Trends and Cycles in China's Macroeconomy (NBER,2016)

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Outline

Introduction

do what?

- Growth has been the **hallmark** for China.
- In recent years, however, GDP growth has **slowed down considerably** while countercyclical government policy has taken center stage.
- Four trillion RMBs into investment to combat the sharp fall of output growth.

lack of empirical research:

- the basic facts about the trends and cycles of China's macroeconomy.
- a theoretical framework that is capable of explaining these facts.

Task:

- Chinese data
- econometric methodology: document China's trend and cyclical patterns.
- theoretical framework: account for the unique patterns of trend and cycle.

Introduction

Facts

The key trend facts are:

- T1 A rise of the investment-to-output ratio and a fall of the consumption-to-output ratio.
- T2 A decline of the labor share of income.
- T3 An increase in the ratio of long-term loans to short-term loans.
- T4 A rise in the ratio of capital in heavy industries to capital in light industries.
- T5 An increase in the ratio of total revenues in heavy industries to those in light industries.

The key cyclical patterns are:

- C1 Weak or negative comovement between aggregate investment and consumption.
- C2 Weak or negative comovement between aggregate investment and labor income.
- C3 A negative comovement between long-term loans and short-term loans.

Construction of Macroeconomic Time Series

Construction data

Question!

- The NBS reports **only percentage changes** of certain key macroeconomic variables such as real GDP.
- Many variables, such as **investment** and **consumption**, **do not even have quarterly data** that are publicly available.
- Even for the annual data, the breakdown of the nominal GDP by expenditure is incomplete.
- But other categories, such as investment in the state-owned sector and investment in the nonstate-owned sector, are unavailable.
- ....

Motivative:

- The most urgent data problem, in our view, is the absence of a **standard set of annual and quarterly macroeconomic time series** comparable to those commonly used in the macroeconomic literature on Western economies.
- Our goal is to provide as **accurately** as possible the series of GDP and other key variables.

Construction of Macroeconomic Time Series

Core Time Series

Table 1
Annual GDP Series and Its Subcomponents

Year	GDP	C	I	Govt.	Nex	C	I	Govt.	Nex
			Billion RMB				Percent of GDP		
1980	459.3	233.1	160.0	67.7	−1.5	50.8	34.8	14.7	−0.3
1981	500.9	262.8	163.0	73.4	1.7	52.5	32.5	14.6	0.3
1982	559.0	290.3	178.4	81.2	9.1	51.9	31.9	14.5	1.6
1983	621.6	323.1	203.9	89.5	5.1	52.0	32.8	14.4	0.8
1984	736.3	374.2	251.5	110.4	0.1	50.8	34.2	15.0	0.0
1985	907.7	468.7	345.8	129.9	−36.7	51.6	38.1	14.3	−4.0
1986	1,050.8	530.2	394.2	152.0	−25.5	50.5	37.5	14.5	−2.4
1987	1,227.7	612.6	446.2	167.8	1.1	49.9	36.3	13.7	0.1
1988	1,538.9	786.8	570.0	197.1	−15.1	51.1	37.0	12.8	−1.0
1989	1,731.1	881.3	633.3	235.2	−18.6	50.9	36.6	13.6	−1.1
1990	1,934.8	945.1	674.7	264.0	51.0	48.8	34.9	13.6	2.6
1991	2,257.7	1,073.1	786.8	336.1	61.8	47.5	34.8	14.9	2.7
1992	2,756.5	1,300.0	1,008.6	420.3	27.6	47.2	36.6	15.2	1.0
1993	3,693.8	1,641.2	1,571.8	548.8	−68.0	44.4	42.6	14.9	−1.8
1994	5,021.7	2,184.4	2,034.1	739.8	63.4	43.5	40.5	14.7	1.3
1995	6,321.7	2,837.0	2,547.0	837.9	99.9	44.9	40.3	13.3	1.6
1996	7,416.4	3,395.6	2,878.5	996.4	145.9	45.8	38.8	13.4	2.0
1997	8,165.9	3,692.2	2,996.8	1,121.9	355.0	45.2	36.7	13.7	4.3
1988	8,653.2	3,922.9	3,131.4	1,235.9	362.9	45.3	36.2	14.3	4.2
1999	9,112.5	4,192.0	3,295.2	1,371.7	253.7	46.0	36.2	15.1	2.8
2000	9,874.9	4,585.5	3,484.3	1,566.1	239.0	46.4	35.3	15.9	2.4
2001	10,902.8	4,943.6	3,976.9	1,749.8	232.5	45.3	36.5	16.0	2.1
2002	12,047.6	5,305.7	4,556.5	1,876.0	309.4	44.0	37.8	15.6	2.6
2003	13,661.3	5,765.0	5,596.3	2,003.6	296.5	42.2	41.0	14.7	2.2
2004	16,095.7	6521.8	6,916.8	2,233.4	423.6	40.5	43.0	13.9	2.6
2005	18,742.3	7,295.9	7,785.7	2,639.9	1,020.9	38.9	41.5	14.1	5.4
2006	22,271.3	8,257.5	9,295.4	3,052.8	1,665.5	37.1	41.7	13.7	7.5
2007	26,659.9	9,633.2	11,094.3	3,590.0	2,342.3	36.1	41.6	13.5	8.8
2008	31,597.5	11,167.0	13,832.5	4,175.2	2,422.7	35.3	43.8	13.2	7.7
2009	34,877.5	12,358.5	16,446.3	4,569.0	1,503.7	35.4	47.2	13.1	4.3
2010	40,281.6	14,075.9	19,360.4	5,335.6	1,509.8	34.9	48.1	13.2	3.7
2011	47,261.9	16,895.7	22,834.4	6,315.5	1,216.3	35.7	48.3	13.4	2.6
2012	52,939.9	19,058.5	25,277.3	7,140.9	1,463.2	36.0	47.7	13.5	2.8
2013	58,667.3	21,218.8	28,035.6	7,997.8	1,415.1	36.2	47.8	13.6	2.4

Note: "C" stands for household consumption, "I" for gross capital formation (aggregate investment), "Govt" for government consumption, and "Nex" for net exports.

Construction of Macroeconomic Time Series
Structural Switches

Table 2
Chronology of Structural Switches

Dates	Major structural changes
December 1978	Introduction of economic reforms
Early 1990s	Price controls and rationing
Beginning of 1992	Advancing of Deng Xiaoping's economic reforms
January 1994	Ending of the two-tiered foreign exchange system
1994	Major tax reforms and devaluation of RMB
1995–1996	Phased out price controls and rationing
1995	Enacted People's Bank of China law and other banking laws with decentralization of the banking system
March 1996	***Strategic plan to develop infrastructure and other heavy industries***
July 1997	Asian financial crisis started in Thailand
November 1997	Beginning of the privatization
November 2001	Joined the WTO and trade liberalization
July 2005	Ending of the explicit peg to the USD
September 2008	US and world-wide financial crisis
2009–2010	Fiscal stimulus of 4 trillion RMB investment

Construction of Macroeconomic Time Series

Core Time Series

Table 3
Annual GDP Series and Further Breakdowns (billion RMB)

Year	GDP	C	SOE	POE	HH I	Govt. C	Nex	Invty
1995	6,321.7	2,837.0	926.8	810.7	351.0	837.9	99.9	458.5
1996	7,416.4	3,395.6	1,016.6	963.4	424.8	996.4	145.9	473.7
1997	8,165.9	3,692.2	1,090.9	1,032.8	472.8	1,121.9	355.0	400.3
1998	8,653.2	3,922.9	1,215.7	1,086.8	554.4	1,235.9	362.9	274.5
1999	9,112.5	4,192.0	1,263.5	1,156.5	632.7	1,371.7	253.7	242.4
2000	9,874.9	4,585.5	1,289.2	1,345.9	749.3	1,566.1	239.0	99.8
2001	10,902.8	4,943.6	1,324.2	1,549.7	901.5	1,749.8	232.5	201.5
2002	12,047.6	5,305.7	1,409.3	1,927.4	1,026.4	1,876.0	309.4	193.3
2003	13,661.3	5,765.0	1,525.6	2,504.5	1,318.9	2,003.6	296.5	247.2
2004	16,095.7	6,521.8	1,654.4	3,155.2	1,702.1	2,233.4	423.6	405.1
2005	18,742.3	7,295.9	1,695.7	3,577.1	2,150.5	2,639.9	1,020.9	362.4
2006	22,271.3	8,257.5	2,055.1	4,728.6	2,011.7	3,052.8	1,665.5	500.0
2007	26,659.9	9,633.2	2,327.6	5,839.3	2,228.0	3,590.0	2,342.3	699.5
2008	31,597.5	11,167.0	2,928.3	7,388.3	2,491.8	4,175.2	2,422.7	1,024.1
2009	34,877.5	12,358.5	3,892.9	8,571.1	3,204.0	4,569.0	1,503.7	778.3
2010	40,281.6	14,075.9	4,388.6	10,156.8	3,816.1	5,335.6	1,509.8	998.9
2011	47,261.9	16,895.7	4,323.5	11,855.9	5,388.7	6,315.5	1,216.3	1,266.2
2012	52,939.9	19,058.5	4,708.6	13,460.3	6,006.8	7,140.9	1,463.2	1,101.6
2013	58,667.3	21,218.8	4,991.9	15,111.7	6,803.3	7,997.8	1,415.1	1,128.1

Note: "C" stands for household consumption, "SOE" for the SOE portion of gross fixed capital formation, "POE" for the POE portion of gross fixed capital formation, "HH I" for household investment, "Govt C" for government consumption, "Nex" for net exports, and "Invty" for changes of inventories.

Table 4
Detailed GDP Subcomponents as Percent of GDP

Year	C	SOE	POE	HH I	Govt. C	Nex	Invty
1995	44.9	14.7	12.8	5.6	13.3	1.6	7.3
1996	45.8	13.7	13.0	5.7	13.4	2.0	6.4
1997	45.2	13.4	12.6	5.8	13.7	4.3	4.9
1998	45.3	14.0	12.6	6.4	14.3	4.2	3.2
1999	46.0	13.9	12.7	6.9	15.1	2.8	2.7
2000	46.4	13.1	13.6	7.6	15.9	2.4	1.0
2001	45.3	12.1	14.2	8.3	16.0	2.1	1.8
2002	44.0	11.7	16.0	8.5	15.6	2.6	1.6
2003	42.2	11.2	18.3	9.7	14.7	2.2	1.8
2004	40.5	10.3	19.6	10.6	13.9	2.6	2.5
2005	38.9	9.0	19.1	11.5	14.1	5.4	1.9
2006	37.1	9.2	21.2	9.0	13.7	7.5	2.2
2007	36.1	8.7	21.9	8.4	13.5	8.8	2.6
2008	35.3	9.3	23.4	7.9	13.2	7.7	3.2
2009	35.4	11.2	24.6	9.2	13.1	4.3	2.2
2010	34.9	10.9	25.2	9.5	13.2	3.7	2.5
2011	35.7	9.1	25.1	11.4	13.4	2.6	2.7
2012	36.0	8.9	25.4	11.3	13.5	2.8	2.1
2013	36.2	8.5	25.8	11.6	13.6	2.4	1.9

Note: "C" stands for household consumption, "SOE" for the SOE portion of gross fixed capital formation, "POE" for the POE portion of gross fixed capital formation, "HH I" for household investment, "Govt C" for government consumption, "Nex" for net exports, and "Invty" for changes of inventories.

Construction of Macroeconomic Time Series

Core Time Series-year

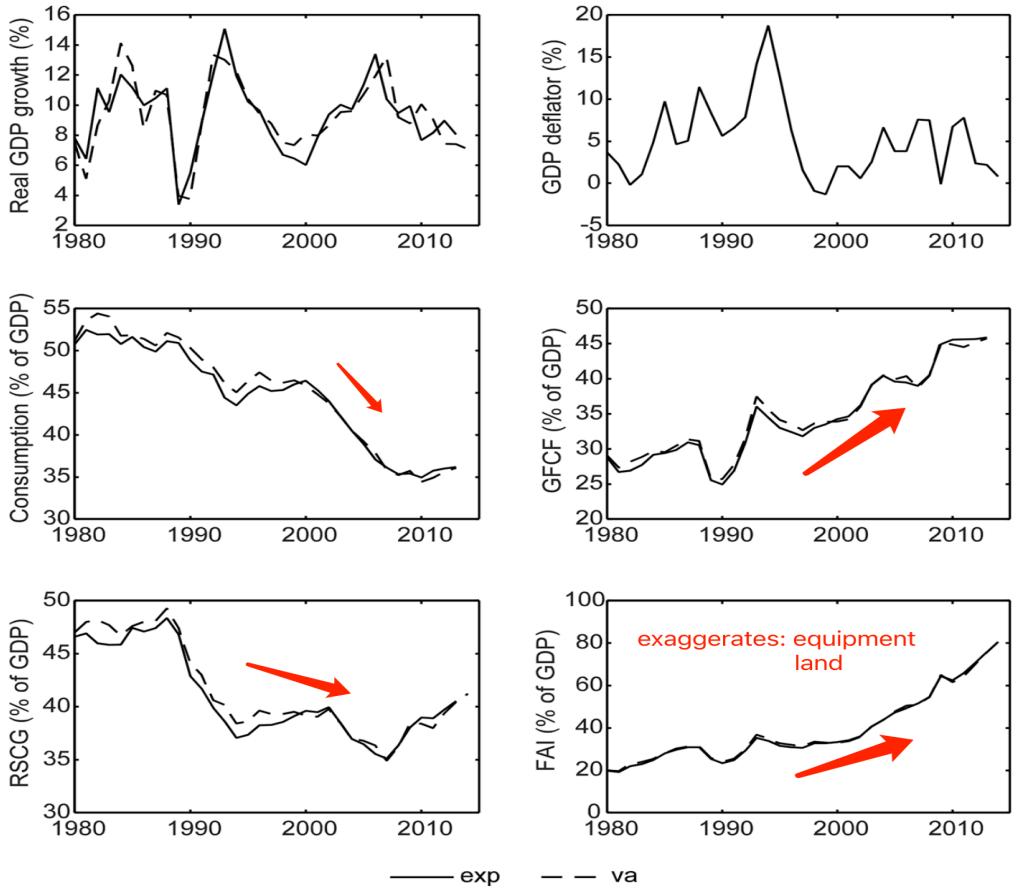


Fig. 2. Time-series history of trends and cycles in China's macroeconomy: annual data
Note: "Consumption" stands for household consumption, "GFCF" stands for gross fixed capital formation, "RSCG" stands for the retail sales of consumer goods, and "FAI" stands for fixed-asset investment. The legend "exp" means that GDP is measured by expenditure and "va" means that GDP is measured by value added.

