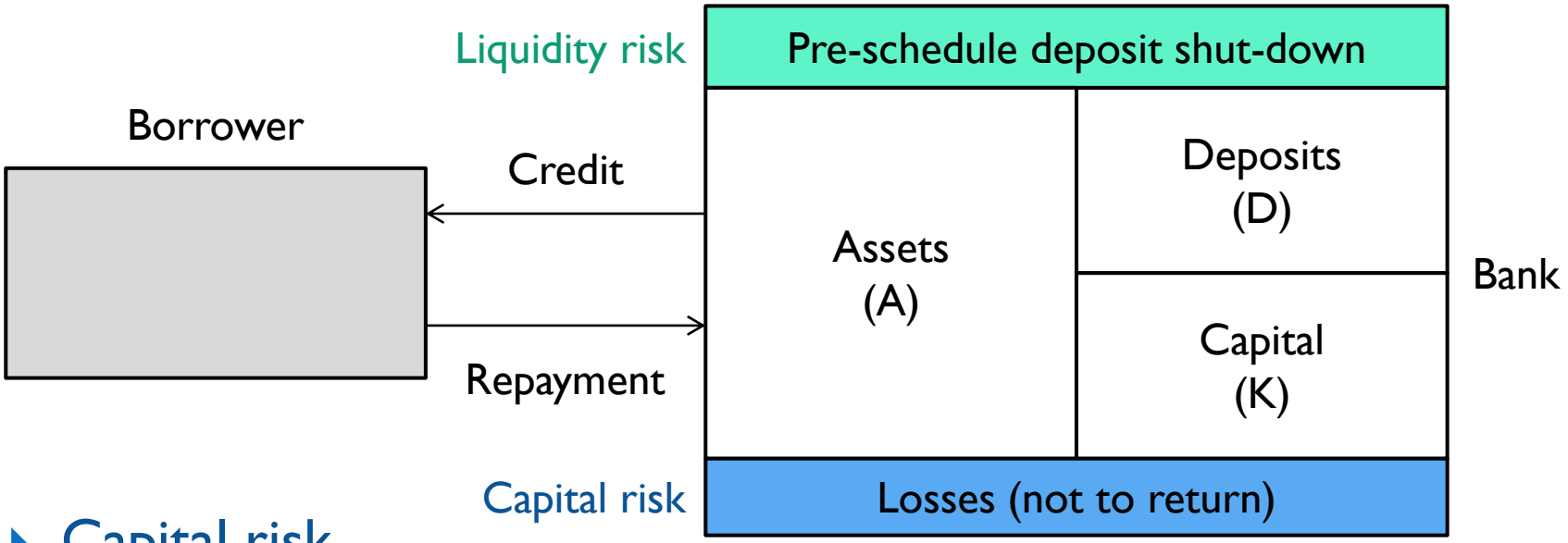
Introduction. The Basel Committee

- The Basel Committee on Banking Supervision (BCBS) was founded in 1974
- Its main objective is developing recommendations of risk regulation
- The third regulatory wave "Basel II" (1999-2008) brought new capital regulation
  - including determination of minimum capital requirements
- The fourth regulatory wave "Basel III" (2009-2011) was a response to 2007-2009 crisis
  - and aimed to decrease systemic risk
- For more information, please, see Penikas (2015)

Introduction. Bank risks



- Capital risk
  - K / (RW * A) > MIN - Capital adequacy ratio (CAR)
    - RW – risk-weights (credit risk)
- Liquidity risk
  - A(M) / (d * D(M)) > MIN - Liquidity coverage ratio (LCR), M = 1 month
    - d – measure of deposit inclination to pre-schedule outflow
    - M – maturity under consideration

Introduction. SIFIs

- A status of the global systemically important financial institutions (SIFIs or SIBs in case of banks) was introduced in 2011
  - as a response to the problem of 'too big to fail banks'
- The main purpose is making banks self-sustainable before central bank capital injection is required
- Probability of default (PD) is lower for SIBs
  - due to higher minimum capital and loss absorbency requirements (will be obligatory beginning from 2016)
- However these requirements don't always mean higher efficiency
  - for example, SIBs' capitalization will be reduced through increase in weighted average cost of capital rate

Hypotheses

- The global systemically important banks are more technically efficient (productive) than other large international banks

- The status of systemic importance awarding has a positive effect on technical efficiency (productivity) of the global banks

Literature review
Main theoretical aspects

- Shepard (1953) – distance function
- Farrell (1957) – formula of technical efficiency (TE)
- Charnes et al. (1978) – Data Envelopment Analysis (DEA)
- O'Donnell (2008) – formula of TFP index decomposition used in this research
- Examples of banks' efficiency researches:
  - Passiouras (2008) – Basel II impact on banks' efficiency
  - Feng, Serletis (2010) – US bank sector
  - Margono et al. (2010) – Indonesian bank sector
  - Bazrkar, Khalilpour (2013) – Iran bank sector

Total factor productivity change

- $q_{it} \in \mathbb{R}_+^N, \; x_{it} \in \mathbb{R}_+^M$ – output and input vectors of bank *i* in period *t*
- $Q_{it} \equiv Q(q_{it}), \; X_{it} \equiv X(x_{it})$ – aggregate output and input (nonnegative, nondecreasing and linearly homogeneous) functions

$$TFPI_{hs,it} = \frac{Q_{it}/Q_{hs}}{X_{it}/X_{hs}} = \frac{QI_{hs,it}}{XI_{hs,it}}$$

- where
  - $TFPI_{hs,it}$ – TFP index
  - $QI_{hs,it}, \; XI_{hs,it}$ – aggregate output and input quantity indices
- Färe-Primont TFP aggregate function is used

TFP change and its components (O'Donnell, 2008)

- Technical change is a measure of production frontier movement as a result of change in technology
- Technical efficiency change is movement towards or away from the production frontier as a result of more or less efficient factors use
- Scale efficiency change is movement along the production frontier in an effort to capture economy of scale
- Mix efficiency change is movement along the production frontier in an effort to capture economy of scope (recombination of inputs and outputs)

TFP change decomposition

$$TFP_{it} = TFP_t^* \times TFPE_{it} = TFP_t^* \times OTE_{it} \times OSME_{it}$$

