TECHNICAL EFFICIENCY IN BANK LIQUIDITY CREATION

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1

MOTIVATION

- Banks create liquidity by financing illiquid assets such as loans with liquid liabilities such as demand deposits.

- Creating liquidity, banks offer a liquidity on demand service to investors and depositors, which benefits to the economy.

- Comprehensive measure of liquidity transformation using all assets, liabilities, and off-balance sheet activities (Berger & Bouwman, 2009) :
  - Classifies all assets, liabilities, and off-balance sheet activities as liquid, semi-liquid, or illiquid
  - Weights the elements: illiquid assets or liquid liabilities (½) ; liquid assets or illiquid liabilities (- ½)
  - Sums the elements classified and weighted

- Studies of factors associated with higher levels of liquidity creation:
  - Size, multibank holding membership, merging (Berger & Bouwman, 2009)
  - Bank value (Cowan & Salotti, 2015), competition (Horvath et al. 2015), regulatory policies and intervention (Berger et al., 2015)

2

CONTRIBUTION

- Banks produce most liquidity when originating the most illiquid loans and collecting the most liquid liabilities.

- This ability is determined by technology, organization, business model i.e. specialization or diversification.

- Liquidity creation is the result of a production process: the ability of each bank to make the best use of its productive resources (financial and physical capital, and labor).

- Contribution:
  - An optimal bank liquidity creation benchmark: the efficient frontier in bank liquidity creation
  - Factors associated with most efficient bank liquidity production

HYPOTHESES

- Relationship between size and efficiency in producing liquidity

- Larger size is associated with higher liquidity creation (Berger & Bouwman, 2009).

- Scale economies and risk diversification affect productivity in the banking sector and increase with bank size (Hughes & Mester, 1998; Hughes et al., 2001).

- Hypothesis 1: Larger banks are expected to be more efficient in creating liquidity.

Hypotheses

- Relationship between bank business model and efficiency in producing liquidity

- Bank diversification stems from a mix of traditional (deposit taking, lending, payment services) and nontraditional activities (e.g. asset management, insurance, nonfinancial business) (Apergis, 2014).

  - Traditional banking relies on the relationship oriented model: associating the highest value added liabilities (core deposits) to the highest value added loans (relationship loans) (Song & Thakor, 2007).
  - Nontraditional banking does not participate to the core intermediation function of banks.

- Hypothesis 2: Traditional banking would be more efficient than nontraditional banking.

HYPOTHESES

- Bank business model and activity mix are related to bank size.
  - Larger banks are more engaged in nontraditional banking (Stiroh & Rumble, 2006), rely more on the use of hard information to perform transactional lending (Berger & Udell, 2002).
  - Smaller banks have an advantage in terms of lending and traditional banking, rely more on soft information to perform relationship lending.

- We expect a stronger effect of traditional banking activities on efficiency than the size effect of scale economies.

- Hypothesis 3: The largest banks are expected to be less efficient because of nontraditional banking activities.

6

Methodology

- Technical efficiency in bank liquidity creation is estimated with a production (value added) approach: overall liquidity production is viewed as an output, consistently with Berger & Bouwman's measure.

- Stochastic Frontier Approach (Aigner et al. 1977; Meeusen & van den Broeck, 1977) and Battese & Coelli (1995) model for panel data:

$$\ln(Y_{it}) = \beta_0 + \sum_{j=1}^{4} \beta_j x_{jit} + \sum_{j=1}^{4}\sum_{k=1}^{4} \beta_{jk} x_{jit} x_{kit} + V_{it} + U_{it} \tag{1}$$

- Output: the logarithm of liquidity creation of bank i at period t
- Inputs: financial capital (ln(total equity)), labour capital (ln(total expenses in salaries and employees benefits)), physical capital (ln(expenses of premises and fixed assets)), output quality (ln(nonperforming loans))

METHODOLOGY

- Technical inefficiency term U_{it} defined as:

$$U_{it} = \delta_0 + \sum_{j=1}^{14} \delta_j z_{jit} + W_{it} \qquad (2)$$

- Where :
  - z_1 : size of the bank i (ln(total assets))
  - z_2 : dummy variable of bank holding company membership
  - z_3 to z_5 : proxies of diversification between traditional and nontraditional banking activities, respectively the diversification of activities, assets, and loans;
  - z_6 to z_{14} : variables assessing the interaction between dummies of bank size class and diversification of banking activities

Methodology

- Effect of activity diversification on technical efficiency in creating liquidity

- The more involved in nontraditional banking a bank, the more diverse its sources of non-interest income.