Construction of Macroeconomic Time Series

Core Time Series-quarterly

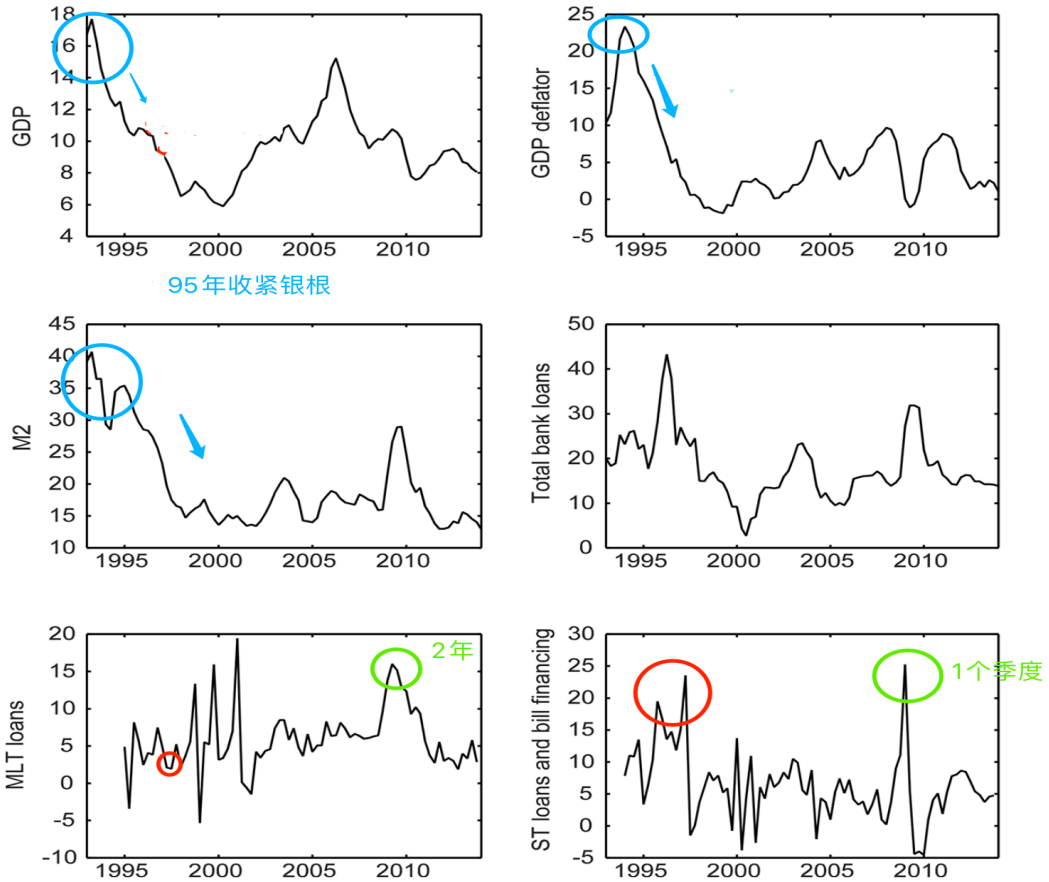


Fig. 3. The top first two rows: year-over-year growth rates (%) of key quarterly time series; the bottom row: quarterly variables as a percent of GDP.

Note: Total bank loans are deflated by the implicit GDP deflator. "MLT loans" stands for medium- and long-term bank loans to nonfinancial firms and "ST loans and bill financing" stands for short-term bank loans and bill financing to nonfinancial firms.

III. Econometric Evidence

Doing

Separating cyclical behavior from trend behavior is inherently a daunting task.

i follow King et al.(1991) and develop a Bayesian reduced-rank time-series method to separate trend and cycle components.

ii we use other empirical methods outlined in Section IV to build robustness of the findings uncovered in this section.

A number of economic reforms

- displayed in table 2.
- switching points for either volatility or trend changes.
- we use Sims, Waggoner, and Zha's (2008) regime-switching (VAR) methodology.

III. Econometric Evidence

Results

We estimate a number of six-variable, time-varying quarterly BVAR models with five lags and the sample 1997Q1—2013Q4.

- four variables are log values of
  - real household consumption, real total business investment, real GDP, and real labor income.
- two variables are the ratio of
  - new medium- and long-term bank loans to GDP and the ratio of new short-term bank loans and bill financing to GDP.

For benchmark BVAR, the estimated correlation between stationary components of (the cyclical part)

- investment and consumption is -0.05.
- investment and labor income is -0.23.
- short-term loans and long-term loans is -0.51.

III. Econometric Evidence

Results

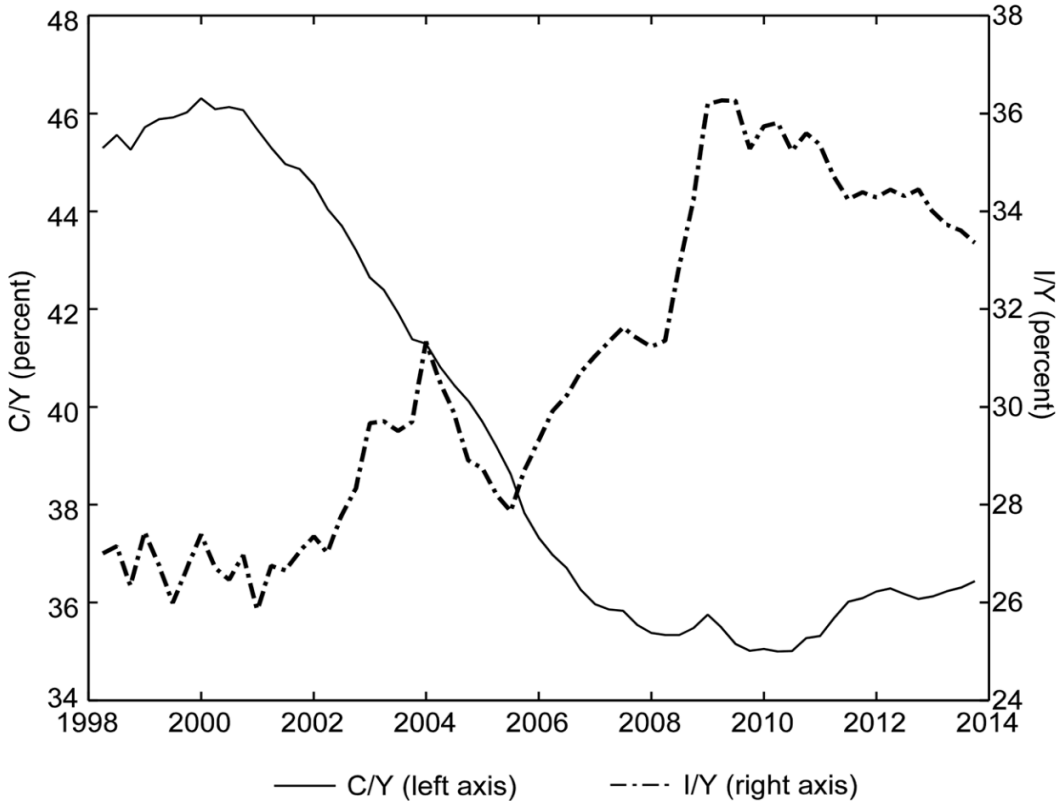


Fig. 1. Trend patterns of household consumption and business investment, estimated from the six-variable regime-switching BVAR model.

IV. Robust Empirical Evidence

Two ways:

i we cross verify the previous findings using the **annual** data.

ii we apply the **HP filter** to the relevant variables to verify the **cyclical patterns** previously obtained.

IV. Robust Empirical Evidence

The trend patterns, reported in figure 1, are confirmed by the raw annual data displayed in figure 5.

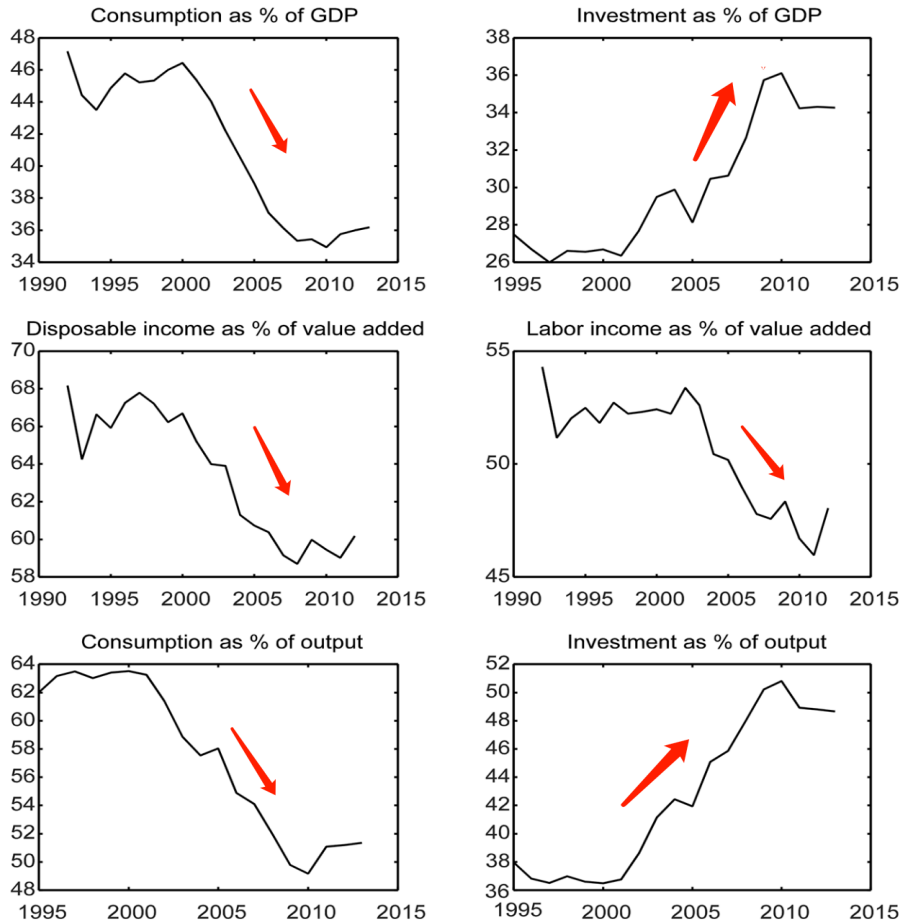


Fig. 5. Annual data: trend patterns for household consumption, investment, GDP, household disposable income, and household labor income.

IV. Robust Empirical Evidence

The time series of the moving 10-year-window correlations of annual growth rates between household consumption (C) and gross fixed capital formation (GFCF).

- trends and cycles

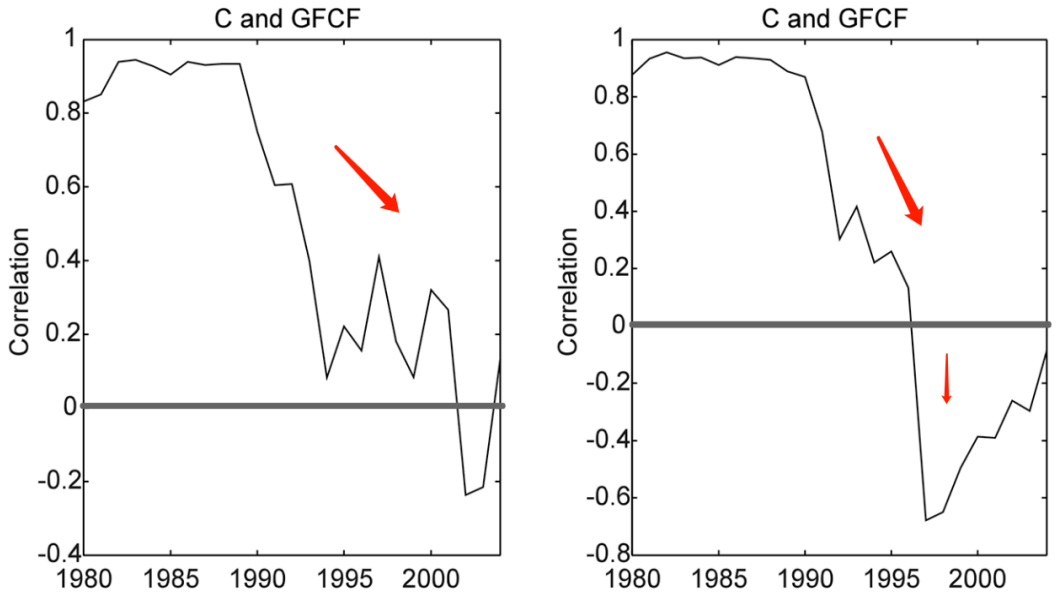


Fig. 6. Time series of correlations using the 10-year moving window

Note: The left-hand graph represents the correlation of annual growth rates. The right-hand graph represents the correlation of HP-filtered log annual values.

IV. Robust Empirical Evidence

This pattern is further confirmed by various 10-year, moving-window correlations of the HP-filtered annual data as reported in figure 7.

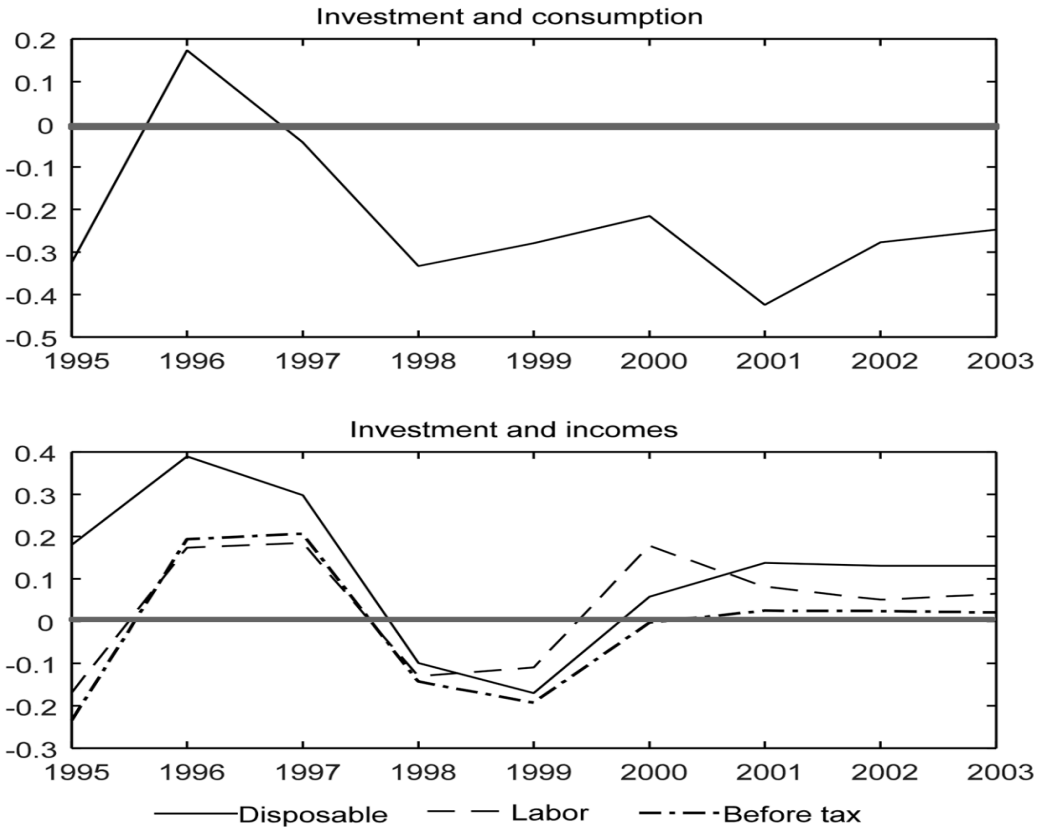


Fig. 7. Correlations between HP-filtered log annual series using the moving window of 10 years

IV. Robust Empirical Evidence
Puzzle or Challenging

Kiyotaki and Moore (1997):

- a credit expansion triggers demand for investment and increases the interest rate.
  - An increase in investment tends to increase household disposable income as well as savings.
  - not just a **positive but also a strong correlation** between investment and household income.
  - This is **inconsistent** with the fact presented in figure 7.

