

# China's Investment Rate: Implications and Prospects

*Carsten A. Holz*

## **Impressum:**

CESifo Working Papers

ISSN 2364-1428 (electronic version)

Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH

The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute

Poschingerstr. 5, 81679 Munich, Germany

Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email [office@cesifo.de](mailto:office@cesifo.de)

Editors: Clemens Fuest, Oliver Falck, Jasmin Gröschl

[www.cesifo-group.org/wp](http://www.cesifo-group.org/wp)

An electronic version of the paper may be downloaded

- from the SSRN website: [www.SSRN.com](http://www.SSRN.com)
- from the RePEc website: [www.RePEc.org](http://www.RePEc.org)
- from the CESifo website: [www.CESifo-group.org/wp](http://www.CESifo-group.org/wp)

# China's Investment Rate: Implications and Prospects

## Abstract

For the past nearly forty years, China has experienced average annual real GDP growth of close to ten percent, much of it driven by investment and capital accumulation. By 2014, gross capital formation had reached 46 percent of aggregate expenditures. This paper documents the role of investment in driving economic growth in China, questions how much longer China can sustain a relatively high investment rate, and examines the arguments that have been offered for an impending drastic reduction in investment. It also notes that investment in China remains broad-based across all economic sectors, with little specialization; the size of the Chinese economy may allow continued comprehensive development across all economic sectors. At the same time, the relative size of foreign investment in China has become negligible and the China growth story thus has become a domestic one.

JEL-Codes (all China): E010, E220, E600, O110, O530.

Keywords (all: China): investment rate, capital-output ratio, ICOR, national investment strategy, economic growth.

*Carsten A. Holz*  
*Social Science Division*  
*Hong Kong University of Science & Technology*  
*Clear Water Bay / Kowloon / Hong Kong*  
*carstenholz@gmail.com*

31 October 2016

The author thanks WAN Jing and the participants of the 2nd CAG Conference on Evolving Finance, Trade and Investment in Asia (at NUS, Singapore, 21 October 2016), as well as Bjoern Conrad, Sebastian Heilmann, and seminar participants at MERICS (Mercator Institute for China Studies, Berlin, 27 July 2015) for feedback and comments.

## 1. Introduction

Between 1978 and 2014, the size of the Chinese economy grew by an average annual 9.7 percent in real terms. Much of this economic growth can be accounted for by investment. The ratio of investment to economy-wide output, measured as the share of gross fixed capital formation (GFCF) in aggregate expenditures or, equally, in gross domestic product (GDP), has been rising drastically in recent years (Figure 1).

Development economics has long stressed the crucial role of investment for a country to take off on a self-sustaining growth path, and then to realize structural change as part of a continued growth strategy. In that respect, China follows traditional economic development patterns.

Investment policies have always featured prominently in the economic policies of the People's Republic of China. Today, the Chinese government influences the amount of investment by directing fiscal funds into investment, for example into infrastructure projects, or by channeling credit to government-supported investment projects. It uses administrative tools to incentivize or dis-incentivize investment, for example in the residential real estate sector, or via industrial policy sectoral investment guidelines. The government also uses indirect macroeconomic policy tools such as interest rate policy and tax policies (for example, tax reductions for investment, investment subsidies, or accelerated depreciation rules) to influence investment decisions. The volume of investment in China, thus, is closely linked to the government's expenditure and lending patterns, administrative regulations, and macroeconomic policies. This means that further economic growth, driven by investment, is in good part a policy choice.

Creating growth through investment has worked well for China in the past. Now, as major infrastructure and real estate construction cycles have run their course and the investment rate appears to be at its peak, or to have already peaked, it is unclear to what extent investment will drive continued economic growth in the future. Raising the investment rate yet further would be historically unprecedented, economically questionable, and probably politically impossible. What then is the role of investment in future economic growth in China?

The analysis that follows draws on time series data as well as some cross-country data. Obvious comparison countries are China's neighboring East Asian economies that have experienced high growth in their development trajectory. At times, a further comparison is drawn to Germany as a developed economy with a focus on industrial production similar to China's, and to the U.S. as the benchmark of a post-industrial economy.

