

# The Banking Sector Productivity and Business Fluctuations

Se-Jik Kim and Seungki Hong

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# 1. Introduction

## Motivation

- The research on the role of financial sector in triggering and propagating business fluctuations has been burgeoning since the 2008 Financial Crisis.
- Various sources and mechanisms have been suggested
- But the empirical measure has been absent, which directly assesses
  - "how poorly the banking industry performs", and
  - "how badly its poor performance aggravates the aggregate activity"

## What We Do

We measure the productivity of the U.S. banking industry through 1984Q1 to 2011Q4 based on a novel method of measuring value-added using individual banks' balance sheet data. Using this productivity measure, we explicitly assesses

- how well or poorly the banking industry performs in the aspect of *how much value is added or destroyed* under given amount of input factors, and
- to what extent its performance affects the aggregate activity.

## Related Literature

- Macro Finance literature
- literature of “efficiency measuring” for individual banks

## 2. Output - KH Bank Value-Added

### **KH Bank Value-Added**

We measure the value-added of the commercial banks from the distribution side using financial statements of individual banks.

$$(\text{KHBVA}) = (\text{labor income}) + (\text{capital income}) + (\text{profit}) + (\text{income tax}) \quad (1)$$

Data Source : Call Report from Chicago Fed

figure 1. quarterly time-series of KHBVA

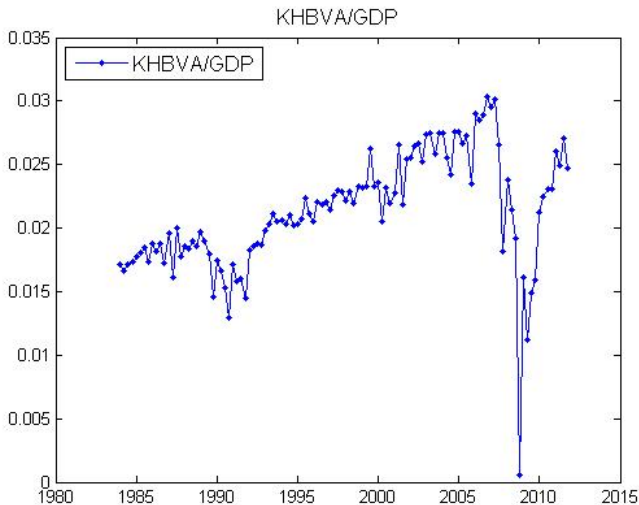
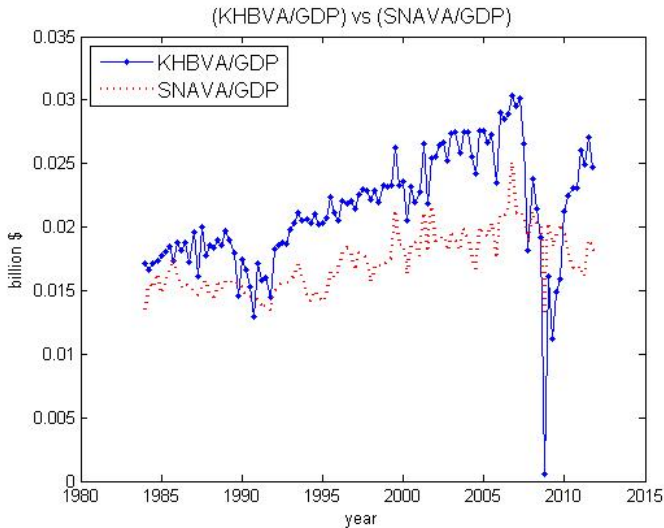


figure2. KHBVA vs SNAVA



**(note) key findings from figure 1 and figure 2.**

- During the 2008 financial crisis, KHBVA plunged.
- The current statistical measure (SNAVA, hereafter) yields different values from KHBVA. In particular, the discrepancy became stark during the 2008 Financial Crisis and the subsequent recession.