V. China in Transition

Facts

Since March 1996, the government has been actively promoting

- heavy industries
  - big capital-intensive industries such as telecommunication, energy, and metal products.
- light industries
  - do not receive the same preferential treatment

Table 2 lists a number of major economic reforms.

- These reforms we focus on the two most important dimensions of the transition.

i state-owned versus privately owned firms, has been extensively studied in the literature on China.

ii the heavy versus light sectors, is a new and enlightening angle that we argue is most helpful to an understanding of trends and cycles in China's aggregate economy.

V. China in Transition
A. SOEs versus POEs

The Chinese economy has undergone two kinds of reforms in SOEs simultaneously, the so-called "**grasp the large and let go of the small.**"

- One transition is **privatization** that allows many SOEs previously engaged in unproductive labor-intensive industries to be privatized.
- The other reform is a gradual **concentration** of SOEs in **heavy industries**, such as petroleum, commodities, electricity, water, and gas.

V. China in Transition

39 two-digit industries.

Table 6
Industry identifiers

Identifier	Industry
1	Mining and washing of coal
2	Extraction of petroleum and natural gas
3	Mining and processing of ferrous metal ores
4	Mining and processing of nonferrous metal ores
5	Mining and processing of nonmetal ores
6	Mining of other ores
7	Processing of food from agricultural products
8	Food
9	Wine, beverage, and refined tea
10	Tobacco
11	Textile
12	Textile product, garment, shoes, and hat
13	Leather, fur, feather, and its product
14	Wood processing, wood, bamboo, rattan, palm, and grass product
15	Manufacture of furniture
16	Manufacture of paper and paper products
17	Printing, reproduction of recording media
18	Cultural, education, and sport
19	Processing of petroleum, coking, processing of nuclear fuel
20	Chemical material and products
21	Manufacture of medicines (pharmaceutical)
22	Manufacture of chemical fibers
23	Manufacture of rubber
24	Manufacture of plastics
25	Manufacture of nonmetallic mineral products
26	Smelting and pressing of ferrous metals
27	Smelting and pressing of nonferrous metals
28	Manufacture of metal products
29	Manufacture of general purpose machinery
30	Manufacture of special purpose machinery
31	Manufacture of transport equipment
32	Manufacture of electrical machinery and equipment
33	Computer, communication and other electronic equipment
34	Instrument, meter, culture and office machinery
35	Manufacture of artwork and other manufacturing
36	Recycling and disposal of waste
37	Electricity, heat production and supply
38	Gas production and supply
39	Water production and supply

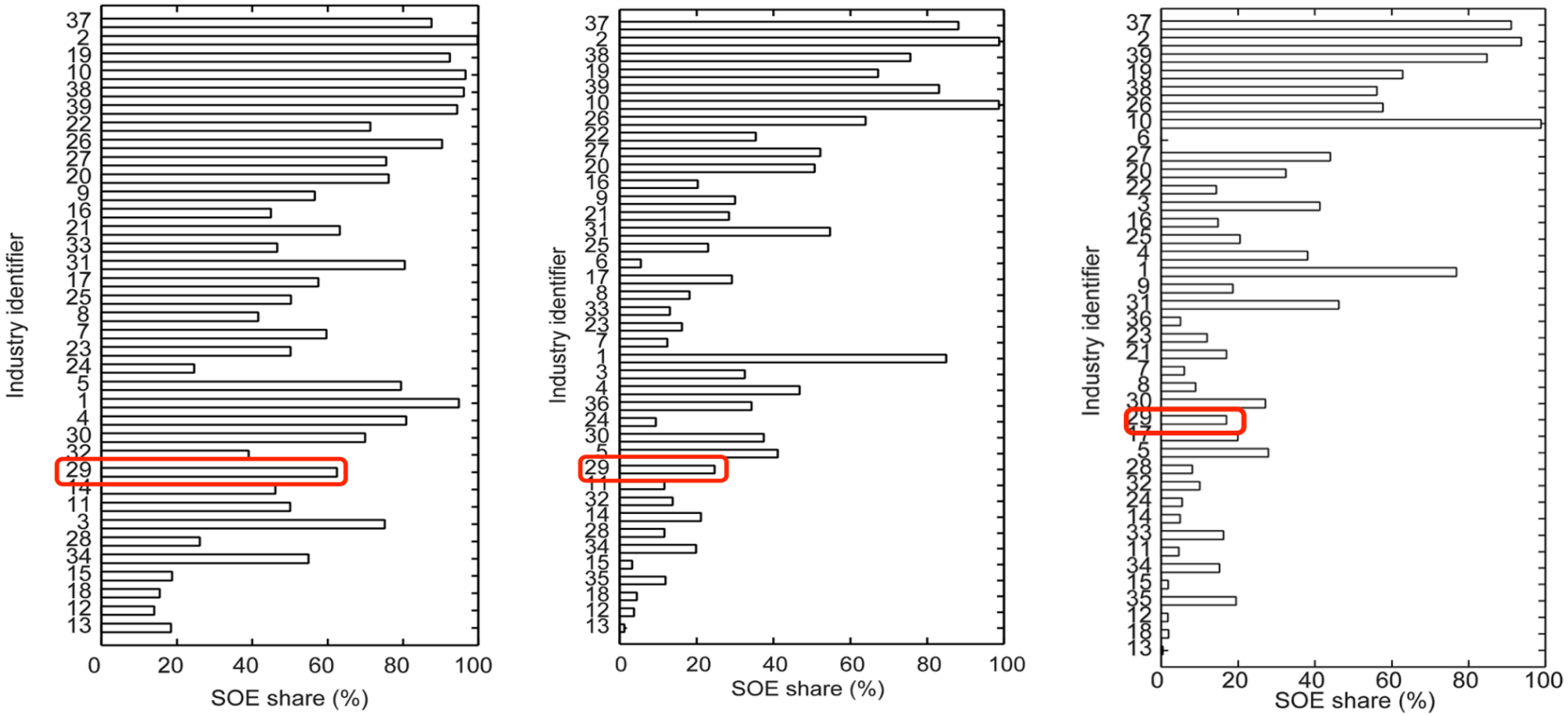
V. China in Transition
A. SOEs versus POEs

Compute the **capital-labor** ratio for each industry to measure the capital intensity.

Table 7
Weights and Capital-Intensity Ranks for Various Industries

	1999		2006		2011	
Industry Identifier	Weight (%) by Value added	Capital Intensity Rank	Weight (%) by Value Added	Capital Intensity Rank	Weight (%) by Gross Output	Capital Intensity Rank
1	2.66	23	3.93	22	3.42	16
2	6.77	2	6.57	2	1.52	2
3	0.25	30	0.64	23	0.93	12
4	0.59	24	0.74	24	0.59	15
5	0.55	22	0.41	28	0.45	27
6	n/a	n/a	0.00	16	0.00	8
7	3.59	19	3.83	21	5.22	22
8	1.62	18	1.61	18	1.66	23
9	2.76	11	1.58	12	1.40	17
10	4.20	4	2.61	6	0.80	7
11	5.26	29	4.35	30	3.86	33
12	2.38	35	2.01	38	1.60	37
13	1.33	36	1.28	39	1.05	39
14	0.62	28	0.75	32	1.06	31
15	0.36	33	0.55	35	0.60	35
16	1.67	12	1.52	11	1.43	13
17	0.93	16	0.61	17	0.45	26
18	0.66	34	0.51	37	0.38	38
19	2.78	3	2.54	4	4.36	4
20	5.73	10	5.92	10	7.20	10
21	2.42	13	1.98	13	1.76	21
22	1.19	7	0.66	8	0.79	11
23	0.95	20	0.78	20	0.86	20
24	1.82	21	1.83	26	1.84	30
25	4.73	17	4.01	15	4.75	14
26	5.09	8	7.69	7	7.58	6
27	1.90	9	3.51	9	4.25	9
28	2.54	31	2.44	33	2.76	28
29	3.50	27	4.17	29	4.85	25
30	2.43	25	2.52	27	3.09	24
31	5.62	15	5.41	14	7.49	18
32	4.72	26	5.07	31	6.09	29
33	6.35	14	7.77	19	7.55	32
34	0.85	32	1.06	34	0.90	34
35	n/a	n/a	0.77	36	0.85	36
36	n/a	n/a	0.10	25	0.31	19
37	10.18	1	7.58	1	5.60	1
38	0.17	5	0.21	3	0.37	5
39	0.68	6	0.34	5	0.13	3

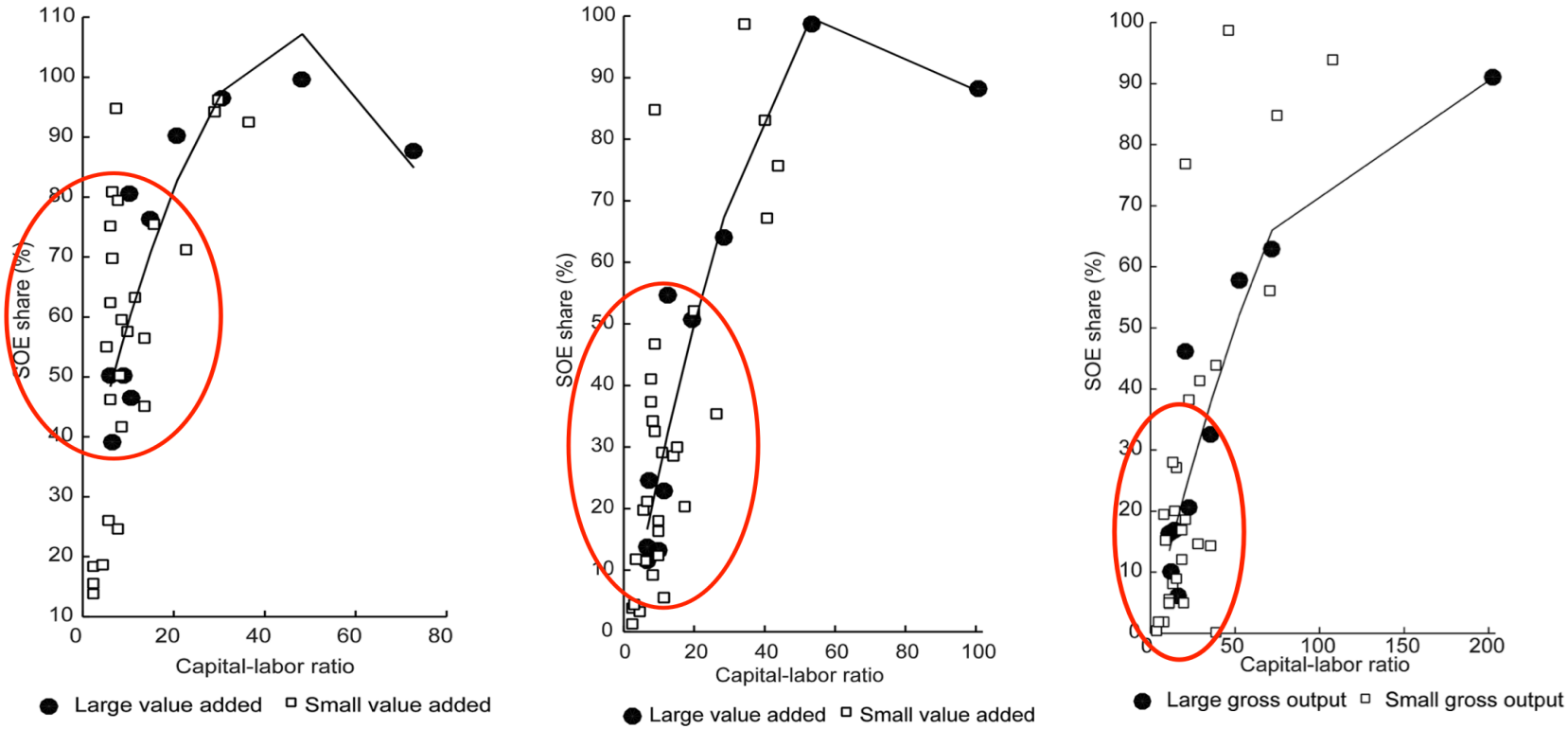
V. China in Transition
A. SOEs versus POEs



1996 2006 2011

Fig.8-10 characteristics of various industries in China.

V. China in Transition
A. SOEs versus POEs



1996 2006 2011

Fig.8-10 characteristics of various industries in China.

V. China in Transition
A. SOEs versus POEs

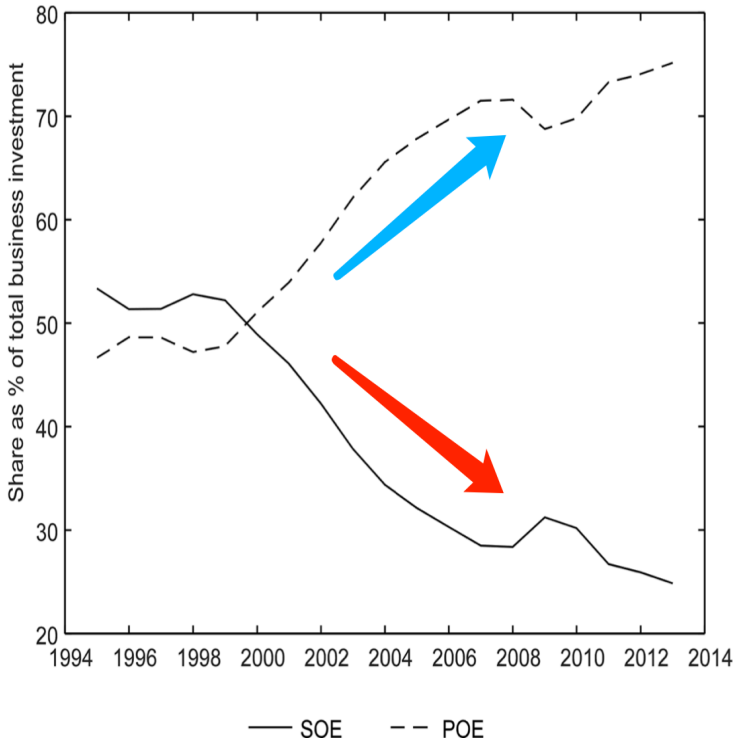


Fig. 11. The share of SOE investment and POE investment as a percent of total business investment, where total business investment equals the sum of SOE investment and POE investment.