- Herfindahl-Hirschman Index (HHI) of non-interest income categories (Schmidt & Walter, 2009 ; Stiroh, 2004):

$$HHI_{Activity_{i,t}} = \left(\frac{FID}{NON}\right)^2_{i,t} + \left(\frac{SRV}{NON}\right)^2_{i,t} + \left(\frac{TRAD}{NON}\right)^2_{i,t} + \left(\frac{S\&I}{NON}\right)^2_{i,t} + \left(\frac{VENT}{NON}\right)^2_{i,t} + \left(\frac{SERV}{NON}\right)^2_{i,t} + \left(\frac{SEC}{NON}\right)^2_{i,t} + \left(\frac{GAINS}{NON}\right)^2_{i,t} + \left(\frac{OTH}{NON}\right)^2_{i,t}$$

  ➤ High value of HHI: concentration of fee sources, activity specialization, traditional banking
  ➤ Low value of HHI: activity diversification, non-traditional banking

METHODOLOGY

- Effect of asset diversification on technical efficiency in creating liquidity
  - Traditional banking focus on lending
  - Nontraditional banking engage in non-lending activities

- Herfindahl-Hirschman Index (HHI) of asset categories :

$$HHI_{Asset_{i,t}} = \left(\frac{CASH}{ASSETS}\right)^2_{i,t} + \left(\frac{SECU}{ASSETS}\right)^2_{i,t} + \left(\frac{LOANS}{ASSETS}\right)^2_{i,t} + \left(\frac{FIX}{ASSETS}\right)^2_{i,t} + \left(\frac{OTH}{ASSETS}\right)^2_{i,t}$$

  - High value of HHI: asset concentration, traditional banking
  - Low value of HHI: asset diversification, nontraditional banking

METHODOLOGY

- Effect of loan diversification on technical efficiency in creating liquidity

- Traditional banking includes making loans to different sectors (C&I, real estate agriculture, financial institutions, individual) (Deng et al., 2007).

- Diversification of the loan portfolio may benefit in terms of economies of scope as banks acquire informations on various clients and sectors.

- Herfindahl-Hirschman Index (HHI) of loan categories (Deng et al., 2007; Estes, 2014):

$$HHI_{Loans_{i,t}} = \left(\frac{1-4RE}{LOANS}\right)^2_{i,t} + \left(\frac{CONST}{LOANS}\right)^2_{i,t} + \left(\frac{FARM}{LOANS}\right)^2_{i,t} + \left(\frac{MULTI}{LOANS}\right)^2_{i,t} + \left(\frac{CRE}{LOANS}\right)^2_{i,t} + \left(\frac{AG}{LOANS}\right)^2_{i,t} + \left(\frac{CI}{LOANS}\right)^2_{i,t} + \left(\frac{CONS}{LOANS}\right)^2_{i,t} + \left(\frac{OTH}{LOANS}\right)^2_{i,t}$$

  ➢ High value of HHI: concentration loan portfolio, nontraditional banking
  ➢ Low value of HHI: loan portfolio diversification, traditional banking

11

METHODOLOGY

- Data
  - Call reports (FDIC): quarterly balance sheet and income statement data
  - Berger & Bouwman's liquidity creation measure
  - Period from 1999 to 2014
  - 103 583 observations and 7 113 banks