## Why is KHBVA different from SNAVA?

- In each period, consumption goods and capital goods are produced. The values of consumption goods return to consumers immediately, while the values of capital goods return to consumers through several following periods in the form of “depreciation”.
- SNAVA includes depreciation of previously constructed capital goods as “newly created values”, although it is merely “realization of previously created values”.
- To correct this “double counting” issue, some economists pay attention to NVA(net value-added), which is calculated by deducting depreciation from SNAVA.
  - ▶ e.g. NDP, NNP



- When values of capital goods suddenly evaporate in crisis episodes, however, the current statistical measure of NVA also does not capture the destroyed values of capital goods.
- KHBVA is different from both SNAVA and NVA in the aspect that it reflects destroyed values of previously created capital goods as *negative value-added*.
- During a financial crisis, the quintessence of the financial crunch is all reflected in the destroyed values of "previously produced assets".
  - ▶ capital quality shock, housing price plunge, liquidity dry-up...
- In this regard, KHBVA can provide more information than SNAVA or NVA regarding "what happened to banking industry during the 2008 financial crisis" and "how the aggregate activities were affected by the banking sector."

## Granger Causality Test: fluctuation of KHBVA $\rightarrow$ fluctuation of GDP

$$y_t = \beta_0 + \beta_1 y_{t-1} + \cdots + \beta_p y_{t-p} + \delta_1 x_{t-1} + \cdots + \delta_q x_{t-q} + \epsilon_t \quad (2)$$

$y_t$  : percent deviation from trend of GDP (using HP filter 1600)

$x_t$  : percent deviation from trend of KHBVA

$t$ : quarter

$(p, q)$  : determined by BIC criterion

Table 1: KHBVA  $\rightarrow$  GDP

	(1) %dev.gdp	(2) %dev.gdp
Granger F-stat		18.7
Granger p-value		0.0000
L1.%dev.gdp	1.073*** (9.87)	0.883*** (11.50)
L2.%dev.gdp	0.0234 (0.12)	0.101 (0.73)
L3.%dev.gdp	-0.291*** (-3.33)	-0.232*** (-2.94)
L1.%dev.khbva		0.0146*** (4.32)
_cons	0.00705 (0.16)	0.0118 (0.27)
<i>N</i>	109	109
<i>adjR</i> <sup>2</sup>	0.8085	0.8332

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

notes. Sample period: 1984Q1:2011Q4. '%dev.gdp' and '%dev.khbva' represent percent deviation from trend of GDP and KHBVA, respectively. 'Ln.x' represents the  $n$ -th lagged variable of  $x$ . The number of lags are determined according to BIC criterion under maximum lag of eight quarters. Newey-West  $F$  statistic (with maximum lag of 4 quarters) is used for the Granger causality test. In parentheses are Newey-West  $t$ -statistics (with maximum lag of 4 quarters).

Table 3: SNA VA  $\rightarrow$  GDP

	(1) %dev.gdp	(2) %dev.gdp
Granger F-stat		3.57
Granger p-value		0.0614
L1.%dev.gdp	1.073*** (9.87)	1.025*** (11.23)
L2.%dev.gdp	0.0234 (0.12)	0.0618 (0.37)
L3.%dev.gdp	-0.291*** (-3.33)	-0.303*** (-3.61)
L1.%dev.snava		0.0119* (1.89)
_cons	0.00705 (0.16)	0.00666 (0.15)
<i>N</i>	109	109
<i>adjR</i> <sup>2</sup>	0.8085	0.8125

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

notes. Sample period: 1984Q1:2011Q4. '%dev.gdp' and '%dev.snava' represent percent deviation from trend of GDP and SNAVA, respectively. 'Ln.x' represents the  $n$ -th lagged variable of  $x$ . The number of lags are determined according to BIC criterion under maximum lag of eight quarters. Newey-West  $F$  statistic (with maximum lag of 4 quarters) is used for the Granger causality test. In parentheses are Newey-West  $t$ -statistics (with maximum lag of 4 quarters).

### **(note) key findings from Table 1 and Table 3.**

- Table 1 demonstrates that the fluctuation of KHBVA Granger-causes that of GDP under 1% significance level. In addition, 1% point decrease in percent deviation from trend of KHBVA reduces the next period's predicted value of GDP in terms of percent deviation from trend by 0.0146% at 1% significance level.
- Table 3 shows that the fluctuation of SNAVA does not Granger-cause that of GDP under 5% significance level. In addition, although 1% point decrease in percent deviation from trend of SNAVA reduces the next period's predicted value of GDP in terms of percent deviation from trend by 0.0119%, this coefficient is not statistically different from zero under 5% significance level.
- These two findings support the previous argument that KHBVA provide more information than SNAVA regarding “what happened to banking industry during the 2008 financial crisis” and “how the aggregate activities were affected by the banking sector”.