- where
  - TFP_{it} – TFP of firm *i* in period *t*
  - TFP_t^* – maximum TFP using technology of period *t*
  - $TFPE_{it}$ – TFP efficiency
  - OTE_{it} – output technical efficiency
  - $OSME_{it}$ – output scale and mix efficiency

$$TFPI_{hs,it} = \left(\frac{TFP_t^*}{TFP_s^*}\right)\left(\frac{TFPE_{it}}{TFPE_{hs}}\right) = \left(\frac{TFP_t^*}{TFP_s^*}\right)\left(\frac{OTE_{it}}{OTE_{hs}}\right)\left(\frac{OSME_{it}}{OSME_{hs}}\right)$$

Data

- 30 global systemically important banks (2013)
- 30 banks from the list (2013) of 100 largest international banks
- Output – loans
- Inputs:
  - Deposits (borrowing funds)
  - Operating costs
  - Total equity (own capital)
- Period – 2008-2013 for balanced panel
- The final sample consists of 25 banks:
  - 13 SIBs
  - 12 non-SIBs

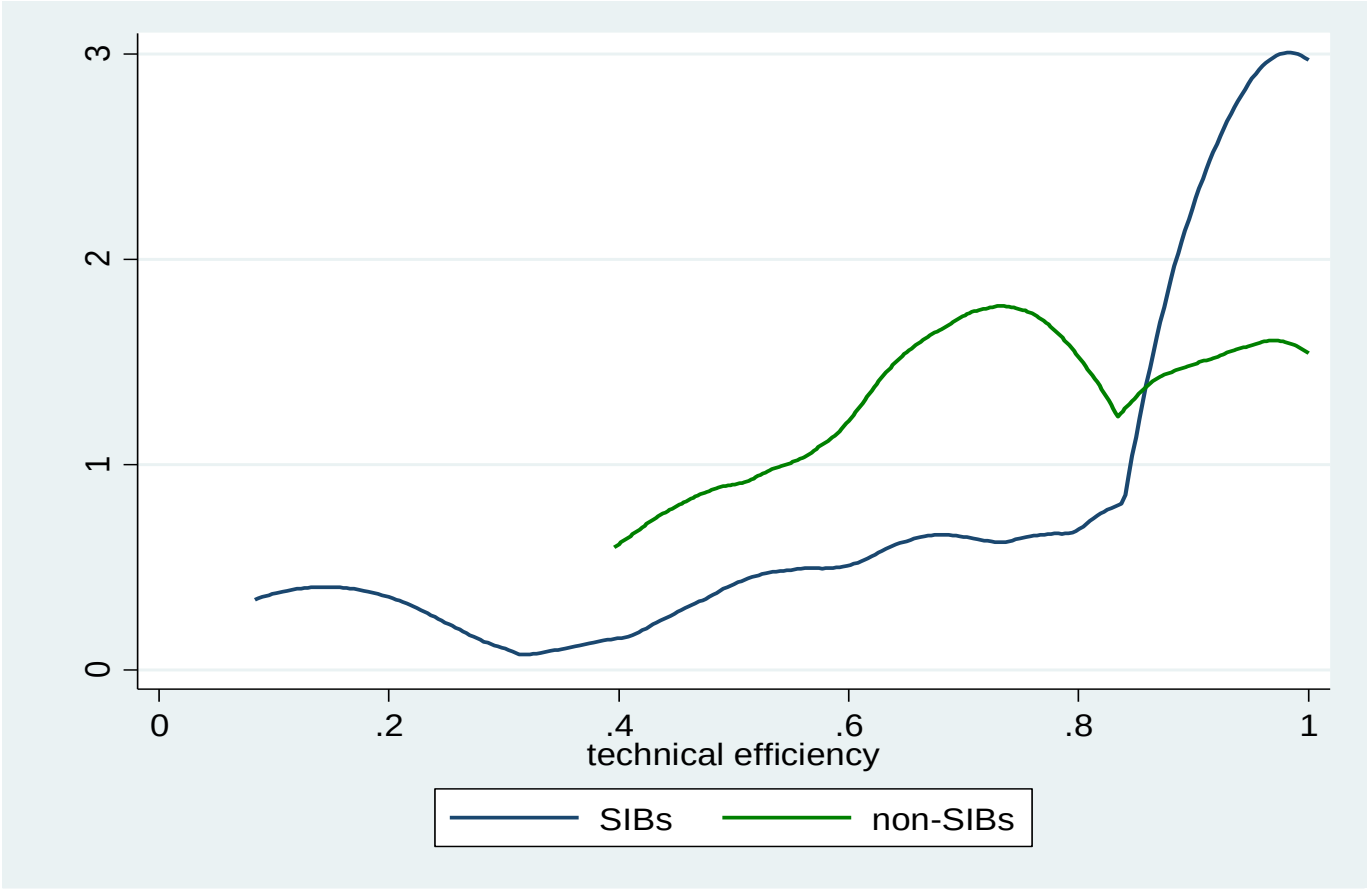
Descriptive statistics of variables in 2008-2013

Variable	Mean	Std. Dev.
Loans	425344.9	263555.6
Deposits	581476.8	361489.7
Operating costs	14080.8	15611.9
Total equity	59581.1	50877.8

Correlation matrix of variables in 2008-2013

	Loans	Deposits	Operating costs	Total equity
Loans	1			
Deposits	0.71	1		
Operating costs	0.43	0.21	1	
Total equity	0.60	0.67	0.57	1

Kernel density of technical efficiency estimates



- There are more observations of SIBs with very high TE estimates than non-SIBs. Nevertheless only SIBs demonstrate cases with TE estimates below 0.4

Spearman coefficient of TFP and technical efficiency estimates

	2008	2009	2010	2011	2012	2013
Between two series of cross-section estimates (from balanced panel and unbalanced)						
TE	0.99	0.97	0.94	0.94	0.92	0.89
TFP	1.00	1.00	0.92	0.97	1.00	0.86
Number of observations in unbalanced panel	38	38	40	41	47	45
Between panel and cross-section estimates (from balanced panel)						
TFP	0.99	0.99	0.94	0.93	0.87	0.79