- Results:
  - Technical efficiency scores of bank i at time t
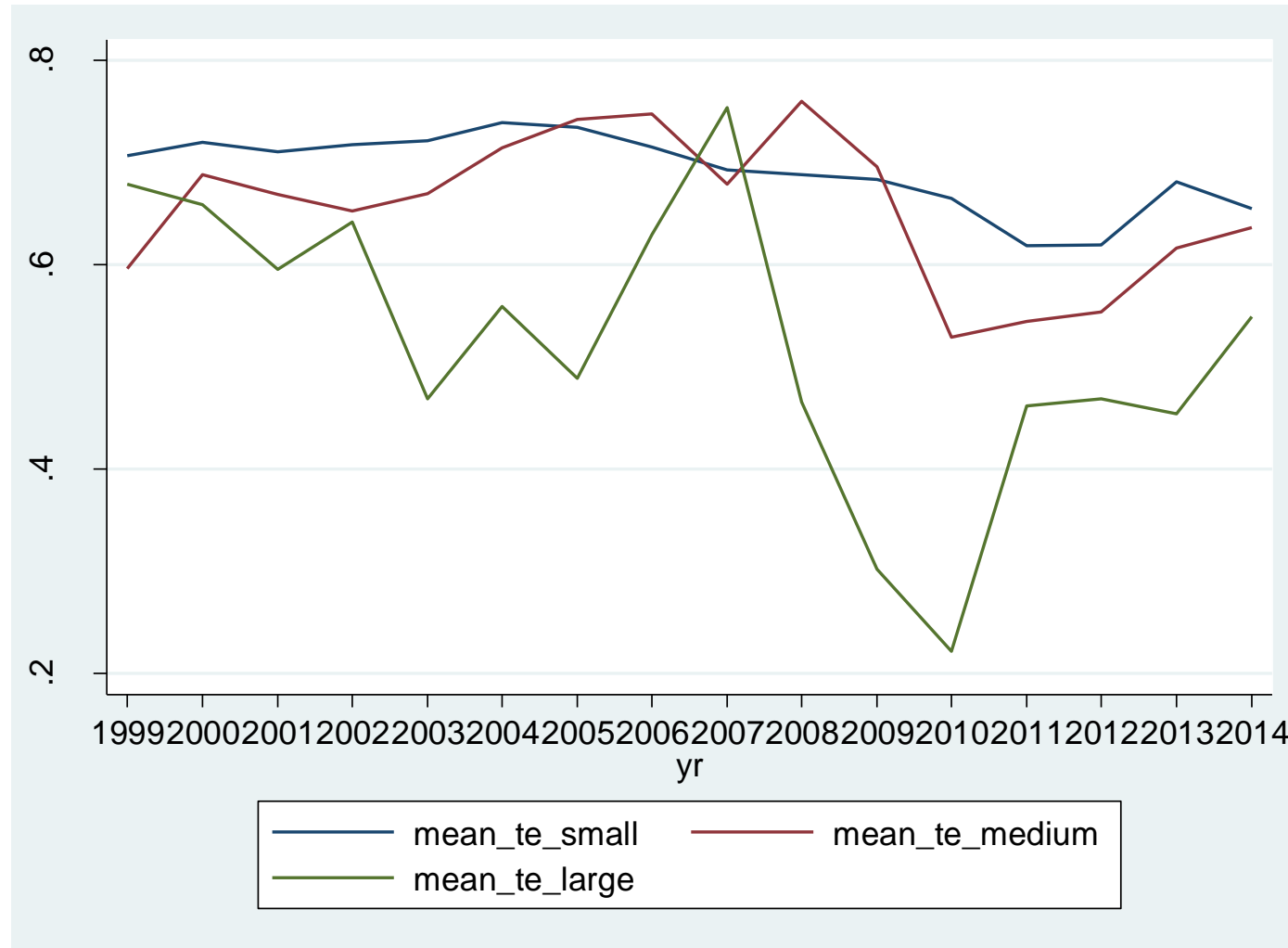 - Determinants of technical efficiency