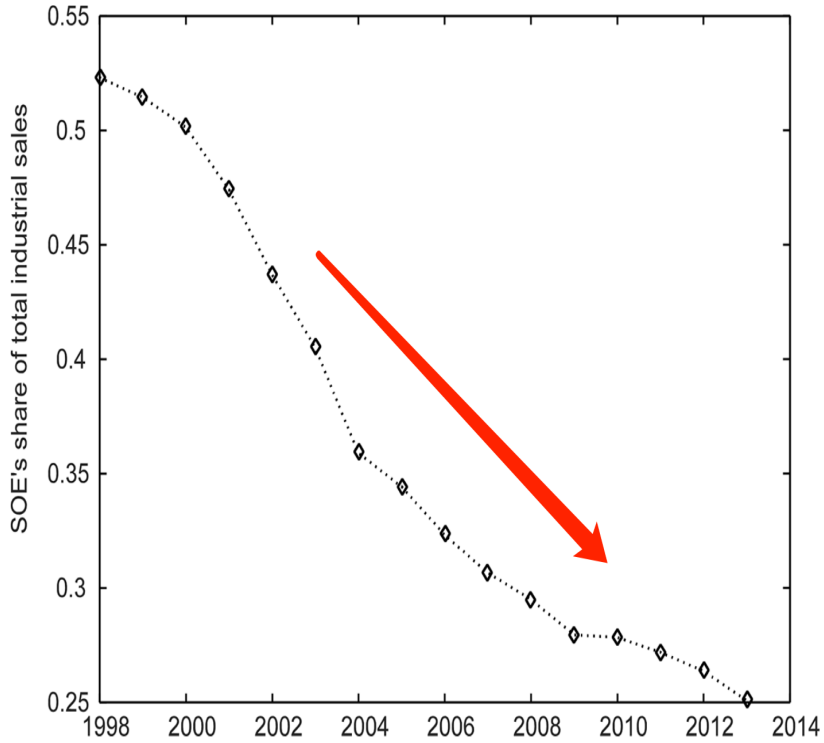


Fig. 12. The ratio of sales revenue in the SOEs to the total sales revenue in all industrial firms.

The SOE-POE classification does not naturally lead up to an explanation of the steady rise of investment as a share of total output (fact [T1]).

V. China in Transition
B. Heavy versus Light Sectors

Place instead: the heavy and light sectors

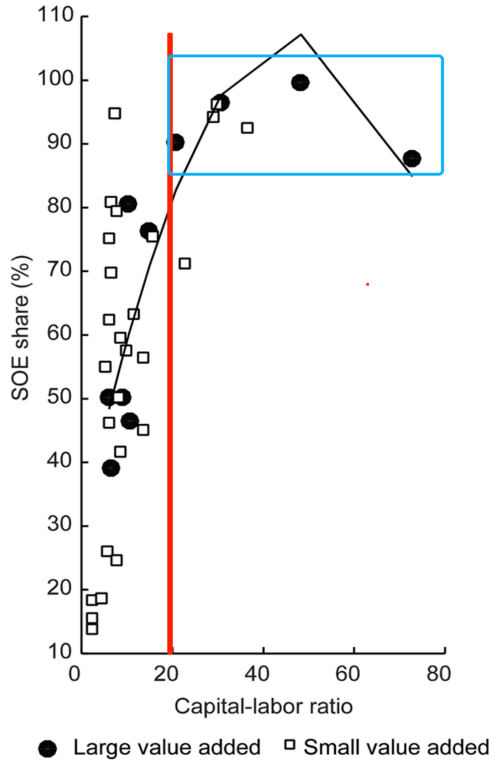
Why use the heavy and light sectors?

National Economic and Social Development and Ninth Five-Year Program: set up a policy goal to adjust the industrial structure for the next 15 years(96-10)

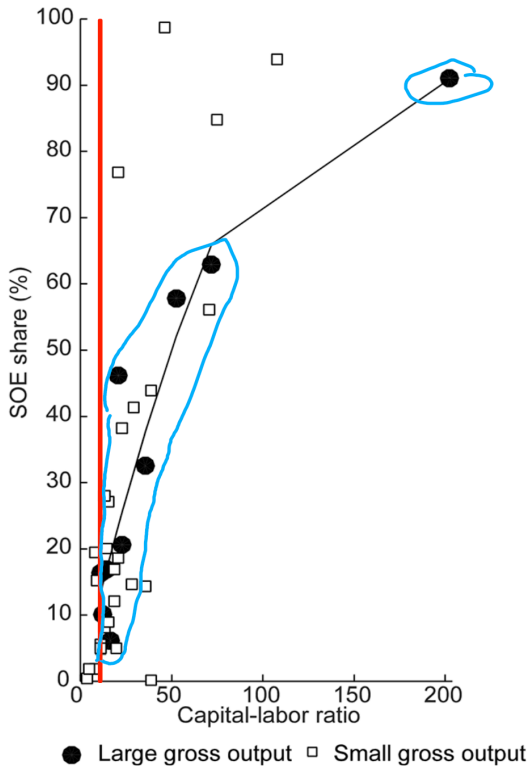
- strengthening the infrastructure
  - transportation and telecommunication—information transmission
- basic industries
  - electricity, coal, petroleum processing, natural gas, smelting and pressing of ferrous and nonferrous metals, and chemical industry
- boosting pillar industries
  - electrical machinery, petroleum processing, automobile, and real estate
- invigorating and actively developing the tertiary industry.

V. China in Transition

B. Heavy versus Light Sectors



1996



2011

Fig.8 and 10 characteristics of various industries in China.

V. China in Transition
B. Heavy versus Light Sectors

The reallocation (between-sector) effect, relative to the sector-specific (within- sector) effect, on the overall investment rate is calculated as

$$\frac{\bar{i}^l P_t^l Y_t^l + \bar{i}^k P_t^k Y_t^k}{P_t^l Y_t^l + P_t^k Y_t^k} - \frac{i_t^l \overline{P^l Y^l} + i_t^k \overline{P^k Y^k}}{\overline{P^l Y^l} + \overline{P^k Y^k}}$$

- The relative reallocation effect is an increase of 16.8 percentage points.(1997-2007)
- the relative reallocation effect is an increase of 11.1 percentage points.(2007-2011).
- These findings provide solid evidence about the importance of a **between-sector contribution** to the rise of the investment rate discussed in Sections III.D and IV and displayed in **figures 1 and 5.**

V. China in Transition
B. Heavy and Light Sectors vs SOE and POE

Firms in the heavy sector are a **mix of SOEs and POEs (especially large POEs).**

- there has been a trend for more large private firms (whose sales are all above 500 million RMB) to engage in heavy industries.

As China's economic reforms deepen, the government no longer adheres to the practice of favoring SOEs and bias against POEs.

- Medium- and long-term bank loans treat large firms symmetrically no matter whether they are SOEs or POEs;
- **labor-intensive firms, most of which tend to be small, have a difficult time obtaining loans**
  - heavy-industry firms to gain easy access to bank loans is the firms'ability to use their fixed assets for collateralizing the loans.

V. China in Transition
C. Aggregate Economy

How important is the rise of the investment-output ratio to GDP growth?

Table 8
Growth Accounting of China's Economy

Growth Rate (in Percent)	1978–1998	1998–2011	1998–2007
GDP per worker	6.78	9.48	9.42
capital per worker	3.56	7.00	6.13
TFP	3.23	2.48	3.29
Contribution by capital deepening	52.4%	73.9%	65.1%

Note: The computation uses the value of the capital share set at 0.5 as in SSZ and Brandt and Zhu 2010.

this investment-driven growth has negative consequences on consumption and labor income, which has caused concern for the Chinese government

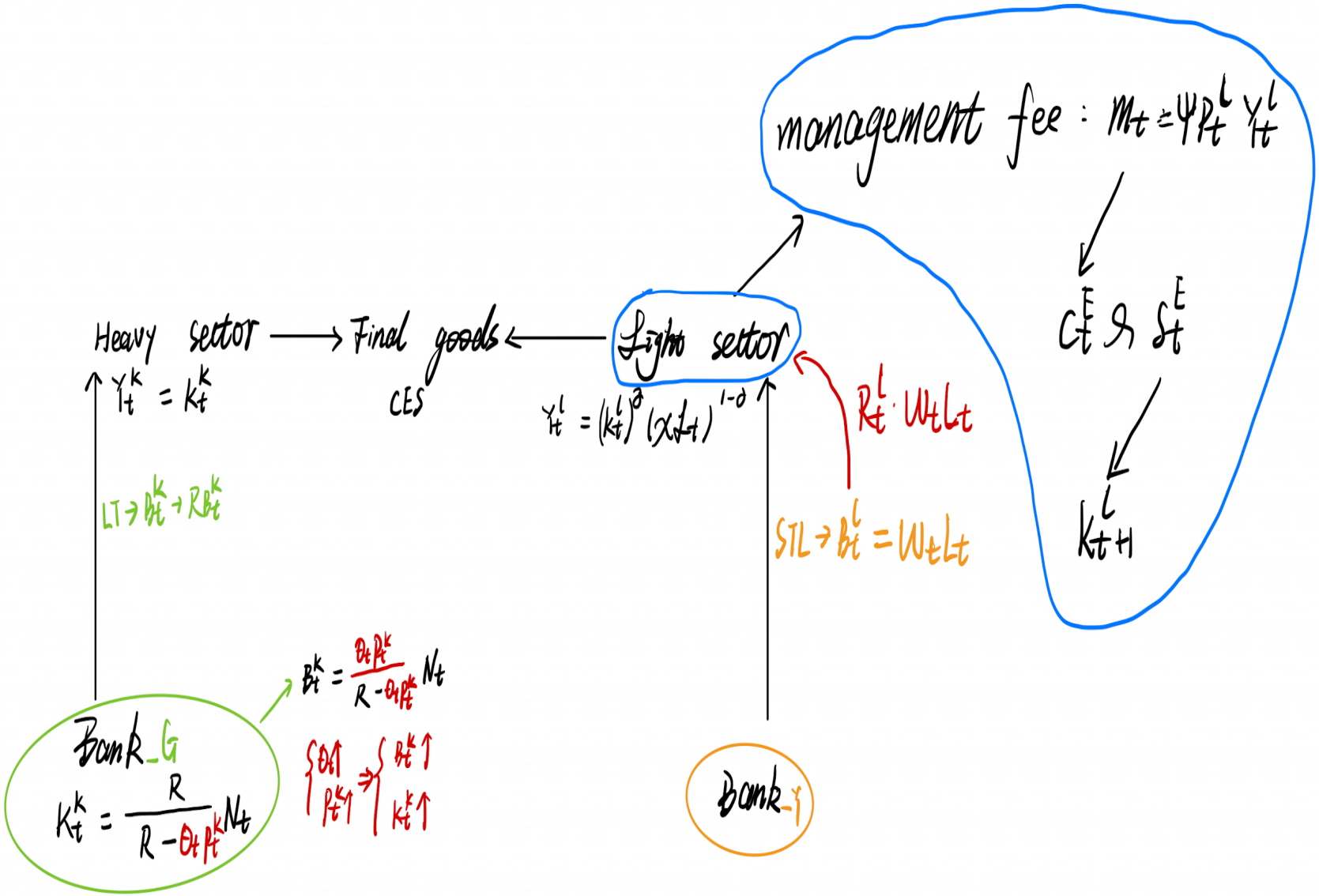
VI. The Theoretical Framework

A. Environment I

- Two-period lived agents with overlapping generations (OLGs).
- Agents work when young and consume their savings when old.
- Agents have heterogeneous skills.
  - Half of the population consists of workers without entrepreneurial skills and the other half is composed of entrepreneurs.
  - Entrepreneurial skills are inherited from parents.