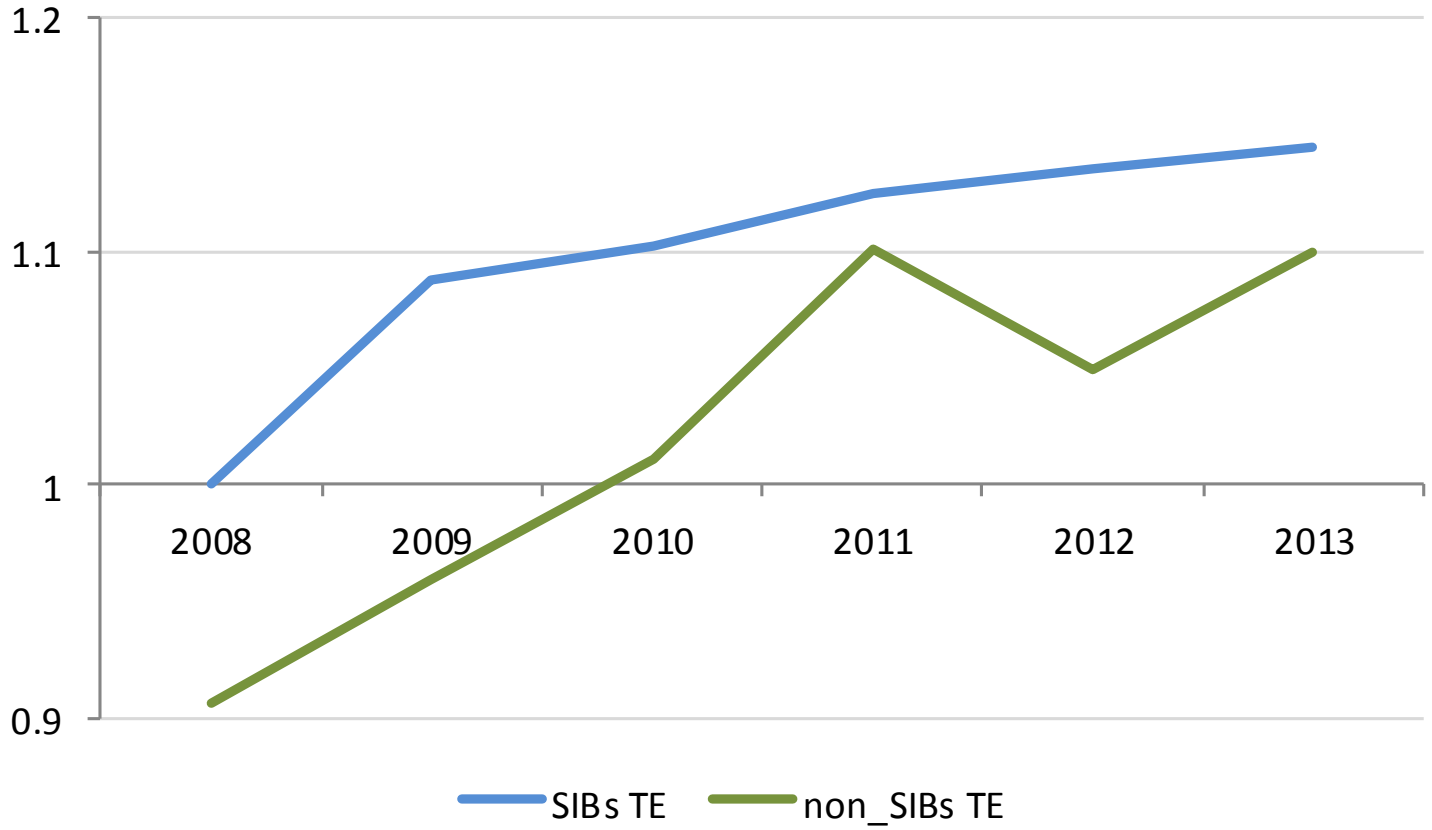
- All Spearman correlations are very high which confirms consistency of banks' ranking to initial sample changes

Average estimates of TFP and its components

	2008	2009	2010	2011	2012	2013
Technical efficiency						
SIBs	0.754	0.821	0.832	0.849	0.856	0.863
non-SIBs	0.684	0.724	0.762	0.830	0.791	0.830
Total factor productivity						
SIBs	0.303	0.297	0.256	0.243	0.228	0.223
non-SIBs	0.280	0.298	0.296	0.298	0.290	0.288
Scale and mixed efficiency						
SIBs	0.682	0.584	0.583	0.621	0.565	0.566
non-SIBs	0.754	0.703	0.758	0.788	0.787	0.769