### 3. KH Bank Productivity

#### KH Bank Productivity(KHBP)

$$V_t = z_t K_t^{\alpha_t} L_t^{1-\alpha_t} \quad (3)$$

$V_t$  : KHBVA

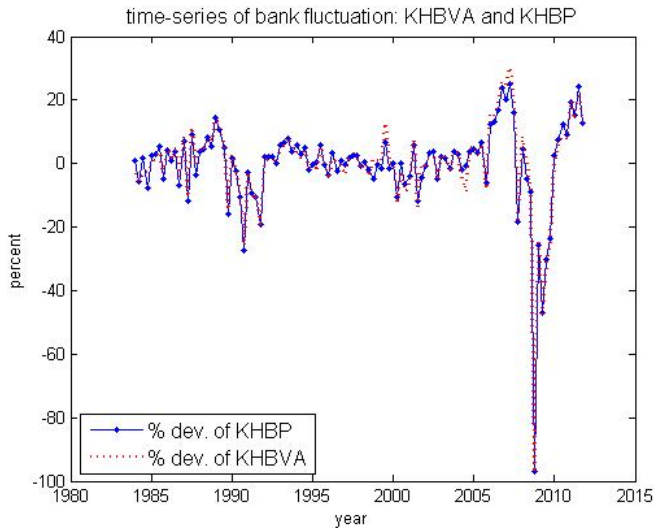
$K_t$  : quarterly total capital input

$L_t$  : quarterly total effective labor input

$\alpha_t$  : quarterly labor income share

$z_t$ : KHBP

figure 3. quarterly fluctuation of KHBV and KHBVA



**(note) key findings from figure 3.**

- Fluctuations of KHBVA mostly come from fluctuations of KHBP, and not from those of input factors(capital and labor).
- From the near congruence of these two series, it may be reasonable to infer that the statistical relationship between fluctuations of KHBVA and those of GDP is similar to that between fluctuations of KHBP and those of GDP.

# Granger Causality Test: fluctuation of KHBP → fluctuation of GDP

Table 4: KHBP → GDP

	(1) %dev.gdp	(2) %dev.gdp
Granger F-stat		17.13
Granger p-value		0.0001
L1.%dev.gdp	1.073*** (9.87)	0.899*** (11.58)
L2.%dev.gdp	0.0234 (0.12)	0.0860 (0.61)
L3.%dev.gdp	-0.291*** (-3.33)	-0.221*** (-2.71)
L1.%dev.khbp		0.0142*** (4.14)
_cons	0.00705 (0.16)	0.0127 (0.28)
<i>N</i>	109	109
<i>adj R</i> <sup>2</sup>	0.8085	0.8307

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

*notes.* Sample period: 1984Q1:2011Q4. 'dev.gdp' and 'dev.khbp' represent percent deviation from trend of GDP and KHBP(KH Bank Productivity), respectively. 'L*n*.*x*' represents the *n*-th lagged variable of *x*. The number of lags are determined according to BIC criterion under maximum lag of eight quarters. Newey-West *F* statistic (with maximum lag of 4 quarters) is used for the Granger causality test. In parentheses are Newey-West *t*-statistics (with maximum lag of 4 quarters).



**(note) key findings from Table 4.**

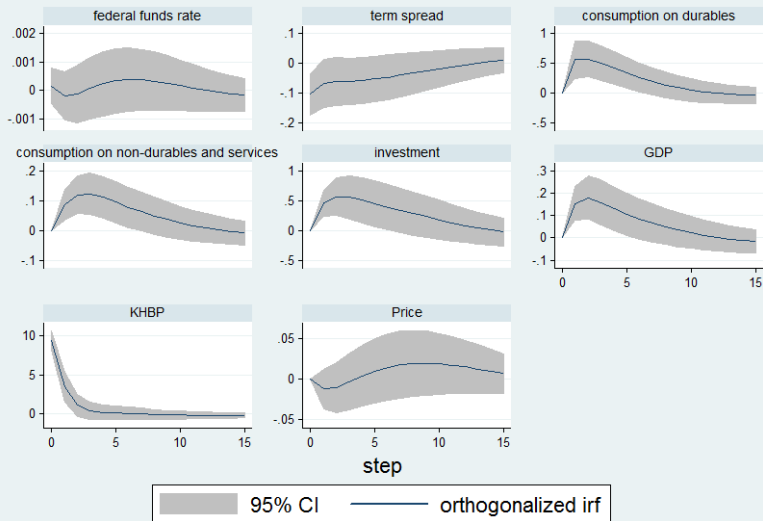
- As inferred from figure 3, the statistical relationship between fluctuations of KHBV and those of GDP is very similar to that between fluctuations of KHBVA and those of GDP.
- Table 4 demonstrates that the fluctuation of KHBVA Granger-causes that of GDP under 1% significance level. In addition, 1% point decrease in percent deviation from trend of KHBV reduces the next period's predicted value of GDP in terms of percent deviation from trend by 0.0142% at 1% significance level.