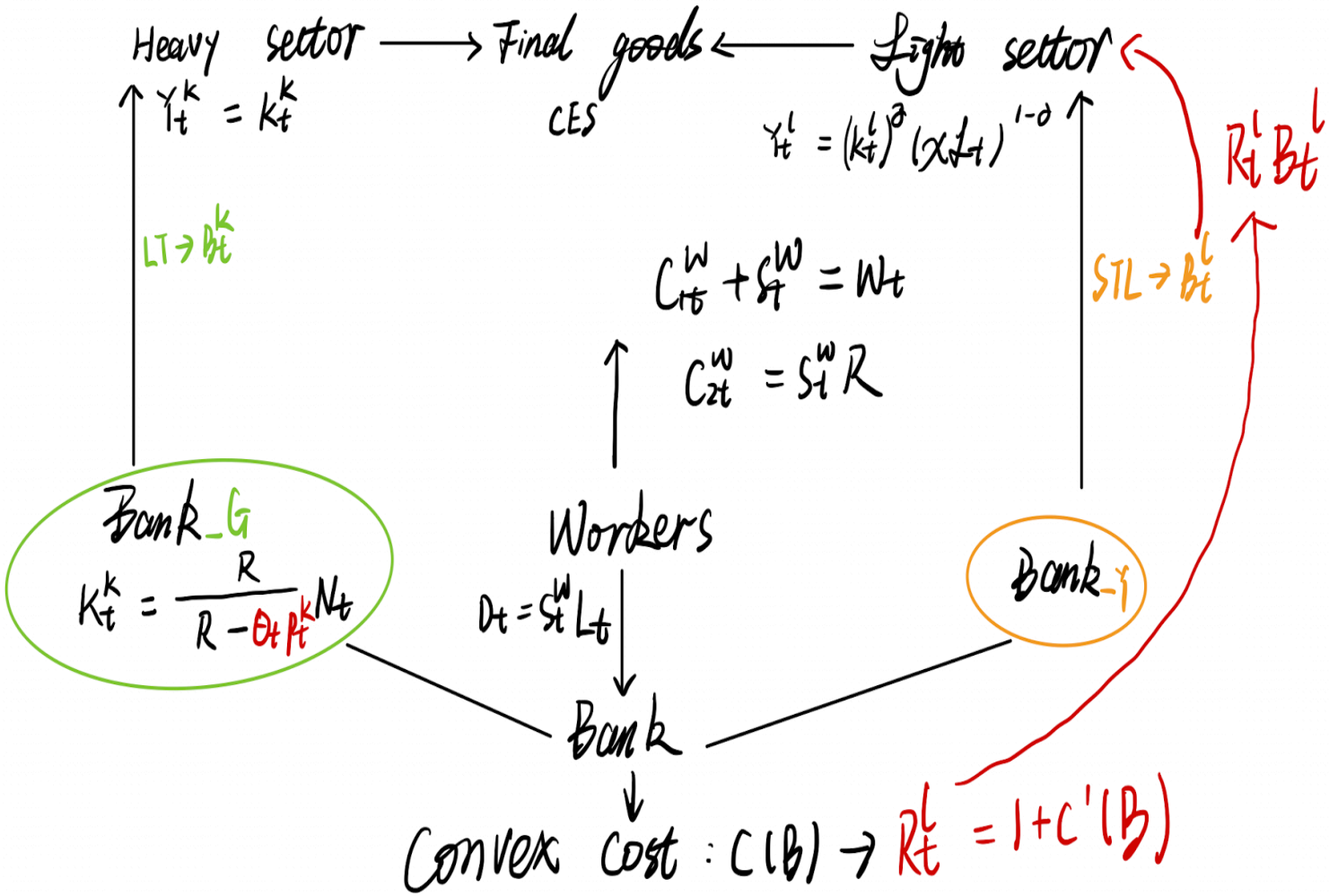
VI. The Theoretical Framework

A. Environment II



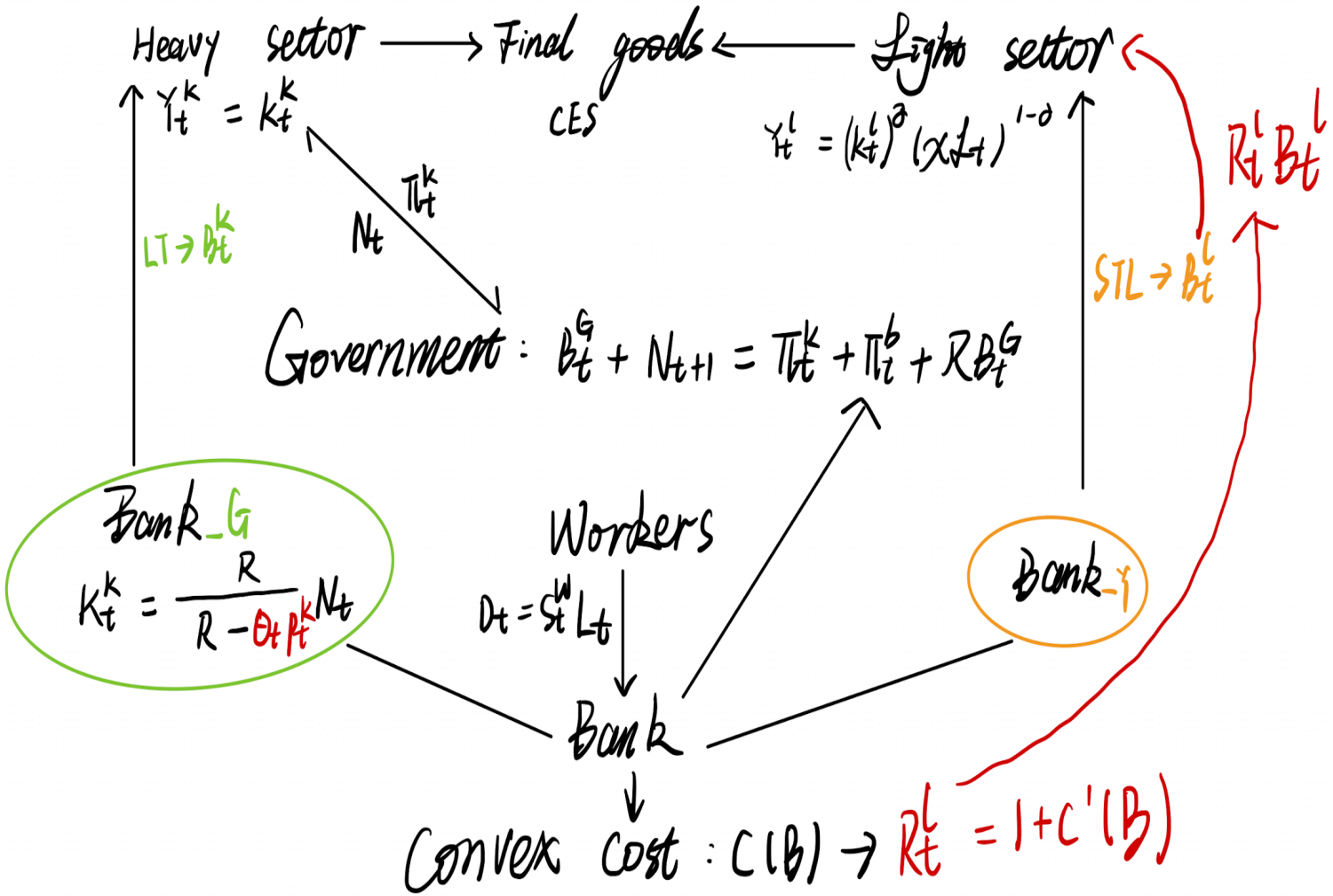
VI. The Theoretical Framework

A. Environment III



VI. The Theoretical Framework

A. Environment IV



VI. The Theoretical Framework
B. Technology

"K-firms"stands for capital-intensive:

$$Y_t^k = K_t^k$$

"L-firms"are labor intensive:

$$Y_t^l = \left(K_t^l\right)^{\alpha} \left(\chi L_t\right)^{1-\alpha}$$

The production of final goods is a CES aggregator:

$$Y_t = \left[\varphi \left(Y_t^k\right)^{(\sigma-1)/\sigma} + \left(Y_t^l\right)^{(\sigma-1)/\sigma}\right]^{\sigma/(\sigma-1)}$$

FOC:

$$\frac{Y_t^k}{Y_t^l} = \left(\varphi \frac{P_t^l}{P_t^k}\right)^{\sigma}$$

$$\left[\varphi^{\sigma} \left(P_t^k\right)^{1-\sigma} + \left(P_t^l\right)^{1-\sigma}\right]^{1/(1-\sigma)} = 1$$

VI. The Theoretical Framework

C. K-Firms'Problem

The problem of the K-firm is

$$\Pi_t^k \equiv \max_{K_t^k} P_t^k K_t^k - R\left(K_t^k - N_t\right) + (1-\delta)K_t^k$$

subject to:

$$P_t^k K_t^k - R\left(K_t^k - N_t\right) \geq (1-\theta_t)\, P_t^k K_t^k \tag{8}$$

where $B_t^k = K_t^k - N_t$. The time-varying parameter θ_t reflects the changing loan quota targeted by the government. The financial constraint to bind, the following inequality must hold:

$$\theta_t P_t^k < R < P_t^k$$

With the binding constraint, we obtain from (8)

$$K_t^k = \frac{R}{R - \theta_t P_t^k} N_t \tag{9}$$

Accordingly, the amount borrowed by the K-firm is

$$B_t^k = \frac{\theta_t P_t^k}{R - \theta_t P_t^k} N_t \tag{10}$$

VI. The Theoretical Framework

C. K-Firms'Problem—Appendix

The incentive-compatibility constraint:

$$
\begin{aligned}
& P_t^k K_t^k - R\left(K_t^k - N_t\right) \geq \left(1-\theta_t\right) P_t^k K_t^k \\
& \Rightarrow \theta_t P_t^k K_t^k \geq R B_t^k \\
& \Rightarrow \theta_t P_t^k < R
\end{aligned}
$$

If the financial constraint is not blinding:

$$
\begin{aligned}
& \theta_t P_t^k K_t^k > R\left(K_t^k - N_t\right) \\
& \Rightarrow K_t^k(\theta_t P_t^k - R) > -RN_t \\
& \Rightarrow K_t^k \leq \frac{RN_t}{R-\theta_t P_t^k} \\
& \Rightarrow K_t^k \leq \frac{N_t}{1-\theta_t} \quad with \quad R = P_t^k
\end{aligned}
$$

if bind:

$$
K_t^k > \frac{N_t}{1-\theta_t}
$$

VI. The Theoretical Framework I

D. L-Firms'Problem

Following SSZ, we assume that the old entrepreneur pays the young entrepreneur a management fee as a fixed fraction of output produced, $m_t = \psi P_t^l \left(K_t^l\right)^{\alpha} \left(\chi L_t\right)^{1-\alpha}$, where $\psi < 1$. Therefore the old entrepreneur's problem:

$$\Pi_t^l \equiv \max_{L_t} P_t^l(1-\psi)\left(K_t^l\right)^{\alpha}\left(\chi L_t\right)^{1-\alpha} - R_t^l w_t L_t + (1-\delta)K_t^l \tag{11}$$

The first-order condition:

$$R_t^l w_t = (1-\psi)(1-\alpha)P_t^l\left(K_t^l/L_t\right)^{\alpha}(\chi)^{1-\alpha} \tag{12}$$

$$\rho_t^l = (1-\psi)\alpha P_t^l\left(K_t^l/L_t\right)^{\alpha-1}(\chi)^{1-\alpha} + 1 - \delta \tag{13}$$

VI. The Theoretical Framework II

D. L-Firms'Problem

The young entrepreneur's problem is to decide on consumption and a portfolio allocation between bank deposits and physical capital investment.

- $\rho^l > R$ in steady state.
- prefers investing in capital to depositing

the young entrepreneur's consumption-saving problem is:

$$\max_{s_t^E} \frac{\left(m_t - s_t^E\right)^{1-(1/\gamma)}}{1-(1/\gamma)} + \beta E_t \frac{\left(\rho_{t+1}^l s_t^E\right)^{1-(1/\gamma)}}{1-(1/\gamma)}$$

First-order conditions determine the optimal saving of young entre- preneurs:

$$s_t^E = m_t / \left(1 + \beta^{-\gamma} E_t \left(\rho_{t+1}^l\right)^{1-\gamma}\right)$$

Since $s_t^E = K_{t+1}^l$, the law of motion for the L -firm's capital becomes

$$K_{t+1}^l = \frac{\psi}{1 + \beta^{-\gamma} E_t \left(\rho_{t+1}^l\right)^{1-\gamma}} P_t^l \left(K_t^l\right)^{\alpha} \left(\chi L_t\right)^{1-\alpha} \tag{14}$$

VI. The Theoretical Framework

E. Workers'Problem & F. The Bank's Problem

Workers'Problem:

The worker's consumption-saving problem is

$$\max_{c_{1t}^w, c_{2t+1}^w} \frac{\left(c_{1t}^w\right)^{1-(1/\gamma)}}{1-(1/\gamma)} + \beta \frac{\left(c_{2t+1}^w\right)^{1-(1/\gamma)}}{1-(1/\gamma)}$$

subject to

$$c_{1t}^w + s_t^w = w_t$$

$$c_{2t+1}^w = s_t^w R$$

The Bank's Problem:

$$\Pi_t^b = \mathrm{Max}_{B_t^l} R_t^l B_t^l + R B_t^k + R\left(D_t - B_t^k\right) - R D_t - C\left(B_t\right) - B_t^l$$

In equilibrium, $D_t = s_t^w L_t$ and $B_t^l = w_t L_t$. The first-order condition

$$R_t^l = 1 + C'\left(B_t\right) \tag{15}$$

VI. The Theoretical Framework

G. The Government's Problem

We assume that N_{t+1} advanced to newborn K -firms is a fraction of K-firms' capital stock at the end of the current period:

$$N_{t+1} = \xi K_{t'}^{k} \tag{16}$$

where $0 \leq \xi \leq 1$. A combination of (9) and (16) gives the law of motion for the K-firm's net worth

$$N_{t+1} = \frac{R\xi}{R - \theta_t P_t^k} N_t \tag{17}$$

The government's budget constraint is

$$B_{t+1}^{G} + N_{t+1} = \Pi_t^k + \Pi_t^b + RB_t^G \tag{18}$$

VI. The Theoretical Framework I

H. Equilibrium Conditions

$$1 = L_t = \left[\frac{(1-\psi)(1-\alpha)P_t^l \chi}{R_t^l w_t}\right]^{1/\alpha} K_t^l/\chi$$

$$\Pi_t^l = \rho_t^l K_t^l$$

$$\rho_t^l = (1-\psi)\alpha P_t^l \left(K_t^l\right)^{\alpha-1} \chi^{1-\alpha} + 1 - \delta$$

$$R_t^l = 1 + C'\left(B_t\right)$$

$$\Pi_t^k = P_t^k K_t^k - R\left(K_t^k - N_t\right) + (1-\delta)K_t^k$$

$$\Pi_t^B = \left(R_t^l - 1\right) B_t^l - C\left(B_t\right)$$

$$m_t = \psi P_t^l \left(K_t^l\right)^{\alpha} \left(\chi L_t\right)^{1-\alpha}$$

$$S_t^E = m_t / \left(1 + \beta^{-\gamma}\left(E_t \rho_{t+1}^l\right)^{1-\gamma}\right)$$

$$c_{1t}^E = m_t - s_t^E, c_{2t}^E = \rho_t^l s_{t-1}^E$$

$$B_t^k = K_t^k - N_t$$

$$B_t^l = w_t L_t$$

$$N_{t+1} = \xi K_t^k$$

$$Y_t = \left[\varphi\left(Y_t^k\right)^{(\sigma-1)/\sigma} + \left(Y_t^l\right)^{(\sigma-1)/\sigma}\right]^{\sigma/(\sigma-1)}$$

$$Y_t^k = K_t^k$$

VI. The Theoretical Framework II

H. Equilibrium Conditions

$$Y_t^l = \left(K_t^l\right)^{\alpha} \left(\chi L_t\right)^{1-\alpha}$$

$$1 = \left[\varphi^{\sigma} \left(P_t^k\right)^{1-\sigma} + \left(P_t^l\right)^{1-\sigma}\right]^{1/(1-\sigma)}$$

$$K_t^k = \frac{R}{R-\theta_t P_t^k} N_t$$

$$B_{t+1}^G = \Pi_t^k + \Pi_t^b + RB_t^G - N_{t+1}$$

$$P_t^l = \frac{P_t^k}{\varphi} \left(\frac{Y_t^l}{Y_t^k}\right)^{1/\sigma}$$

$$s_t^w = w_t / \left(1 + \beta^{-\gamma} R^{1-\gamma}\right)$$

$$c_{1t}^w = w_t - s_t^w, c_{2t}^w = s_t^w R$$

$$B_t^w = s_t^w - B_t^k$$

Combining the budget constraints of households, entrepreneurs, and the government, we obtain the following resource constraints

$$C_t + I_t + S_t^f = \mathrm{GNP}_t = Y_t - C\left(B_t\right) + (R-1)\left(B_t^w + B_t^G\right)$$

VI. The Theoretical Framework III
H. Equilibrium Conditions

where S_t^f stands for a current account or foreign surplus and

$$
\begin{aligned}
C_t &= c_{1t}^w + c_{2t}^w + c_{1t}^E + c_{2t}^E \\
I_t &= K_{t+1} - (1-\delta)K_t \\
K_t &= K_t^k + K_t^l \\
S_t^f &= B_{t+1}^w + B_{t+1}^G - \left(B_t^w + B_t^G\right)
\end{aligned}
$$

VII. Characterizing the Equilibrium

A. Steady State

We consider the case that the borrowing constraint for the K-firm is binding at steady state.

$$P^k = \frac{R}{\bar{\theta}}(1-\xi)$$

$$P^k \bar{\theta} < R$$

For the collateral constraint to bind, that is, $R < P^k$, it must be

$$1 - \xi > \bar{\theta} \tag{20}$$

- the smaller $\bar{\theta}$ is, the stronger the firm's default incentive is, and thus the more binding the collateral constraint is.
- the smaller ξ is, the slower the net worth accumulates, and the more binding the collateral constraint becomes.
- Condition (20) implies that the collateral constraint always binds along the transition path.