RESULTS

- Evolution of average technical efficiency scores in creating overall liquidity, by bank size
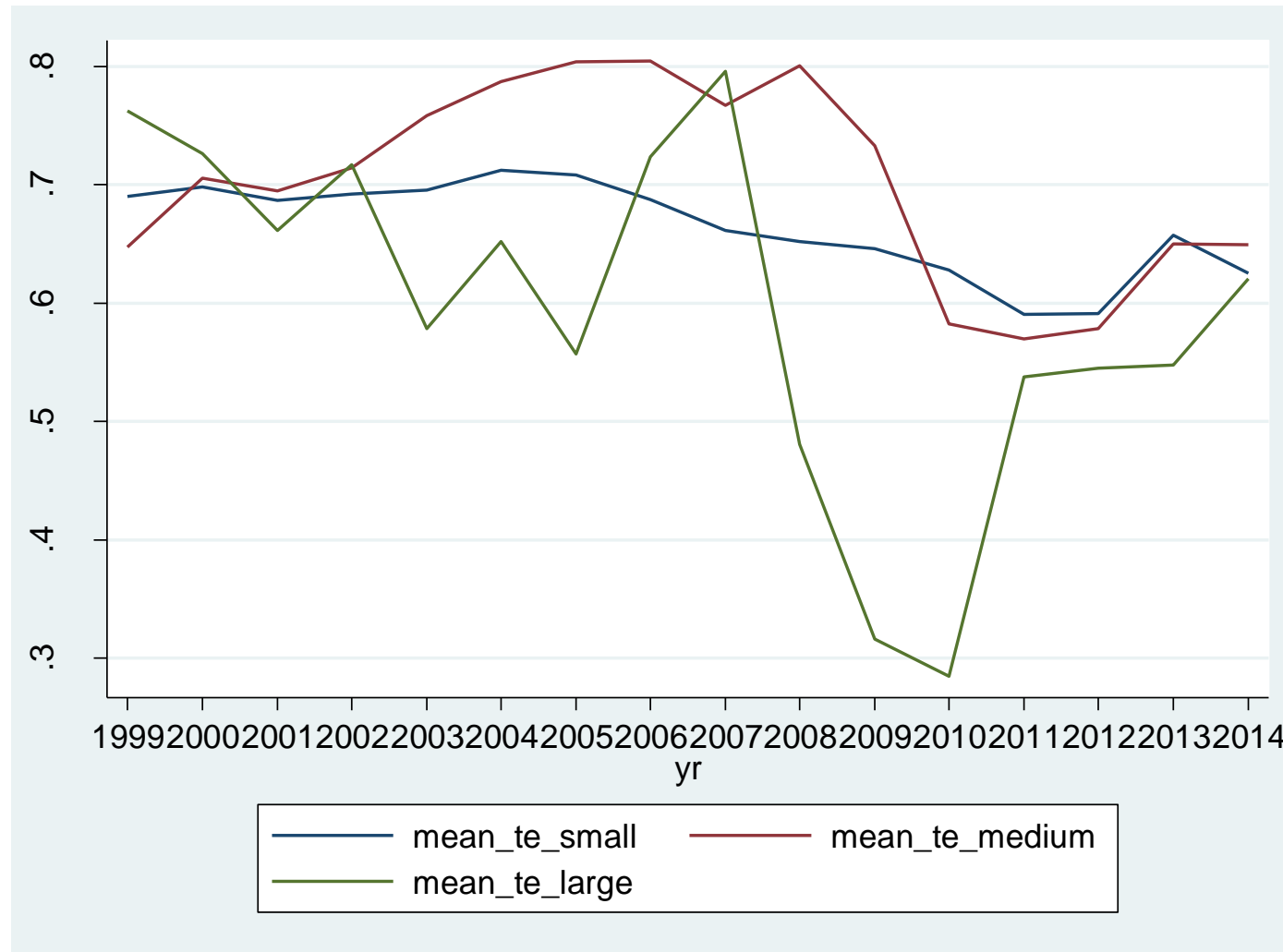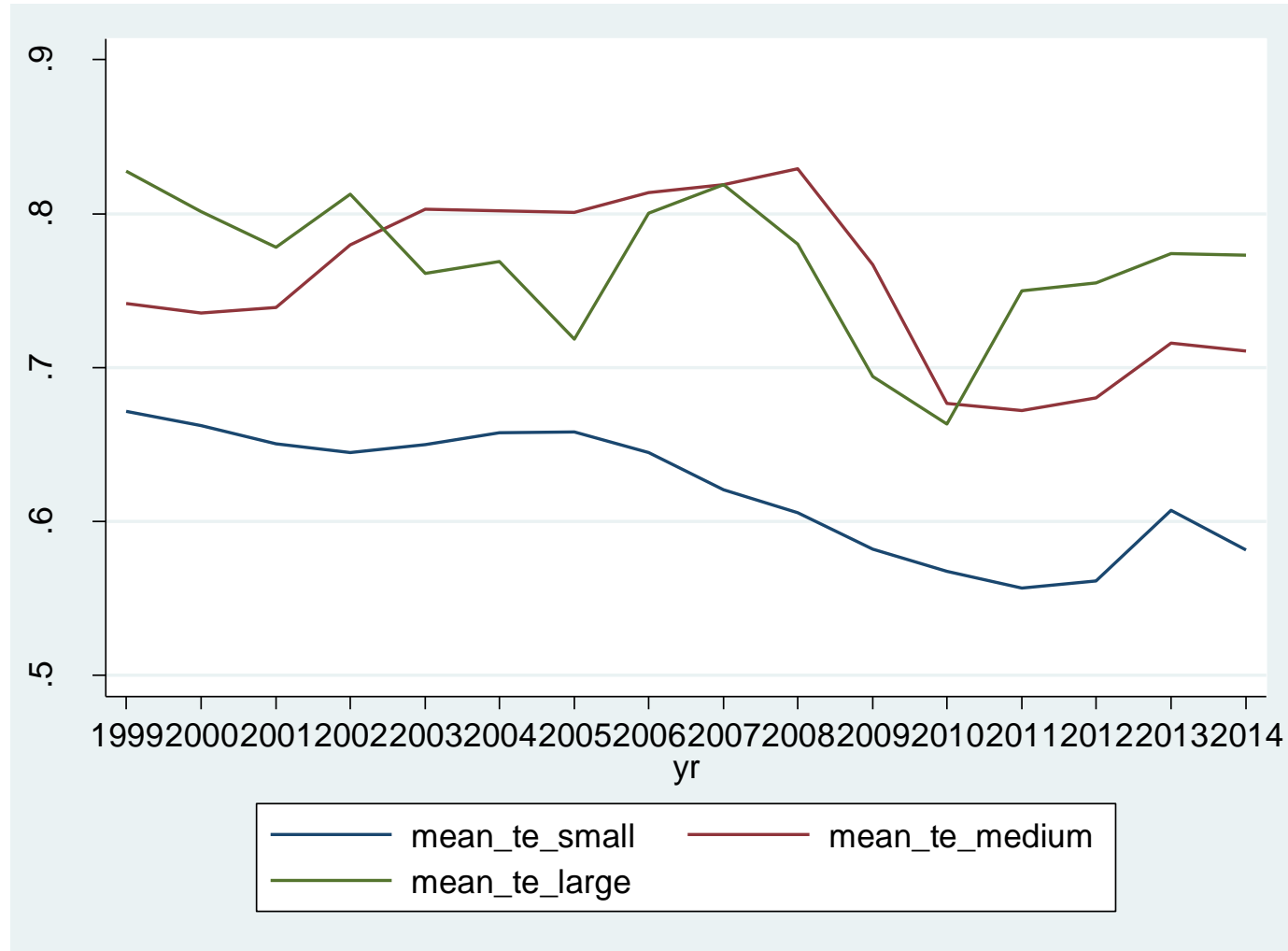
RESULTS