## **2. How investment drives economic growth in China**

Demand-side analysis allows identification of what drives economic growth in the short run. Supply-side analysis reveals the long-run drivers of economic growth. On both accounts, investment is crucial for economic growth in China.

### ***2.1 The short run: demand-side analysis***

In the short run, from the point of view of aggregate demand, any additional expenditures on investment goods imply additional production and thereby economic growth. Annual real growth in aggregate expenditures can be decomposed into growth of its three components consumption, investment, and net exports. Figure 2 shows a relatively stable contribution of consumption to economic growth in China, of an average 5.5 percentage points per year from 1979 through 2014. The contribution of net exports fluctuates tremendously, with a long-run average of 0.2 percentage points per year. The national accounts measure of investment, gross capital formation (GCF), comprising investment in fixed assets produced and acquired this year plus a typically very small volume of inventory investment, contributed 4.0 percentage points per year.

Although consumption's average annual contribution to growth is larger than that of GCF, since the early 2000s GCF is as important as consumption for generating annual economic growth in China. Furthermore, given that annual investment fluctuates more than consumption, stable annual economic growth is conditioned on a steadily growing stream of investment.

This is quite different from Germany and from the U.S. In Germany, the average annual contribution of GCF to economic growth in the period 1992-2014—with 1992 being the first

year for which the data are available—was exactly zero (Figure 3). The average annual real GDP growth rate of 1.3 percent was driven by consumption (0.9 percentage points) and net exports (0.3 percentage points, with a 0.1 percentage point discrepancy to annual real GDP growth due to rounding).

In the U.S., following a slightly different growth decomposition in the official statistics, private consumption was the main driver of economic growth: it contributed 1.9 percentage points to the average annual real GDP growth rate of 2.7 percent in the period 1978-2014 (Figure 4). Gross private domestic investment contributed 0.6 percentage points, net exports negative 0.1 percentage points, and government consumption 0.3 percentage points.

Two findings stand out. First, investment plays a much larger role for GDP growth in China than it does in the U.S., let alone in Germany. Second, on an annual or short-run basis, investment's contribution to economic growth is much more volatile than consumption's contribution, across all three economies. Because investment is volatile, China's economic growth, in good part driven by investment, is volatile. Periods of relatively low growth may alternate with periods of relatively high growth.

## ***2.2 The long run: supply-side analysis***

From a supply-side point of view, annual investment adds to the existing physical capital stock. GDP is produced using the services provided by accumulated physical capital, labor, and a third factor that represents everything which is not captured by capital or labor inputs ("total factor productivity," TFP).

Figure 5 shows China's annual real GDP growth rates and their decomposition into growth in the services of capital and of labor, plus TFP growth. In the long-run analysis covering 1979-2013 (with 2013 being the most recent year of analysis due to technical requirements in the construction of capital stock data), labor growth contributed only 0.9 percentage points to the average annual 9.8 percent GDP growth rate. TFP growth contributed 5.0 percentage points, and capital growth 4.0 percentage points.

While in the early years of reform, growth in labor contributed up to two percentage points to annual real GDP growth, the contribution of labor has virtually vanished by 2013.

Growth in China's labor force is about to turn negative. I.e., all future growth will have to come from TFP growth and capital accumulation.

TFP growth made major contributions to GDP growth in the early years of reform and then again in the mid-2000s. TFP captures everything from institutional factors to the education level of the labor force and the rate of capacity utilization. Policy makers do not have available a channel through which to predictably influence TFP. While one might envisage a link between market-enhancing economic reforms and TFP growth, the precise nature of the link is unclear (how big is the impact, how fast do reforms feed through into TFP growth?). Pursuing TFP growth through specific government policies in order to achieve GDP growth thus is not a reliable option for achieving economic growth.

What remains is capital accumulation. From the supply side, investment appears of supreme importance—more physical capital of the same quality, or capital of better quality, directly leads to higher levels of output. Some types of investment may yet have positive externalities (such as network effects) which then imply TFP growth.