## Macroeconomic Implications of KHBP

To investigate the macroeconomic impacts of a shock to the banking productivity, we set up a VAR model by adding KHBP to a standard model.

- endogenous variables:
  - i) real private non-residential fixed investment
  - ii) real personal consumption expenditure on durable goods
  - iii) real personal consumption expenditure on non-durable goods
  - iv) real GDP
  - v) price (GDP Deflator)
  - vi) banking sector productivity (KHBP)
  - vii) term spread (10 year treasury yield - 3 month treasury yield)
  - viii) nominal effective federal funds rate
- identifying assumption : recursive ordering  
i)→ ii)→ iii)→ iv)→ v) → vi)→ vii)→ viii)
- Optimal number of lags: 1 (according to BIC criterion)

figure 4. macroeconomic implications of a shock to KHBP



impulse responses to an orthogonalized shock to KHBP

**(note) key findings from figure 4.**

- A negative orthogonalized shock to KHBP leads a prolonged and hump-shaped slumps in GDP, investment and consumption.
- A positive orthogonalized shock to KHBP reduces term spreads. This result suggests that the channel through which fluctuations of KHBP affect aggregate activities could be related to banks' supply of long-term credit.

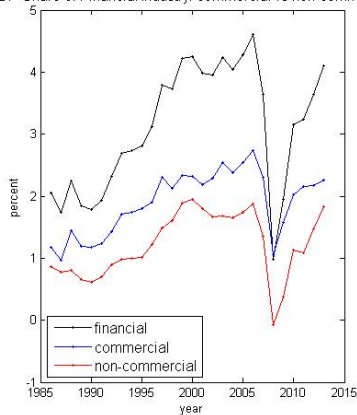
## 4. Commercial Banks vs Non-commercial Banks

### **KHBVA of Commercial Banks and Non-Commercial Banks**

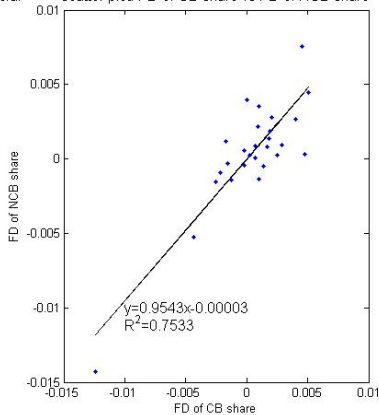
- Although it has been often pointed out that non-traditional banking business such as broker-dealer activities played an important role in initiating, amplifying and propagating the financial crisis, banks are confined to commercial banks in the previous sections due to data availability.
- To get some sense regarding the value-added distributed from the non-commercial banks, in this section we use an alternative data set from Worldscope database, which includes both commercial and non-commercial banks' financial data while the coverage is not as comprehensive as Call Report.

figure 5. yearly KHBVA: CB vs NCB

GDP Share of Financial Industry: commercial vs non-commercial



scatter plot: FD of CB share vs FD of NCB share



Data Source: Datastream Worldscope

**(note) key findings from figure 5.**

Figure 5 suggests that the influence of the non-commercial banking industry on the aggregate economy might be similar, not only qualitatively but also quantitatively, to that of the commercial banking industry.

## 5. Summary

### Summary

- We construct a productivity measure of a banking industry based on a novel method of measuring value-added using individual banks' balance sheet data. This measure reflects destroyed values of previously created capital goods as negative value-added.
- This productivity measure of a banking industry provides more information than current statistical measures regarding what happens to the banking industry and how the aggregate activities are affected by the banking sector in crisis episodes.
- Our productivity measure works as the empirical summary statistic for measuring the combined effect of various triggering and propagating mechanisms suggested in the Macro Finance literature.