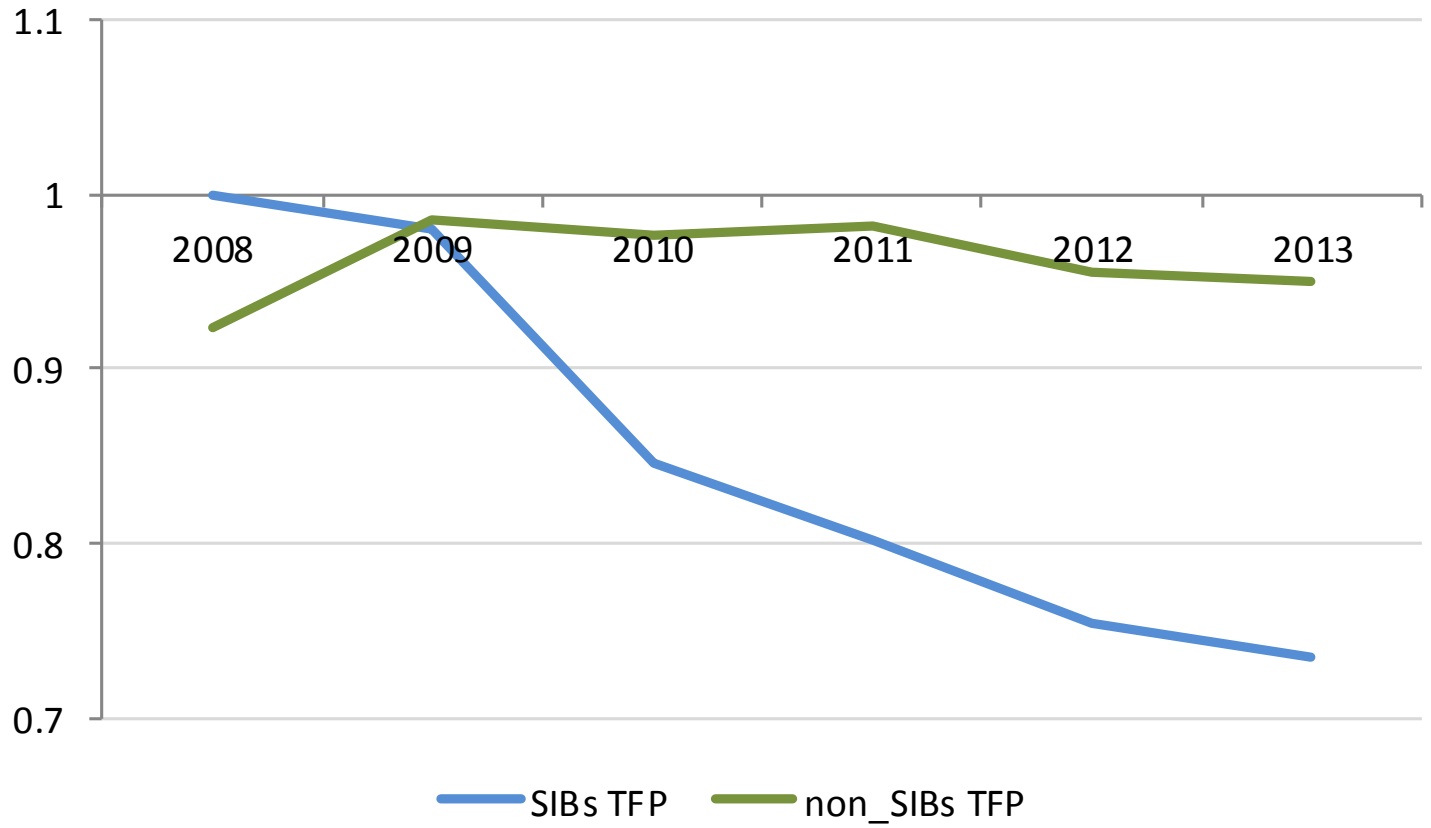
- Average technical efficiency estimates of SIBs are larger than non-SIBs for all years with slight difference between estimates in 2011
- Average TFP estimates are significantly higher for non-SIBs after 2009

Average values of technical efficiency estimates index (2008 of SIBs=100)



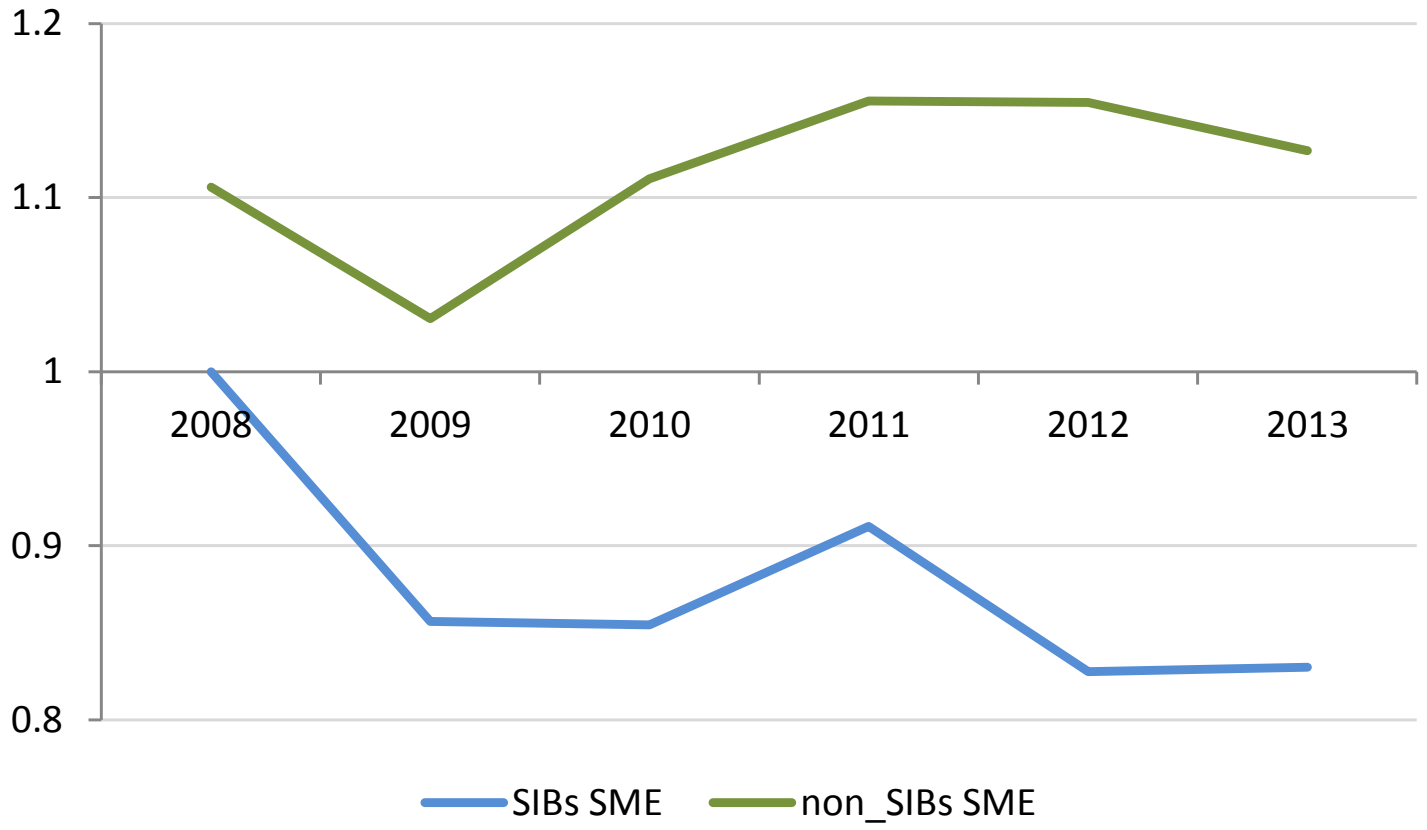
- Average technical efficiency estimates of SIBs were increasing during all period but more slowly than non-SIBs except 2012 (maybe through reputational effect)

Average values of TFP estimates index (2008 of SIBs=100)



- Average TFP estimates of non-SIBs were almost unchangeable during all period. In the same time this index of SIBs has dropped dramatically

Average values of scale and mixed efficiency estimates index (2008 of SIBs=100)



- Average SME estimates of non-SIBs were higher during all period. The same estimates of SIBs dropped in 2012 after the status awarding

Conclusion

- The global systemically important banks were more technically efficient than other large international banks in 2008–2013 according to DEA
- The awarding of the SIBs status hasn't brought some significant positive or negative effect on SIBs' technical efficiency
- However SIBs were less productive than non-SIBs after 2009
- The status awarding didn't change the falling dynamics of TFP estimates. But it maybe caused a reduction of average SME estimates in 2012

Thank you for your attention!