### **3. China invests a lot for good reason**

China re-invests close to half of GDP every year (Figure 1). At first sight, this appears to be an exorbitantly high share. However, in a cross-country comparison China's investment behavior comes as no surprise, though China is pushing the frontier.

Figure 6 shows the share of GCF in GDP for China in comparison to selected other countries. For comparability, all data are taken from the Penn World Tables, which cover the years 1950 (or later) through 2011. The data in the Penn World Tables are in purchasing power parity (PPP) terms, i.e., adjusted for price differences between countries.

In China, the share of GCF in GDP rose from approximately 10 percent in the early 1950s to approximately 20 percent by the late 1970s. It hovered around 20 percent until the early 1990s, and then gradually rose to the current level of close to 50 percent.

In Japan, the ratio peaked at the 40 percent mark in 1973, then gradually fell back to just above 20 percent in 2011. Around its peak, the ratio stayed at a high level of around 35 percent for more than two decades. In South Korea, the ratio peaked repeatedly around the 40

and 35 percent levels between the late 1970s and the mid-1990s, with virtually uninterrupted high ratios from the mid-1970s until today. In Taiwan, the ratio peaked at just above 30 percent in the 1970s and stayed around 25 percent until 2000.

There appears to be a pattern whereby developing economies experience a period of rising levels of investment relative to GDP. Invariably, the ratio of investment to GDP peaks and falls back, but the turn-about can be prolonged (measured in decades).

Germany fits this pattern, too, although at an earlier point in time. In Germany, the ratio of GCF to GDP rose to a high of just short of 40 percent in 1960 before gradually falling back over the next 50 years to approximately 20 percent; the ratio was near or above 35 percent for a total of 12 years from the mid-1950s through the mid-1960s. In the chart, only the U.S. does not match the pattern, likely because it experienced an investment boom during World War II, prior to the period covered by the Penn World Tables (and prior to the adoption of a complete system of national accounts).

China thus is no different from other economies in take-off, except that the peak in its investment rate is more pronounced. China's investment rate is out of line in cross-country comparison only since 2008, the year of the U.S. financial crisis which triggered an economic stimulus package in China targeting infrastructure investment. China's extraordinarily high investment rate since 2008, thus, likely reflects the fact that investment policy has always been China's major macroeconomic policy tool. These high investment rates are the outcome of a—presumably temporary—reliance on investment to achieve economic growth goals. Beyond the short run, if the patterns of the other East Asian economies are anything to go by, China's investment rate will come down but still remain at a relatively high level for two to three decades.<sup>2</sup>

Viewed differently, countries undergoing a process of economic development tend to have a relatively high investment rate at low levels of economic development. Figure 7, for

---

<sup>2</sup> China's relatively high investment rate may also reflect overestimation of investment. ZHANG Jun and ZHU Tian (2013, 2014a), argue that household consumption in China is underestimated by approximately ten percentage points of GDP, and therefore GCF overestimated. Consequently, ZHU Tian, ZHANG Jun, and LIU Fang (2014) suggest to reduce the official measure of GFCF downward by approximately ten percentage points of GDP, while accepting the official government consumption and net export values.



the same selection of countries as before, documents that a low level of GDP per laborer is accompanied by a high share of GCF in GDP. China fits the pattern well, albeit with a tendency for relatively high investment rates at an earlier stage of economic development than the other countries, and then the unprecedented high levels since 2008.<sup>3</sup>

Figure 7 confirms the findings of Figure 6 regarding the duration of high investment rates. Figure 7 suggests that while the investment rate may come down from its immediate peak, it is likely to remain at a relatively high level until China's output per laborer has tripled if not quadrupled. At a seven percent real GDP growth rate, that will take twenty years.

One factor that is likely to support strong investment for another twenty years is the continued trend of urbanization. Since data on residential investment became available twenty years ago, China's urbanization rate (share of urban population) has climbed from 29.0 to 54.8 percent and this trend shows little sign of leveling off (Figure 8). If it continues as in the past, an 80 percent urbanization rate will be reached in twenty years' time.<sup>4</sup> The increases in the urbanization rate over the past twenty years went hand in hand with society-wide investment in residential housing that accounted for one-fifth of total investment (and a sub-category "real estate" residential investment that accounted for just above 10 percent of total investment since 2000). For the past ten years, both series near-consistently exhibited double-digit real growth rates.