- Evolution of average technical efficiency scores in creating on-balance sheet liquidity, by bank size

RESULTS

- Evolution of average technical efficiency scores in creating off-balance sheet liquidity, by bank size

Results

- Estimation of the technical inefficiency effects

Intercept	10.880 (21.97)**	Intercept	9.308 (57.26)**
Ln (total assets)	0.095 (27.21)**	Ln (total assets)	0.164 (35.65)**
BHC dummy	0.098 (8.91)**	BHC dummy	0.066 (5.92)**
HHI_activity	-1.280 (68.86)**	Small dummy * HHI_activity	-1.465 (75.18)**
HHI_asset	-0.986 (32.71)**	Medium dummy * HHI_activity	1.116 (11.29)**
HHI_loan	1.972 (63.95)**	Large dummy * HHI_activity	0.601 (3.87)**
Vsigma	-3.052 (267.26)**	Small dummy * HHI_asset	-0.779 (25.21)**
		Medium dummy * HHI_asset	-4.591 (38.55)**
		Large dummy * HHI_asset	-5.620 (38.40)**
		Small dummy * HHI_loan	1.858 (58.33)**
		Medium dummy * HHI_loan	1.953 (10.94)**
		Large dummy * HHI_loan	3.576 (21.29)**
		Vsigma	-3.038 (267.44)**

CONCLUSION

- Size matters for efficiency in liquidity creation in a nonlinear shape.
  - Medium banks are most correlated to the efficient frontier of overall liquidity creation.
  - Small banks – experienced in processing soft information and relationship lending – are closer to the efficient frontier of the on-balance sheet liquidity creation.
  - Large banks – relying on hard information and transaction lending- are more correlated to the efficient frontier of the off-balance sheet liquidity creation.

- Effect of global financial conditions on efficiency in producing liquidity
  - Small banks are more resilient to the 2007-2008 financial crisis.
  - Large banks are the most affected.

- Policy implications
  - Regulation affects the choice of activity mix by banks (DeYoung et al. 2004)
  - Relationship between activity mix and efficiency in liquidity creation
  - Help understand the consequences of regulation in terms of welfare of the economy