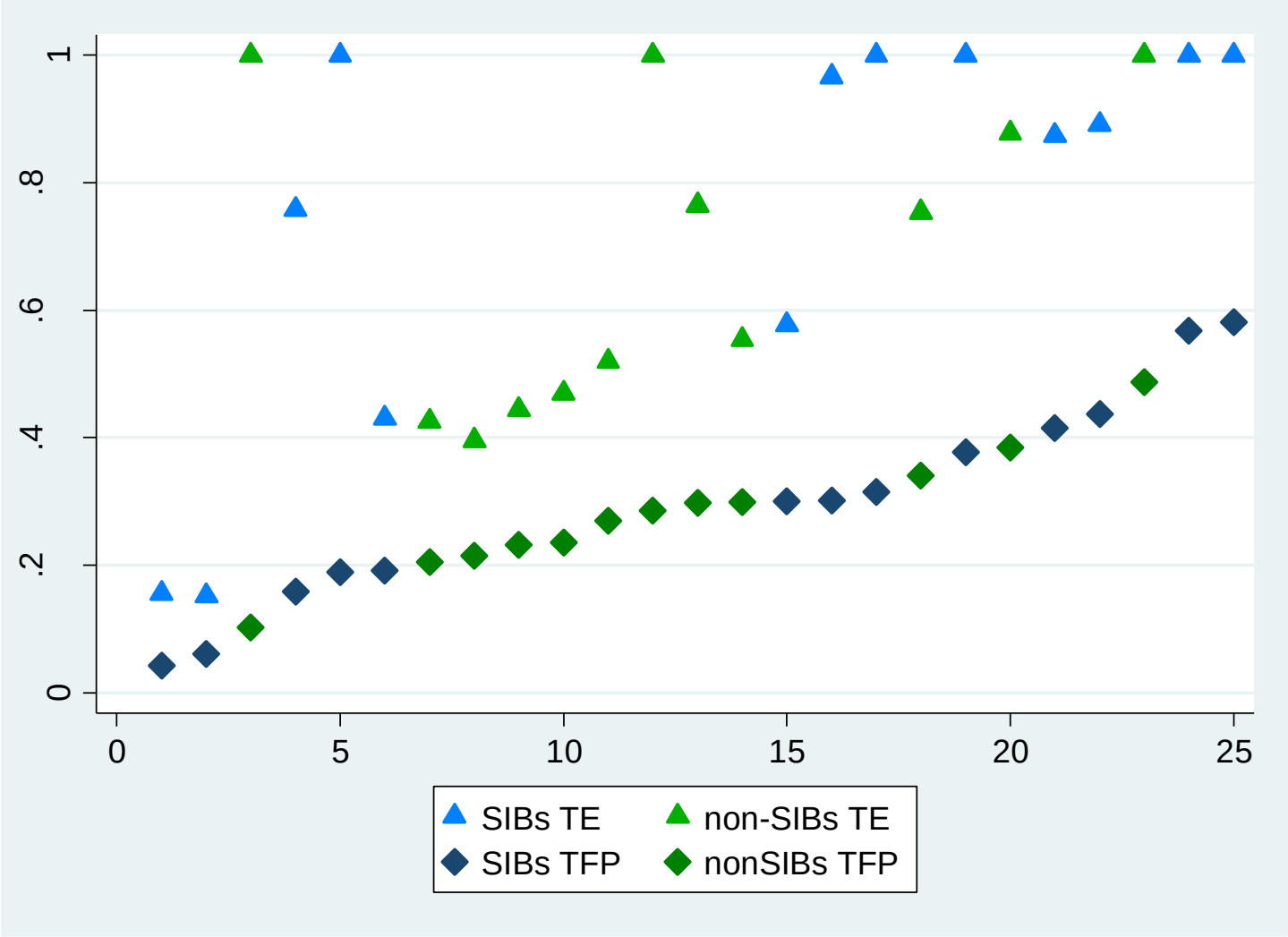
Aggregate function

- DEA – Färe-Primont TFP function:

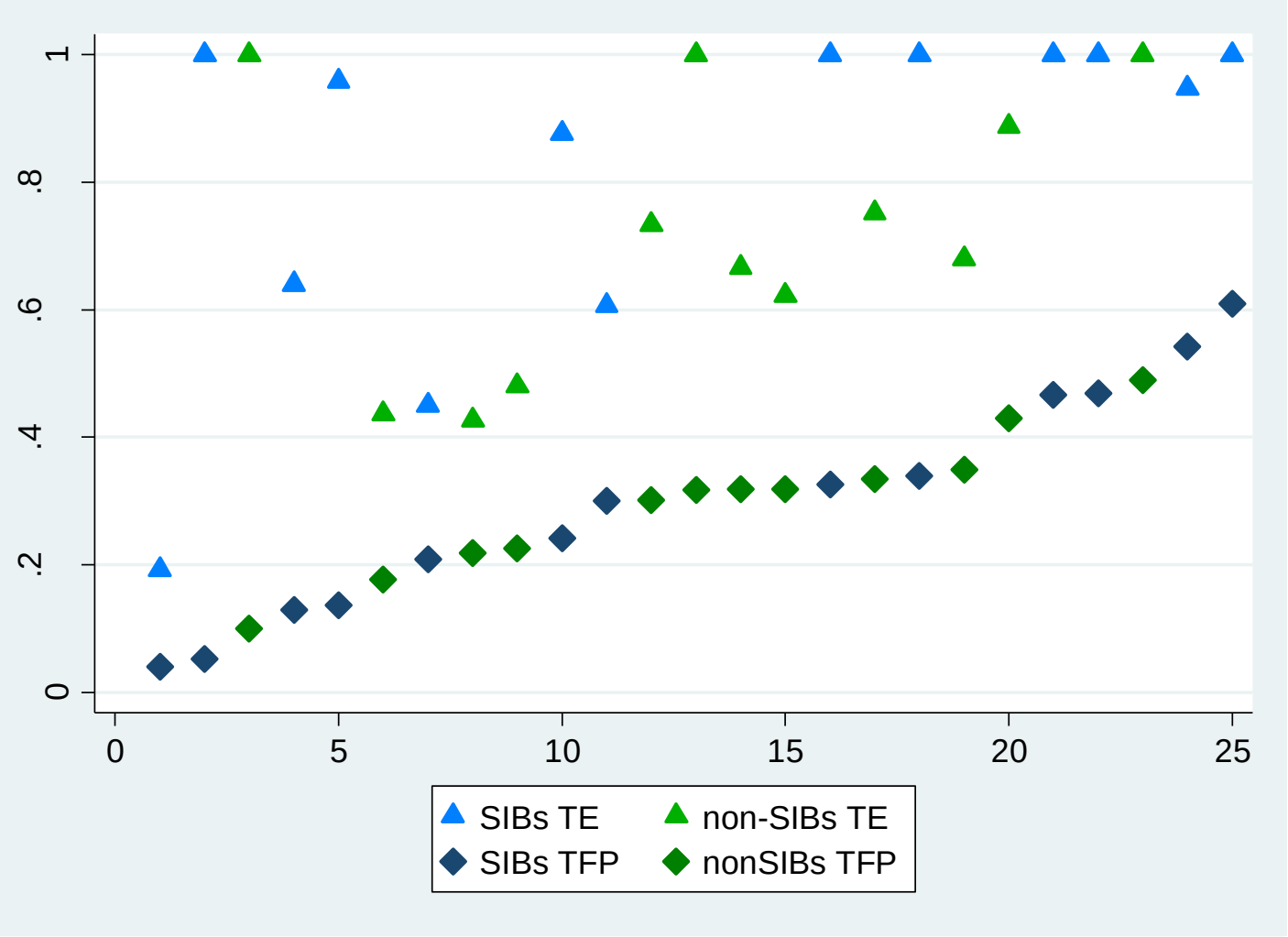
$$TFP_{it} = \frac{Q_{it}}{X_{it}} = \frac{D_O(x_0, q_{it}, t_0)}{D_I(x_{it}, q_0, t_0)}$$

- where
  - $D_O(\cdot)$, $D_I(\cdot)$ – output and input distance functions
  - x_0, q_0 – vectors of representative quantities
  - t_0 – a representative time period