Furthermore, the amount of capital per worker in China is still relatively low, with much scope for catching up. Compared to Germany, China has an increasingly larger investment volume (in comparable prices), rising from approximate equivalence in 1978 to a ten-fold higher investment value by 2011 (Figure 9). In the same period, China's accumulated capital stock—using the Penn World Tables' definition of capital stock—rises from a value half that of Germany's to a value four times Germany's. However, the amount of capital *per laborer*

---

<sup>3</sup> China's recent investment rates reported in Figure 7 exceed those reported in Figure 1. The Penn World Table data are in purchasing power parity terms and make adjustments to the official Chinese data. (The adjustments have been questioned in Holz, 2006.)

<sup>4</sup> The urbanization rate of Germany is 73.9 percent (2011) and that of the U.S. 82.4 percent (2011). See [https://en.wikipedia.org/wiki/Urbanization\\_by\\_country](https://en.wikipedia.org/wiki/Urbanization_by_country) (accessed 19 Sept. 2015).

in China is still far below that in Germany, rising from 4 percent of Germany's value in 1978 to 23 percent in 2011. The same picture emerges in a comparison of China to the U.S. (Figure 10), except that U.S. investment and capital stock are four times higher than Germany's, in line with the difference in population and employment numbers. The U.S. capital per laborer comparison also matches that in the case of Germany, with the amount of capital *per laborer* in China rising from 3 percent of the U.S. value in 1978 to 20 percent in 2011.

Thus, even though investment and the capital stock in China are large, China is lagging far behind in capital per laborer. With output per worker intricately linked to the capital stock available to each worker, China thus has much further scope for increasing output per worker by increasing the capital stock. While China has narrowed the gap to Germany and the U.S. between 1978 and 2011, it is still a four- to five-fold gap today.

#### **4. Potential issues with investment-driven growth**

Across countries, a high investment rate is invariably linked to high economic growth. The higher the investment rate, the higher economic growth, whether that is growth this period or growth two years later (Figure 11). A growth objective thus implies certain investment objectives.

China's investment-growth nexus appears to be problematic in a number of respects: it takes an increasing amount of new capital to produce an extra unit of output (making future growth more expensive), much of Chinese investment is debt-financed (and not sustainable due to the interest burden on debt), and investment is state driven (and therefore not efficient). But these concerns are largely unfounded.

While the analysis so far has focused on the national income accounts concept of investment, namely GFCF (and GCF), detailed sectoral, regional, funding, and ownership-based investment data for China are only available for the investment measure "Fixed Asset Investment" (FAI). GFCF equals FAI, plus a few minor items (including imputed items), less the purchase of old structures and old equipment (which are included in FAI but not in GFCF). The transition between the two concepts is non-trivial and inevitably leads to questions about the quality of Chinese investment data (which are explored in Holz, 2016).

Nevertheless, the available breakdown of FAI data by sector, region, funding source, and ownership form could well be equally applicable for GFCF (for which such a breakdown is not published). Given that FAI data are the only investment data available with any detail to explore some of the issues of investment in China, these data are used in the following sections as appropriate.

#### ***4.1 Capital-output ratio: no long-term rise and no cross-country anomaly***

A standard issue in development economics is the over time rising capital-output ratio or, in its marginal form, the rising *incremental* capital-output ratio (also known as ICOR): to produce an additional unit of output requires more additional capital than the previous unit of output did, implying that it will be ever harder for China to achieve economic growth through investment. But this widely accepted truism is not as straightforward as it may appear.

Capital-output ratios may well exhibit an upward trend over time, but this trend is not uniform and can even reverse (Figure 12). The most striking changes, in accordance with standard expectations, occurred in Japan and in South Korea, with their capital-output ratios in 2011 double those of the early 1950s. In contrast, the capital-output ratio of the U.S. has remained rather stable over time. China's capital-output ratio shows some variation but ends the period little above the beginning level. Capital-output ratios also vary drastically across countries: in 2011, Japan's capital-output ratio was twice that of Taiwan, and about a third higher than those of China and the U.S.