VII. Characterizing the Equilibrium
B. A Growing Foreign Surplus

Why? ***Tables 3 and 4 show that net exports since 1997 have grown large.***
we begin with workers'purchases of foreign bonds denoted as

$$B_t^w = s_t^w - \left(K_t^k - N_t\right)$$

The net foreign surplus as a fraction of GDP is

$$\frac{B_{t+1}^w + B_{t+1}^G - \left(B_t^w + B_t^G\right)}{Y_t - C\left(B_t\right)}$$

Two forces drive up the net foreign surplus

- households' savings in foreign bonds $\left(B_{t+1}^w - B_t^w\right)$
- the government's savings in foreign reserves $\left(B_{t+1}^{\mathrm{G}} - B_t^G\right)$.

NBS annual data

- government savings as a percent of GDP increased by 7%(2000-2012)
- contributing to 63.90% of an increase of 11 percentage points in the national saving rate(from 37.47% to 48.43%).

VII. Characterizing the Equilibrium
C. Key Transition Paths I

For tractability we set $\theta_t = \bar{\theta}$ and $\delta = 1$ such that $I^j_t = K^j_{t+1}$. In our two-sector model, the investment rate can be decomposed as

$$\frac{I_t}{Y_t} = \frac{I^k_t}{P^k_t Y^k_t}\frac{P^k_t Y^k_t}{Y_t} + \frac{I^l_t}{P^l_t Y^l_t}\frac{P^l_t Y^l_t}{Y_t} \tag{21}$$

Two channels: the reallocation (between-sector) effect and the sector-specific (within-sector) effect.

- If the investment rate in the capital-intensive sector is higher than the investment rate in the labor-intensive sector, reallocation of resources from the labor-intensive sector to the capital-intensive sector tends to increase the investment rate (the reallocation effect).
  - $\frac{I^k_t}{Y^k_t} > \frac{I^l_t}{Y^l_t}$
- Given the ratio of revenue in the capital-intensive sector to that in the labor-intensive sector, a change in the investment rate in the capital-intensive sector tends to move the aggregate investment rate in the same direction (the sector-specific effect)
  - $\frac{I_t}{Y_t} \uparrow = \frac{P^k_t Y^k_t}{P^l_t Y^l_t}\left(\frac{I^k_t}{P^k_t Y^k_t} \uparrow .....\right)$

VII. Characterizing the Equilibrium
C. Key Transition Paths II

The other key object is the share of labor income in total output:

$$\frac{w_t L_t}{Y_t} = \frac{(1-\psi)(1-\alpha)}{1 + P_t^k Y_t^k / \left(P_t^l Y_t^l\right)} \tag{22}$$

Intuition: an increase in the ratio of revenue in the capital-intensive sector to that in the labor-intensive sector reduces the share of labor income.

- $P_t^k Y_t^k / \left(P_t^l Y_t^l\right) \uparrow \rightarrow \frac{w_t L_t}{Y_t} \downarrow$

Proposition 1. *Given that $\sigma > 1$, during the transition the ratio of revenue in the capital-intensive sector to that in the labor-intensive sector increases monotonically toward the steady state.*

Proof. The growth rate of the ratio of revenues in the two sectors can be expressed as

$$\Delta \log \frac{P_t^k Y_t^k}{P_t^l Y_t^l} = \left(1 - \frac{1}{\sigma}\right) \Delta \log \frac{Y_t^k}{Y_t^l} \tag{23}$$

VII. Characterizing the Equilibrium
C. Key Transition Paths III

Along the transition path, the output ratio of the two sectors is

$$\frac{Y_t^k}{Y_t^l} = \left(\frac{\varphi \left(1 - \varphi^{\sigma} \left(P_t^k \right)^{1-\sigma} \right)^{1/(1-\sigma)}}{P_t^k} \right)^{\sigma} \tag{24}$$

- the ratio move in an opposite direction to the relative **price of capital-intensive goods.**
- As net worth of the capital-intensive sector increases, the collateral constraint becomes less binding, which reduces the price of capital-intensive goods toward R.
  - $N_t \uparrow \Rightarrow$ *less blinding* $\Rightarrow P_t^K \downarrow$ *toward* $R \Rightarrow \frac{Y_t^k}{Y_t^l} \uparrow$
- the ratio Y_t^k / Y_t^l increases monotonically during the transition path.
- Given that $\sigma > 1$, the ratio $P_t^k Y_t^k / \left(P_t^P Y_t^l \right)$ increases along the transition path.

VIII. Quantitative Results and the Mechanism

A. Trend Patterns

We set both the initial capital stock in the labor-intensive sector and the initial net worth of the capital-intensive sector to values smaller than the corresponding steady-state values.

- $N_t \uparrow \Rightarrow$ borrowing capacity $\uparrow \Rightarrow P_t^K \downarrow$ *toward* $R \Rightarrow \frac{Y_t^k}{Y_t^l} \uparrow \rightarrow \frac{I_t}{Y_t} \uparrow$
- $\frac{Y_t^k}{Y_t^l} \uparrow \rightarrow \frac{w_t L_t}{Y_t} \downarrow$
- $K_t^l \uparrow \rightarrow S_t^E \uparrow \rightarrow C_t^E \downarrow$

VIII. Quantitative Results and the Mechanism

A. Trend Patterns

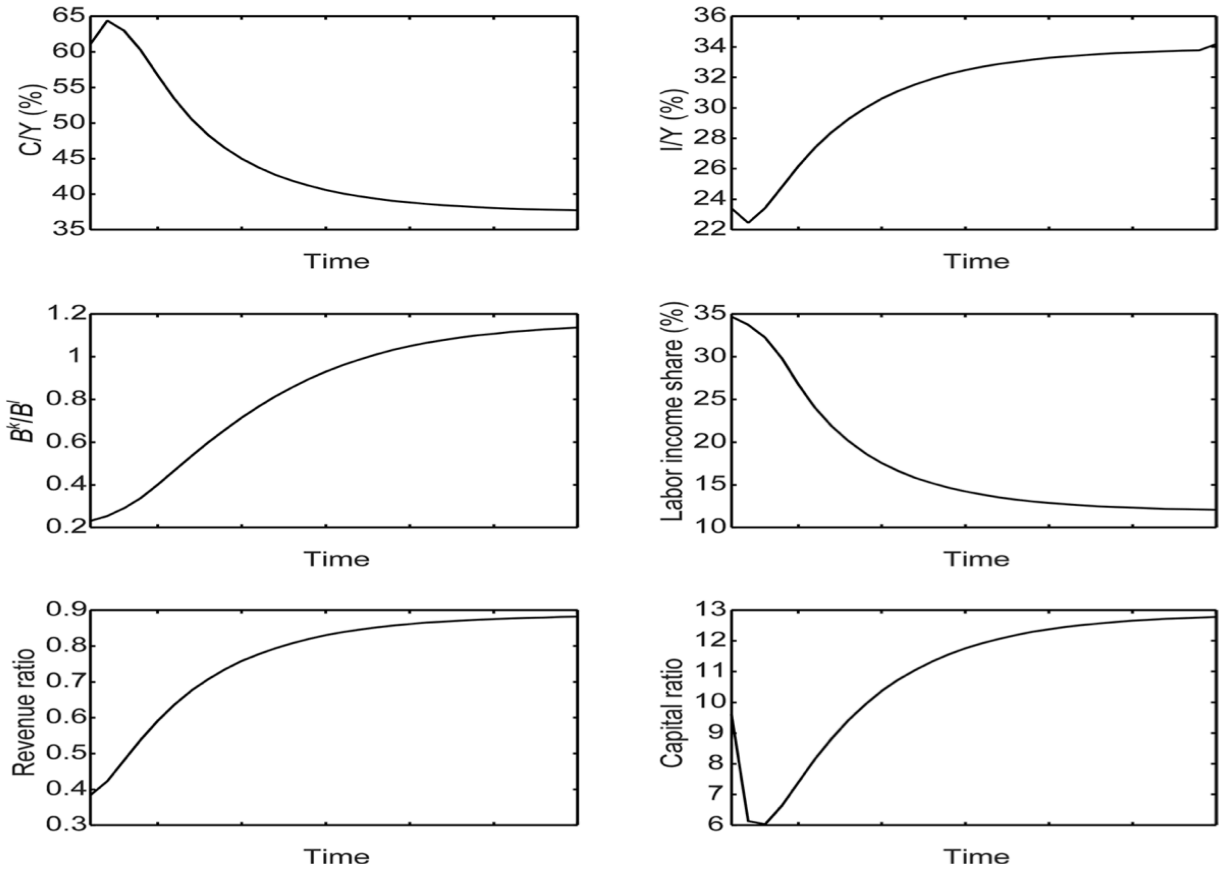


Fig. 14. The trend patterns for the benchmark theoretical model.

VIII. Quantitative Results and the Mechanism

B. Cyclical Patterns

$$\theta_t \uparrow \Rightarrow B_t^K \uparrow \Rightarrow \begin{cases} B_t \uparrow \Rightarrow R_t^l \uparrow \Rightarrow L_t \downarrow \Rightarrow w_t L_t \downarrow \Rightarrow C \downarrow \\ K_t^k \uparrow \Rightarrow K_t \uparrow \Rightarrow I_t \uparrow \\ \Rightarrow MLT \uparrow \Rightarrow STL \downarrow \end{cases}$$

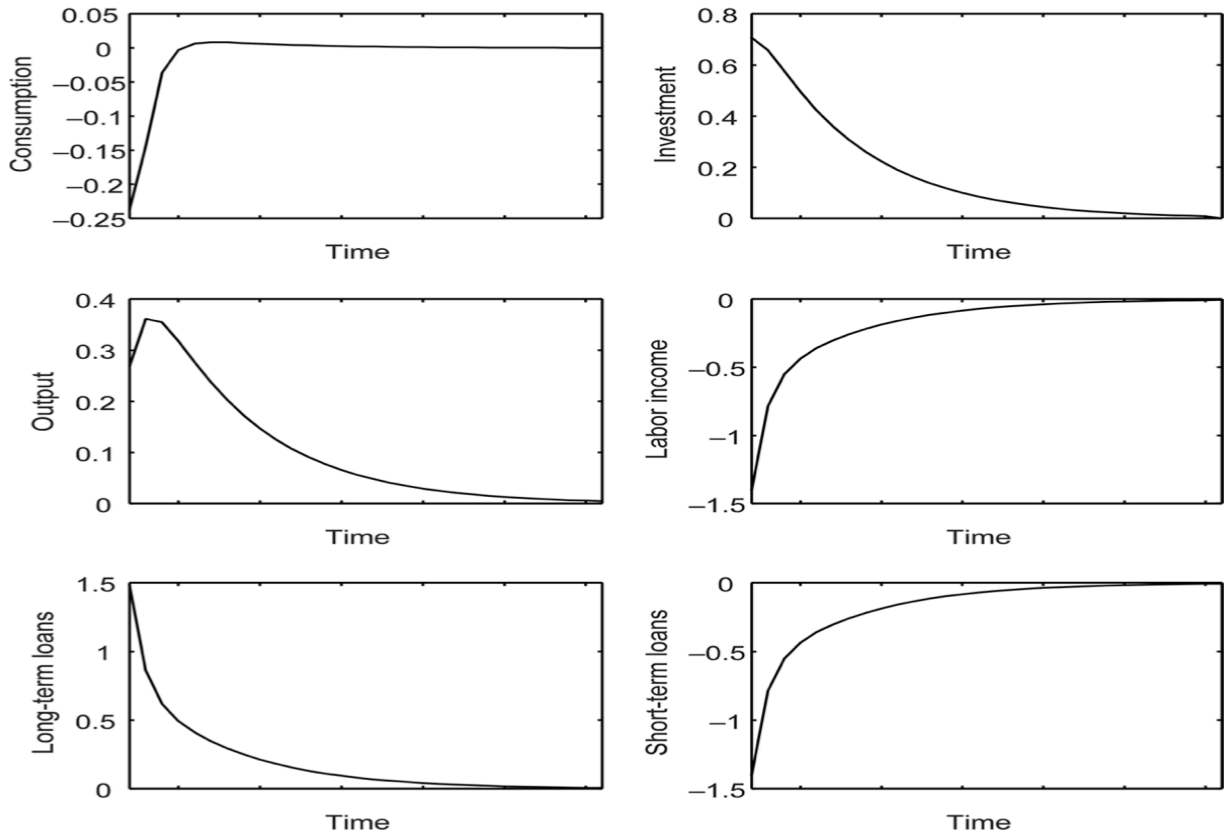


Fig. 15. Impulse responses to an expansionary credit shock in the benchmark theoretical model.

VIII. Quantitative Results and the Mechanism
Estimating the Elasticity of Substitution

The fall of the labor income share generated by our model economy depends crucially on the magnitude of the elasticity of substitution in the aggregate production function being greater than 1.

...

VAR; 1996:10-2012:12;

Table 10

Estimate and Probability Intervals of σ Using System (27) or (29)

Seasonally Adjusted Monthly Data		
Point Estimate	68% Interval	95% Interval
2.32	(2.11, 2.54)	(1.94, 2.79)
Original (Not Seasonally Adjusted) Monthly Data		
Point Estimate	68% Interval	95% Interval
2.15	(1.96, 2.35)	(1.80, 2.57)

Note: The simulated results are based on one million MCMC posterior probability draws.

VIII. Quantitative Results and the Mechanism
Between-Sector Contribution to the Labor Share Decline

Its decline over time is attributed to a combination of within-sector and between-sector effects.

- The within-sector effect concerns the decline of the labor share in each of the heavy and light sectors.
- the between-sector effect reflects the difference between the two sectors.

To calculate these two effects, note that

$$\mathrm{LS}_t \equiv \frac{w_t L_t}{Y_t} = \frac{w_t L_t^k + w_t L_t^l}{P_t^k Y_t^k + P_t^l Y_t^l} = \alpha_t^l \frac{1 + \beta_t \left(P_t^k Y_t^k / P_t^l Y_t^l\right)}{1 + \left(P_t^k Y_t^k / P_t^l Y_t^l\right)}$$

where $\alpha_t^l = w_t L_t^l / P_t^l Y_t^l$, $\alpha_t^k = w_t L_t^k / P_t^k Y_t^l$, and $\beta_t = \alpha_t^k / \alpha_t^l < 1$

$$B_t^{\text{effect}} = \bar{\alpha}^l \frac{1 + \bar{\beta} \left(P_t^k Y_t^k / P_t^l Y_t^l\right)}{1 + \left(P_t^k Y_t^k / P_t^l Y_t^l\right)}$$

where $\bar{\alpha}^i$ is the average of α_t^i over t for $i = l, k$ and $\bar{\beta} = \bar{\alpha}^k / \bar{\alpha}^l$, while the within-sector effect is measured by $W_t^{\text{effect}} = \mathrm{LS}_t - B_t^{\text{effect}}$.