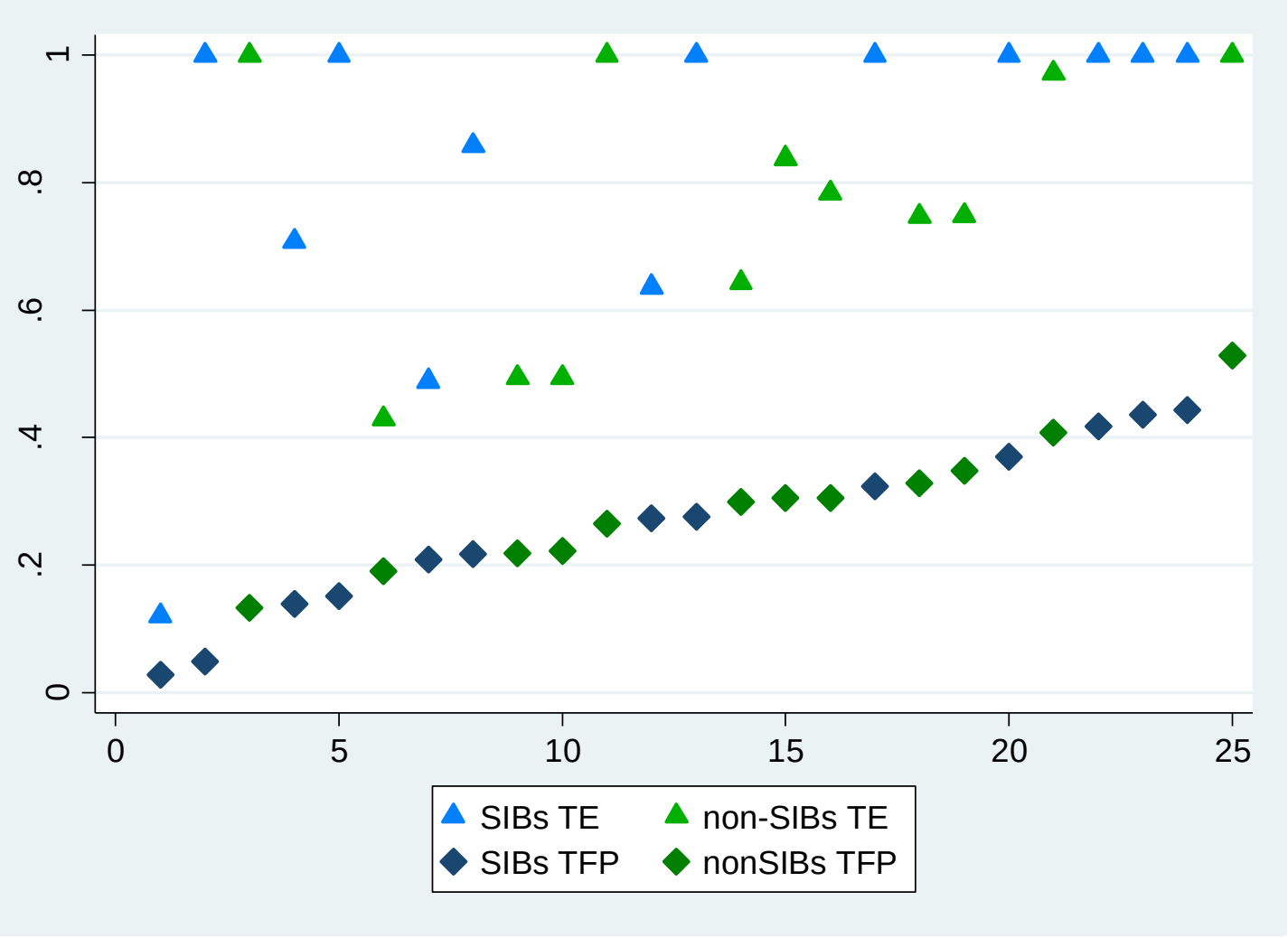
TFP and TE estimates in 2008



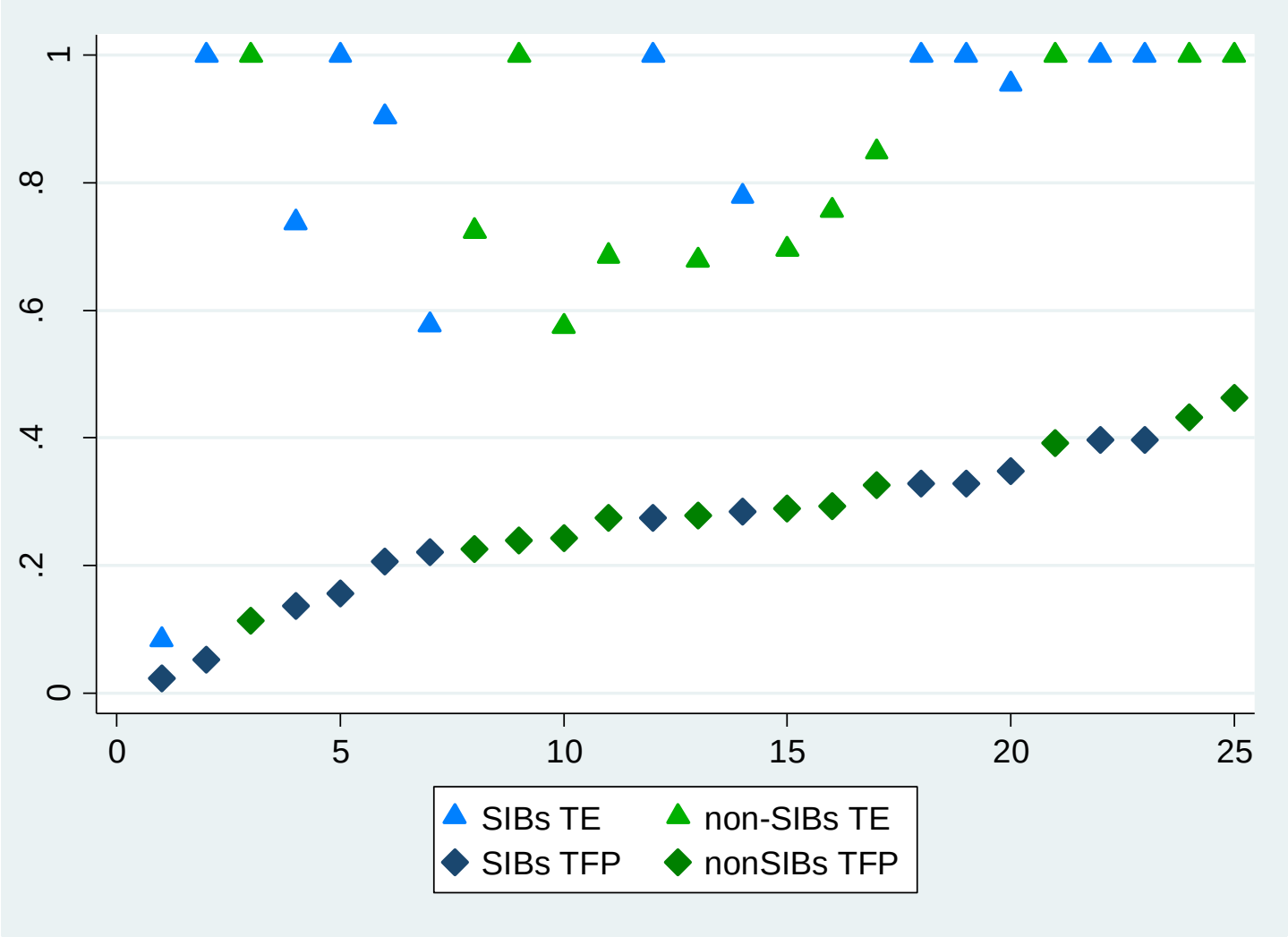
TFP and TE estimates in 2009



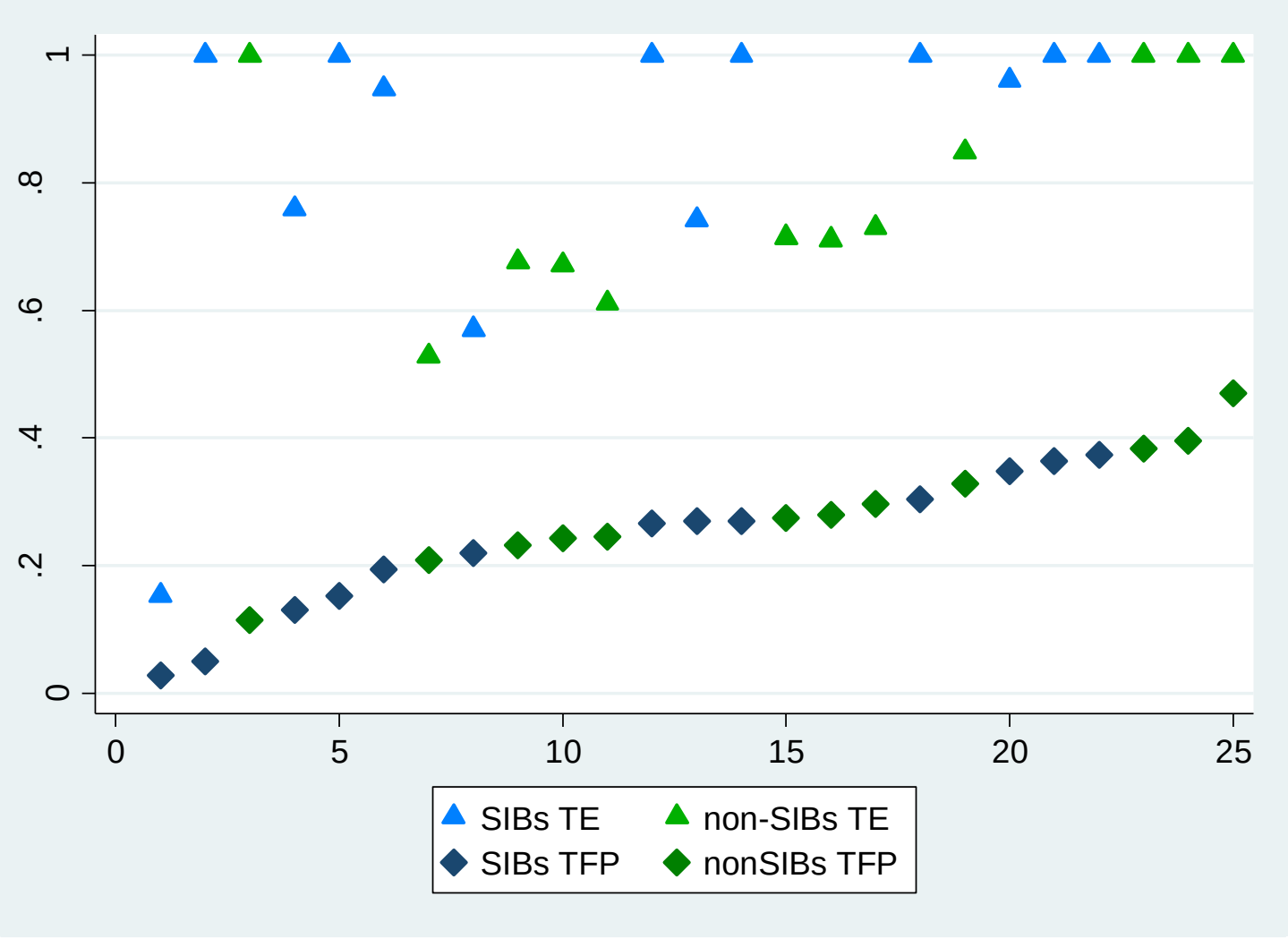