Capital-output ratios appear to vary more systematically with development level (GDP per laborer), but even that association is weak (Figure 13). The Chinese data, all at relatively low levels of development, hint at a negative long-run correlation: the capital-output ratio declines with increasing GDP per laborer. The U.S. data, at higher development levels, tell the same story. Germany, Japan, South Korea, and Taiwan, however, suggest a strong positive relationship between development level and the capital-output ratio. The cross-country data also show that any given level of development can come with a wide range of capital-output ratios. For a given value of GDP per laborer, the highest capital-output ratio can be twice the lowest capital-output ratio.

The *incremental* capital-output ratio (ICOR) is yet more difficult to interpret. When annual changes in output are close to zero, the incremental capital-output ratio can assume values that go into the thousands. Trend lines, whether linear or polynomials, paint chaotic patterns. Removing outliers and taking three-year differences does create an upward trend for the incremental capital-output ratio over time (except for the U.S.). China's trendline has the lowest slope (and values at the lower end of the spectrum). I.e., among the selected countries (except for the U.S.), China's incremental capital-output ratio increases least from year to year (Figure 14).

If one examines the relationship between the level of economic development and the incremental capital-output ratio, the results are similar to the case of the (non-incremental) capital-output ratio (Figure 15). The trendlines slope upward, except for the U.S. What is new is that China's incremental capital-output ratio is relatively high—compared to the other economies—at low levels of economic development. The data show that this has always been the case and is not a phenomenon of only the recent years. The bunching of all observations at a relatively narrow range in the level of economic development implies that future observations, should growth continue, may yet rotate the trendline significantly.

In sum, what these data imply is that a quick look at an aggregate capital-output ratio, incremental or not, conveys very little long-run information: capital-output ratios can go up or down over time (in this sample more up than down), and, across countries, the same level of economic development can come with very different capital-output ratios.

If attention focuses on the recent years, one will notice that China's capital-output ratio has been gradually trending upward since the mid-1990s. But seen in perspective, both Japan and Korea's capital-output ratios are higher than China's and have been rising faster. Is that a sign that growth in China will slow, as it did in Japan and in Korea? There is no easy answer. Over the fifteen years through 2010, China's gradually rising capital-output ratio came with invariably high growth rates; since 2010, it doesn't.

Capital-output measures suffer from severe deficiencies. Relating capital changes to output changes is problematic because capital values depend on such measures as the depreciation rate, which in turn depends on such factors as climate, tax regulations, and

planned obsolescence. Variations in depreciation rates etc. affect capital but not output, softening any relationship between capital and output.<sup>5</sup>

Capital stock calculations, in particular those constructed for cross-country comparisons, typically assume a *uniform* depreciation rate across countries. But what if China's capital stock is in heavy industry and depreciates over 50 years, while a comparison country's capital stock is in software and depreciates over 5 years? If one assumes that one unit of investment leads to one additional unit of output, i.e., the two countries perform identically in terms of additional output derived from additional capital, then the application of a uniform depreciation rate across countries will show China's capital-output ratio to be many times higher than that of the comparison country. I.e., equally efficient use of investment leads to vastly different capital-output ratios due to different depreciation rates.

This can in part be a reflection of structural differences. Thus, economy-wide capital-output ratios do not consider structural change: as an economy moves from heavy industry into services, an additional unit of output in services is likely produced with less additional capital than the previous unit of output in heavy industry. The capital-output ratio may rise only within an industrial sector, or in the course of structural change towards capital-intensive sectors.

China's history of socialist development through central planning with the ensuing "investment hunger" also implies that at least early on in the reform period the capital-output ratio may be unusually high; nor need this historical tendency of a planning apparatus have been abandoned abruptly. Further, China's capital stock could be systematically overestimated because in a rapidly developing economy physical assets may experience a much higher rate of (unexpected) obsolescence, not reflected in the depreciation rate, due to fast technological progress. And varying rates of capacity utilization during cycles of rapid economic development may lead to short-run fluctuations in the capital-output ratio.