VIII. Quantitative Results and the Mechanism
Between-Sector Contribution to the Labor Share Decline

...
decomposed into

$$\Delta \mathrm{LS} = \Delta B^{\text{effect}} + \Delta W^{\text{effect}} \tag{30}$$

It is straightforward to prove that (30) is equivalent to the decomposition formula proposed by Karabarbounis and Neiman (2014) such that

$$\Delta B^{\text{effect}} = \sum_{i=k,l} \bar{\alpha}^i \Delta \omega^i, \Delta W^{\text{effect}} = \sum_{i=k,l} \Delta \alpha^i \bar{\omega}^i$$

where $\omega_t^i = P_t^i Y_t^i / \left(P_t^k Y_t^k + P_t^l Y_t^l\right)$ and $\bar{\omega}^i$ is the average of ω_t^i over t.

VIII. Quantitative Results and the Mechanism

Between-Sector Contribution to the Labor Share Decline

A necessary condition for the between-sector effect on the declining labor share is for the ratio of value added in the heavy sector to value added in the light sector to rise over time.

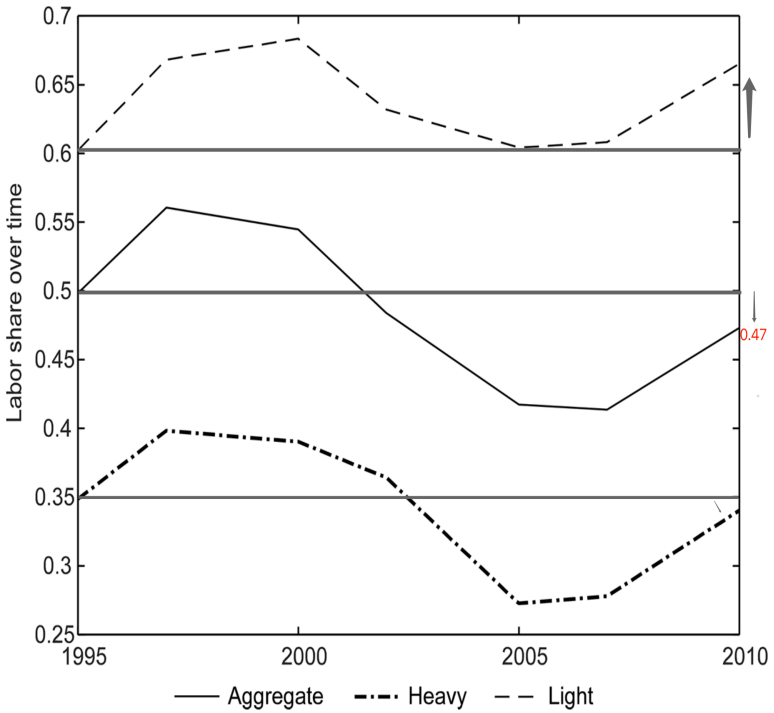


Fig. 17. Labor shares in the heavy and light sectors

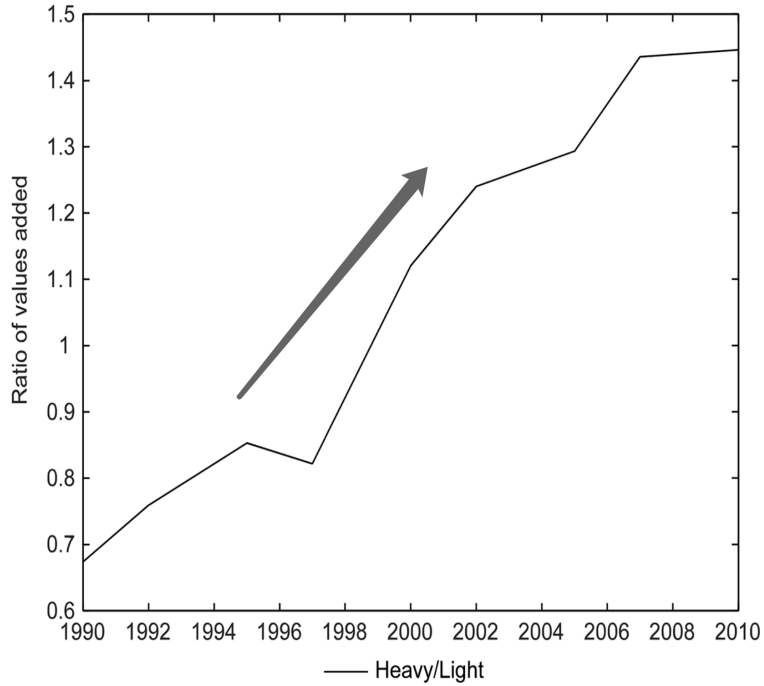


Fig. 18. Ratio of values added in the heavy and light sectors grouped from the 17 sectors in the NBS input-output data.

VIII. Quantitative Results and the Mechanism

Between-Sector Contribution to the Labor Share Decline

Table 12 reports that with 1997 as an initial year for comparison, the between-sector effect continues to be significant in explaining the decline of the overall labor income share.

Table 12
Between-Sector and Within-Sector Decompositions of Changes in the Labor Share

Year	ΔLS	Between	Within	Between (%)	Within (%)
		All 17 Sectors, ΔLS Relative to the 1995 Labor Share			
2000	–0.085	–0.052	–0.032	61.84 (–)	38.15 (–)
2010	–0.025	–0.052	0.027	65.81 (–)	34.19 (+)
		All 17 Sectors, ΔLS Relative to the 1997 Labor Share			
2000	–0.147	–0.057	–0.089	39.00 (–)	61.00 (–)
2010	–0.088	–0.057	–0.030	65.59 (–)	34.40 (–)
		Excluding Agriculture, ΔLS Relative to the 1995 labor Share			
2000	–0.043	–0.019	–0.024	43.30 (–)	56.69 (–)
2010	0.028	–0.019	0.047	29.01 (–)	70.99 (+)
		Excluding Agriculture, ΔLS Relative to the 1997 Labor Share			
2000	–0.119	–0.026	–0.093	21.76 (–)	78.23 (–)
2010	–0.048	–0.027	–0.021	55.84 (–)	44.16 (–)

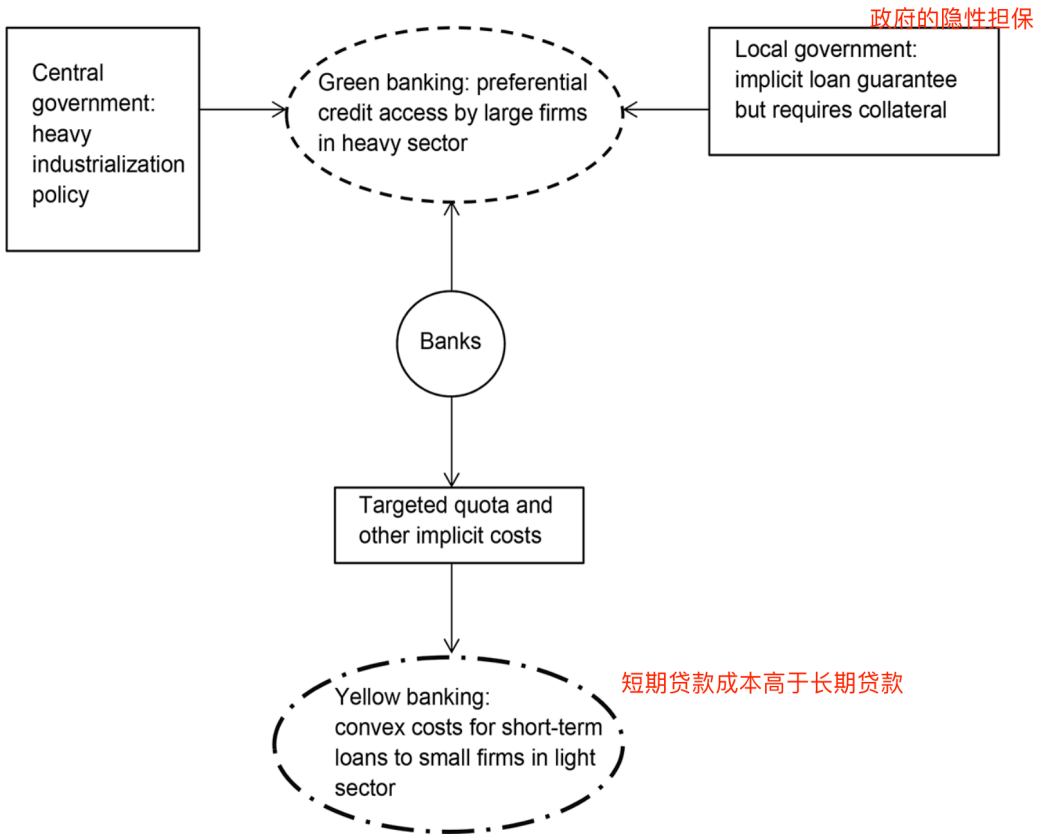
Note: "ΔLS" stands for the change of the labor share relative to the value in the initial year (1995 or 1997). The "–" sign in parentheses indicates a contribution to a decline in the labor share and the "+" sign indicates a contribution to an increase in the labor share. "Excluding agriculture" means all 17 sectors excluding the sector of farming, forestry, animal husbandry, and fishery.

For a majority of cases, the between-sector effect contributes at least 40% of the decline to the aggregate labor share.

VIII. Quantitative Results and the Mechanism
Short-Term versus Long-Term Loans

Figure 19 summarizes the key loan structure in China.

- Heavy industries, given the priority by the "Five-Year Program", have enjoyed easy access to bank loans for medium- and long-term investment.
- One main reason for rapid increases of bank loans toward heavy industries is the persistent monopoly held by large banks **(most of them are state owned)**.



VIII. Quantitative Results and the Mechanism

Short-Term versus Long-Term Loans

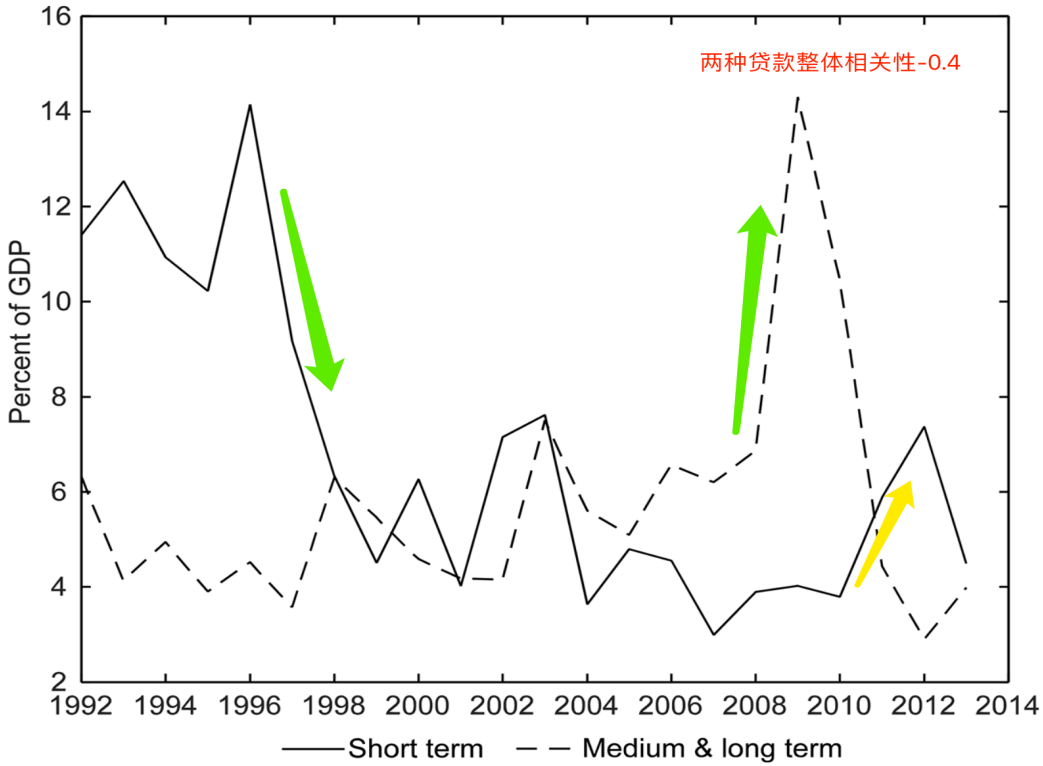


Fig. 20. New bank loans to nonfinancial enterprises as percent of GDP

Note: The correlation between the two types of loans is –0.403 for 1992–2012 and –0.405 for 2000–2012.

VIII. Quantitative Results and the Mechanism
Short-Term versus Long-Term Loans

shortcoming: it does not have the data on new loans made to households.

- An alternative hypothesis is that when the government makes loans to firms, loans to households get crowded out
- which leads to the negative comovement between consumption and investment.
- To entertain this hypothesis, we obtain a breakdown of the quarterly time series of loans outstanding into loans to nonfinancial enterprises (NFE) and to households.
- These disaggregated series are available from 2007Q1 to 2014Q3.

VIII. Quantitative Results and the Mechanism

Short-Term versus Long-Term Loans

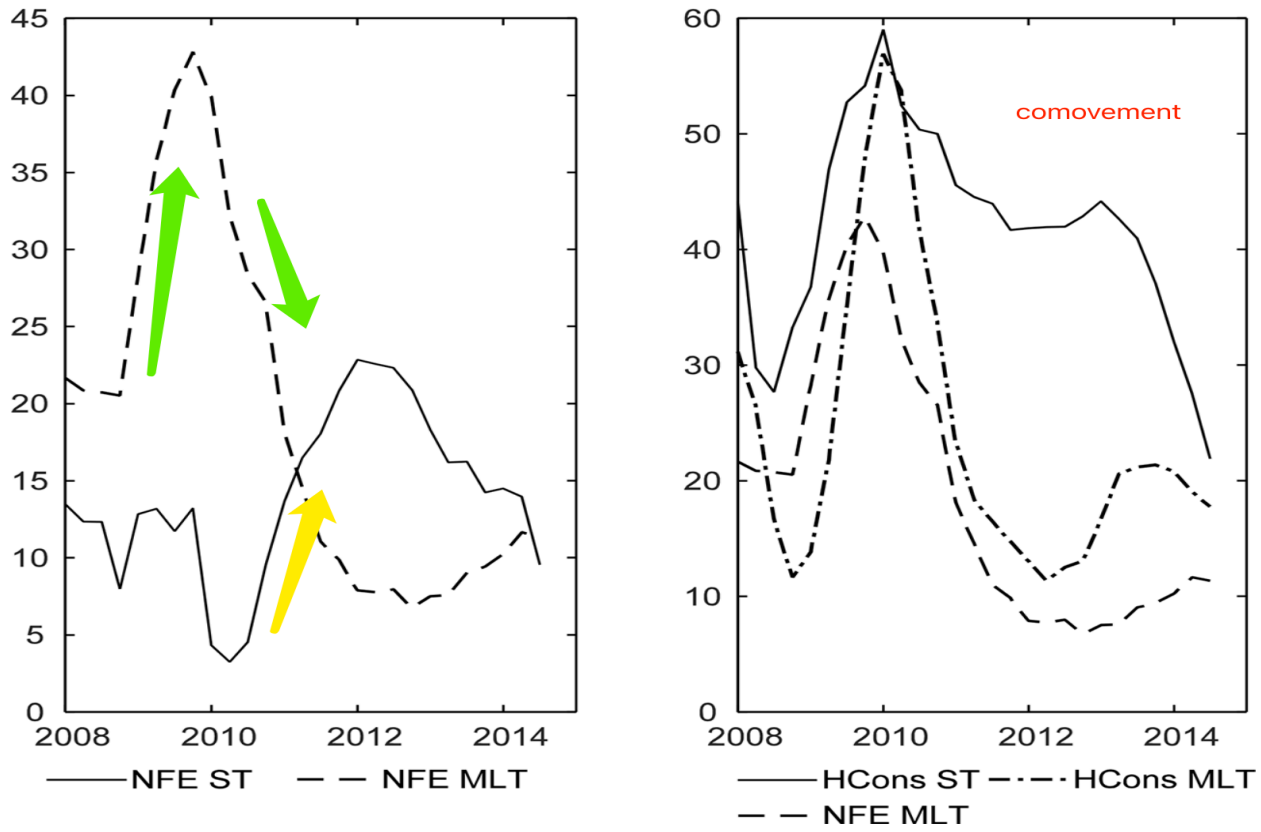


Fig. 21. Year-over-year growth rates of short-term (ST) and medium- and long-term (MLT) bank loans (outstanding) to household consumption (Hcons) and nonfinancial enterprises (NFE) from 2008Q1 to 2014Q3.