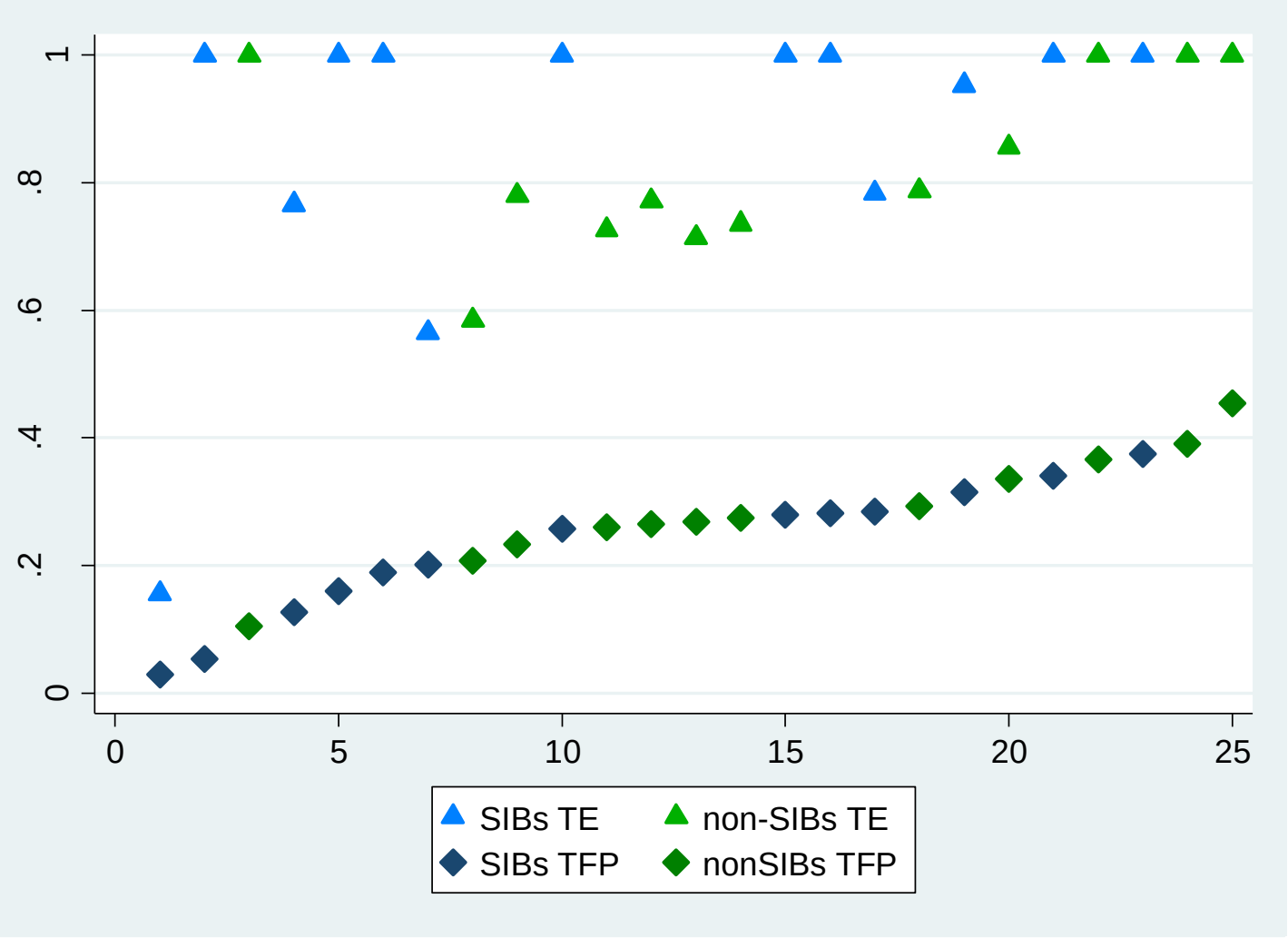
TFP and TE estimates in 2010



TFP and TE estimates in 2011



TFP and TE estimates in 2012



TFP and TE estimates in 2013