---

<sup>5</sup> If one were to use current-period GFCF instead of capital, some of these difficulties could be avoided, but it is far from clear if the effects of this year's GFCF should be seen in output changes this year, next year, or, say, the five years starting two years from now.

As a result, while the capital-output ratio and its derivative, the incremental capital-output ratio, constitute standard vocabulary in development economics, their use in short-run analysis, or in anything beyond rule-of-thumb analysis, appears limited. As an outgrowth of neoclassical thinking at the margin, in simple one- or two-sector models, the ICOR may play a crucial theoretical role, but once one allows for significant structural change and for the intricacies of a real world setting with varying capacity utilization and government policies ranging from industrial policy to depreciation-based tax deductions, its usefulness for understanding economic growth becomes rather limited.

#### ***4.2 Investment does not lead to unsustainable debt levels***

Another common concern is that investment in China is the cause of severe and unsustainable levels of indebtedness. A comprehensive treatment of debt in China is beyond this paper. Suffice to report that the share of state budget appropriations in the financing of investment in fixed assets in China has fallen from 28 percent in 1981 (the first year for which the data are available) to 5 percent in 2014 (Figure 16). The share of investment financed through credit rose from 13 percent in 1981 to a high of 27 percent in 1992 before falling back to 12 percent in 2014, while the share of foreign funds rose from 4 percent in 1981 to a high of 12 percent in 1996 and then fell to 1 percent in 2014. The residual consists of “own” funds (largely retained earnings) and “other” (unspecified) funding. By 2014, 70 percent of investment was financed through own funds and a further 13 percent through “other” funds, which, in the aggregate, hardly makes for an overly debt-financed investment scenario.

One caveat, however, is that “own funds” include—besides the “private capital” (*ziyou zijin*) of firms and institutions (presumably retained earnings)—funds collected from other units to be used for investment in fixed assets. I.e., some of the own funds could be obtained through the shadow banking/finance system, or perhaps from issuing bonds, which could then justify a suspicion of unsustainability. A further breakdown of the funding statistics is not available. “Other funds,” finally, cover everything not included in the other four categories, including “funds collected from society,” funds collected from individual people, donations, and transfers from other units. Perhaps more so than “own funds,” the category “other funds”

could be the receptacle of funds from the shadow banking system—and the share of “other funds” in total investment funding is small, at 13%.

The data suggest that shadow financing of investment via “own funds” or “other funds” is likely limited. First, the proportions of own and other funds in total investment financing has always been high, even before the days of shadow financing. In 1995, own funds accounted for 52% of total investment financing, and other funds for 13%. In 2000, the percentages were 49% and 19%, in 2005 58% and 16%, and in 2010 63% and 16%.<sup>6</sup> If earlier years had known no shadow finance, then a proportion of own funds on the order of 50-60% of total investment financing would seem historically appropriate—while the percentages for “other funds” have only come down since 2000—with the remaining 10-20% of total investment financing then possibly due to shadow finance.<sup>7</sup>

Second, data on total social finance show that newly issued trust loans, entrusted loans, bankers’ acceptances, and corporate bonds in 2014 accounted for 8% of GDP. If all these funds had flown into investment, then, with approximately half of aggregate expenditures consisting of investment, approximately 16% of investment was funded via these channels, yielding a very similar overall picture as the calculation in the previous paragraph based on historical trends.<sup>8</sup>

None of these alternative funding sources are necessarily unsustainable. There is nothing intrinsically wrong or limiting about loans extended by trust companies (with new lending in 2014 equal to just below 4% of GDP), entrusted loans (just below 1%),<sup>9</sup> bankers’ acceptances (with a near-zero reduction in 2014), or enterprise bonds (close to 4%). A peak in such activities at a volume equal to 12% of GDP was reached in 2013, and the total 8% volume of 2014 may already indicate a return to a more likely long-run level. Widespread reports of non-repayment of shadow financing could be an indicator of unsustainability, but that has so far not occurred.

---

<sup>6</sup> For the data see *Statistical Yearbook 2015*, p. 311.

<sup>7</sup> This obviously assumes that the percentage of non-shadow-finance own funds in total investment has stayed constant over time.