Note: The correlation is −0.744 between short-term and medium- and long-term NFE loans, 0.725 between short-term and medium- and long-term household consumption loans, and 0.769 between medium- and long-term NFE and household consumption loans.

VIII. Quantitative Results and the Mechanism
Short-Term versus Long-Term Loans

The negative correlation between short-term and long-term loans in China is in sharp contrast to the positive one for the US economy.

Table 13
Correlation between Short-Term and Long-Term Loans (Quarterly Data)

Start of the Sample	Loan Growth (yoy) United States	Loan Growth (yoy) China	New Loans as Percent of GDP China
1961:1-	0.63 (2014:3)	n/a	n/a
1997:1-	0.60 (2014:3)	−0.26 (2014:4)	−0.27 (2013:4)
2000:1-	0.59 (2014:3)	−0.40 (2014:4)	−0.27 (2013:4)

These negative correlations for the Chinese economy reflects

- the government's policy priority that supports heavy industries at the cost of crowding out short-term loans to labor-intensive industries.

VIII. Quantitative Results and the Mechanism
Short-Term versus Long-Term Loans

Figure 22 presents further facts along this dimension, but over a longer span of periods.

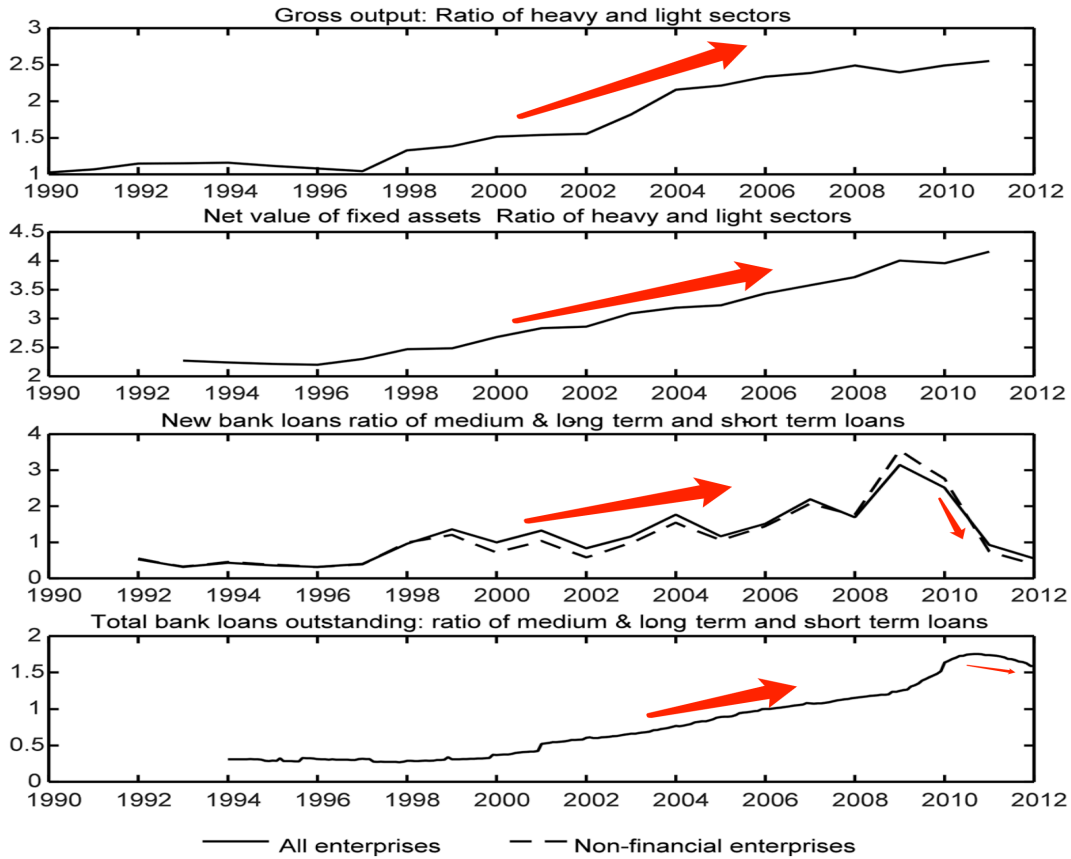


Fig. 22. Secular patterns for heavy versus light sectors and for medium- and long-term bank loans versus short-term bank loans.

VIII. Quantitative Results and the Mechanism
C. Understanding the Mechanism Further

Three counterfactual economies to understand the role of the two key ingredients in our model: **the collateral constraint** on capital-intensive firms and the **financial friction in the banking sector.**

i We first drop the banking-sector friction.

ii We then drop both banking-sector friction and collateral constraint on capital-intensive firms so that this counterfactual economy mimics the SSZ two-sector economy.

iii Last, we allow firms in the labor-intensive sector to borrow to finance their investment so that this counterfactual economy becomes a standard frictionless small-open economy.

VIII. Quantitative Results and the Mechanism
Economy without Lending Frictions

We remove the convex lending cost from our benchmark model.

- $\theta \uparrow \Rightarrow B_t^K \uparrow \Rightarrow K_t^k \uparrow \Rightarrow I_t^K \uparrow \Rightarrow Y_t^K \uparrow \Rightarrow Y_t \uparrow$
- $L_t \uparrow \Rightarrow w_t \uparrow \Rightarrow w_t L_t \uparrow \ldots \Rightarrow C_t \uparrow$

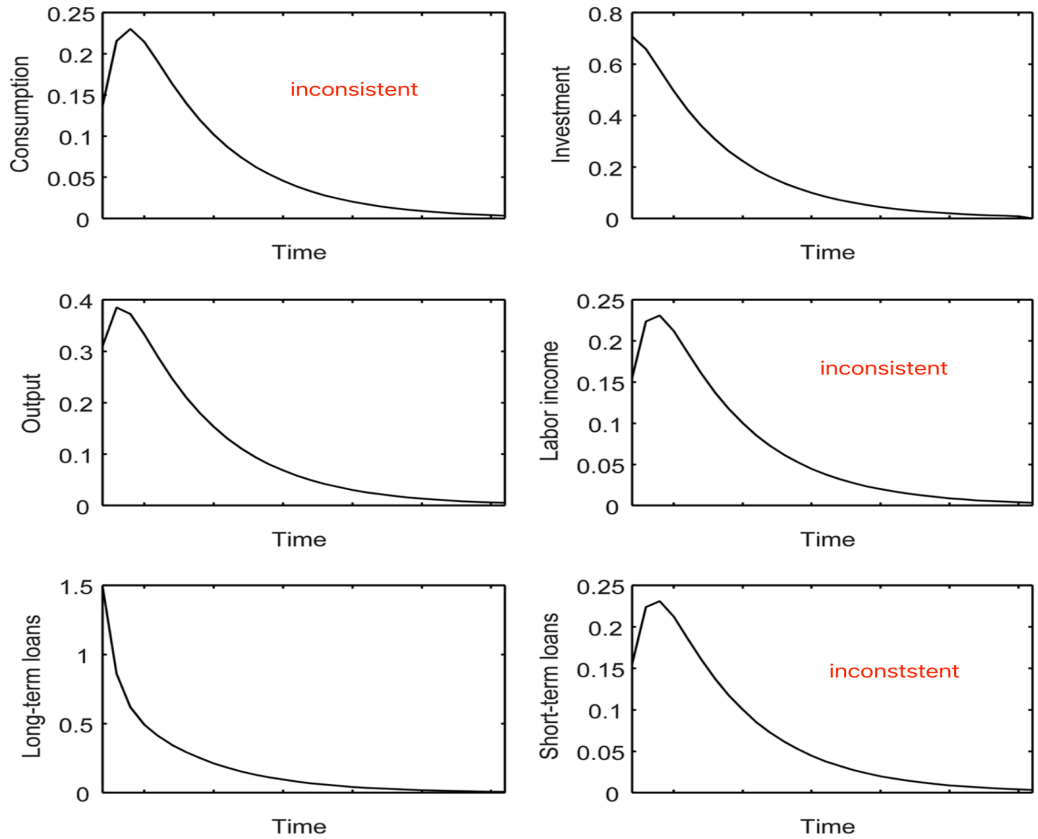


Fig. 23. Impulse responses to an expansionary credit shock in an economy without the bank-lending friction.

VIII. Quantitative Results and the Mechanism
Economy without Lending and Collateral Frictions

Let the starting point be **the low initial capital stock** below the steady state for labor-intensive firms.

- Similar to a neoclassical model, the investment-output ratio **declines** over time while the consumption-output ratio **increases**.

Without the collateral constraint

- As the economy grows, output growth in the labor-intensive sector slows down due to the diminishing marginal return to capital.
- The fall of output growth in the labor-intensive sector in turn reduces the investment rate in the capital-intensive sector
  - because of the imperfect substitutability of outputs between the two sectors

Complete capital depreciation and the risk-aversion parameter $\gamma = 1$. **Because no collateral constraint, have $P_t^k = R$ and P_t^l is constant according to (7)**. The investment rate in the capital-intensive sector becomes

$$\frac{K_{t+1}^k}{P_t^k Y_t^k} = \frac{K_{t+1}^k}{P_{t+1}^k Y_{t+1}^k} \frac{P_{t+1}^k Y_{t+1}^k}{P_t^k Y_t^k} = \frac{1}{R} \frac{Y_{t+1}^l}{Y_t^l}$$

VIII. Quantitative Results and the Mechanism

Economy without Lending and Collateral Frictions

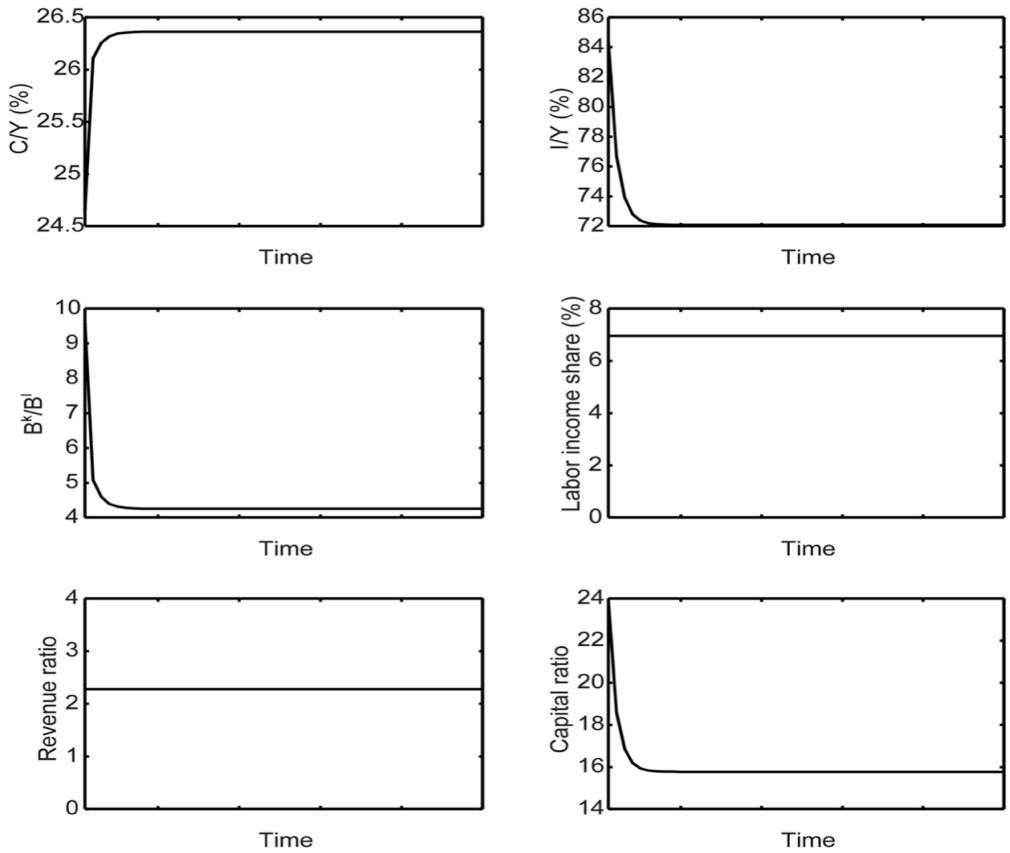


Fig. 24. The trend patterns for an economy without lending frictions and collateral constraints.

VIII. Quantitative Results and the Mechanism

Frictionless Economy

We allow the labor-intensive sector to have free access to the financial market.

- a standard frictionless small-open economy with an exogenous interest rate.
- the old entrepreneur owns the L-firm that is able to borrow from the bank at the fixed interest rate **R** for capital input.

this economy is at the steady state in all periods.

- both the consumption rate and the investment rate are **constant** across time.
- the ratio of long-term loans to short-term loans is **constant**.
- the labor income share and the ratio of the capital-intensive sector's revenue to the labor-intensive sector's revenue is **constant**

IX. Conclusion

Work

- data; empirical analyses; Macroeconomics models; theoretical frramework.

extension

- collect the relevant microbanking data to see how a particular loan is made to a firm, including the information on the type of loan, the type of firm, and the terms of new loans.
- refine and enrich the model for day-to-day policy analysis, an analysis much needed by the People's Bank of China.

problems facing China's macroeconomy today

- low consumption and income growth
- overcapacity of heavy industries with rising debt risks.

...
How to resolve these problems might have profound policy implications.

感谢大家的聆听！

请大家批评指正！