<sup>8</sup> The highest percentage was reached in 2013 with 12% (and around 11% in 2010 and 2012, and 8% in 2011), up from 2% in 2005. *Statistical Yearbook 2015*, pp. 58 and 635.

<sup>9</sup> Entrusted loans are loans made on behalf of large corporations, typically via financial or other intermediaries, and include loans to customers.

What might give rise to a different concern is the low share of foreign funds in investment financing in China, at just one percent today, down from a peak of 12 percent in 1996. Even if the foreign-funded investment were all in crucial industries, the volume of foreign-funded investment (compared to total investment) is still exceedingly small. In 2014, foreign funding accounted for more than 5 percent of total funding in just three sectors out of the approximately 100 second-digit level sectors: support activities for mining (5.56 percent), computers, communication, and other electronic equipment (6.15 percent), and air transport (5.26 percent).<sup>10</sup>

#### ***4.3 Investment is not simply state-driven***

The final concern is that investment in fixed assets is driven by the state, and that because state ownership is less efficient than private ownership, investment in China is not as productive as it would be if it were in private hands. Again, the data tell a different story (Figure 17).

First, state investment is not the dominant form of investment. Investment by state-owned units, while accounting for 82 percent of all investment in 1980 (the first year, for which these time series data are available), accounted for only 25 percent of all investment in 2013 (the last year for which these data are available). Investment by individual/privately owned units accounted for 30 percent of all investment in 2013, and investment by shareholding units for another 32 percent (with the remainder undertaken by units in collective, foreign, Hong Kong / Macau / Taiwan, “joint,” and “other” ownership). I.e., three-quarters of investment today occurs outside the state sector.

One caveat is that shareholding units likely include state-controlled listed stock companies (while 100% state-owned limited liability companies are included in state investment). I.e., the state may have a hand in more than just the investment by “state units.” Additional data points available for 2014 suggest that the true extent of the state may be

---

<sup>10</sup> For the data see *Statistical Yearbook 2015*, pp. 326-9. One sector is very close to five percent: processing of petroleum, coking and processing of nuclear fuel (4.99 percent).



underestimated by 20% (only).<sup>11</sup> No doubt the central government after the U.S. financial crisis in 2008 pushed for accelerated infrastructure investment. But the effect on the size of the share of the state sector in investment tends to be marginal (Figure 17).

Second, there is a temptation to equate state investment with inefficiency. But that is too simplistic. State-controlled listed stock companies may not differ much in their behavior from private listed companies. And private companies could well be quasi state-controlled/-influenced via Party cell or other mechanisms. While some state investment could indeed be wasteful, some seemingly inefficient state investment may have positive externalities (for example, supporting growth in other enterprises, including private enterprises), whereas private investment tends to internalize all benefits. I.e., from an economy-wide, social perspective, even seemingly inefficient state investment may contribute to economic growth.<sup>12</sup>

The data on investment by firm *ownership form* moderates the observation in the previous section of very little foreign *funding* of investment in China, though not by much. While investment in foreign-funded enterprises accounted for (a peak) eight percent of total investment in 1994-1997 and investment by Hong Kong / Macau / Taiwan enterprises for (a peak) five percent in 1998, by 2013 each of these ownership forms accounted for only two percent of total investment, in contrast, for example, to the state's share of 25 percent, or the shareholding companies' share of 32 percent.

## 5. What does China invest in?

---

<sup>11</sup> The *Investment Yearbook 2015* (p. 15) for 2014 reports a 27% share for the state sector in national, economy-wide investment. A separate table (pp. 50-54) reports total investment net of investment by rural households, by type of enterprise registration (with the total investment value being approximately 2% lower than the economy-wide investment value). In this table, the share of state-owned units in total investment is 24.9%; adding in joint state enterprises (0.1%), joint state-collective enterprises (0.05%), and solely state-owned companies (2.3%) yields a share of 27.4%. Yet a different source with the same overall coverage, *Statistical Yearbook 2015* (p. 323), reports data on "state-owned and state-controlled" units, equal to 32.2% of total investment. The difference of 27.4% and 32.2% is 14.9% of the latter, the difference of 24.9% and 32.2% is 22.7% of the latter.

<sup>12</sup> Journalism and much of the research literature easily jumps to a conclusion of "state ownership bad, private ownership good," but when subjected to careful examination such a conclusion is not tenable. At the very least, one will have to distinguish between the remnant of unreformed, traditional state-owned enterprises, and state-owned enterprises that have undergone the transition to the "modern enterprise system."

China offers a multitude of sectoral data that allow analysis of the distribution of investment across sectors, identification of the sectors in which investments grows fastest, analysis of the distribution of investment per laborer across sectors, and evaluation of the role of foreign firms.

### ***5.1 Sectoral distribution of investment***

Investment in China is heavily concentrated in one-third of the 19 first-digit economic sectors: in 2011, the last year of a particularly defined investment time series that began in 2003, six sectors together account for more than four-fifths of total investment (bars in Figure 18). Manufacturing alone accounts for 33 percent of total investment, followed by real estate with 26 percent (keeping in mind that much of real estate investment may not be investment in new fixed assets but reflect trading in existing fixed assets). The next four sectors are transport, storage and post (9 percent), environment and public facilities (8 percent), utilities (5 percent), and mining (4 percent).

On average, sectoral (nominal) investment grew 5.6 fold between 2003 and 2011, with some variation across those sectors that receive only a small amount of investment (line in Figure 18). The growth rate of investment in IT (information transmission, computer services and software) as well as the share of investment in this sector in 2011 are astonishingly low and could indicate that some investment in IT might not be captured by the sector “IT.”

Comparable investment in fixed asset data for Germany are not available. The Statistisches Bundesamt appears to not compile comprehensive economy-wide investment statistics (but collect investment data from enterprises in several sector-specific enterprise surveys). The data that are available are a breakdown of GFCF by economic sector—with GFCF constituting the more desirable data to begin with, as it excludes trading in existing fixed assets. For the U.S., neither the Bureau of Economic Analysis nor the Bureau of Labor Statistics offer data on investment (or GFCF) by industry. Industry data only come with a breakdown by income.

Comparing the available German GFCF data to the available Chinese investment in fixed asset data, the two sectors manufacturing and real estate together account for half of all GFCF

in Germany (Figure 19), as they do in China. Also similar to China, the top six sectors account for three-quarters of total GFCF in Germany. China and Germany share four of the six largest sectors (with the sectoral classifications being only approximately identical): the sectors public management and the sector transport and storage make the top six in both countries; other economic services and ‘health and social work’ make it into the top six sectors in Germany whereas utilities and mining do so in China, a difference that appears plausible given the different stages of economic development in the two countries.

The variation in growth rates of sectoral investment in Germany between 2003 and 2011 is similar to that in China (albeit at much lower rates of growth in Germany). As in China, growth in (nominal) investment in manufacturing and real estate in Germany is around the sectoral average value, of a 2011 multiple of 1.33 times the 2003 investment value in Germany. Germany has only one sector with an outstanding growth rate, namely the hospitality sector. China has three, including, as in Germany, the hospitality sector, and then also trade and ‘leasing and business services.’

## ***5.2 In which sectors does investment grow fastest?***

For China, detailed sectoral investment data covering 1182 sectors (first- through fourth-digit sectors) are available for *urban* areas. These data allow identification of the specific sectors in which investment grew fastest between 2003 and 2010.<sup>13</sup> Table 1 reports the 30 fastest-growing third- and fourth-digit sectors. Fast-growing sectors are found across the economy, with a relatively small number in manufacturing—manufacturing accounts for only 8 of the 30 fastest-growing sectors but comprises half of all sectors by number (though only 31 percent of investment)—and a relatively large number in retail trade. The list comprises a range of diverse sectors, from magnesium dressing to notary services. The 30 fastest-growing sectors together account for only 1.7 percent of total investment in 2010, where one would

---

<sup>13</sup> 2003 and 2010 are the beginning and final years due to statistical breaks in 2002/2003 and in 2010/2011. Detailed data on urban investment first became available in 2003. 2010 is chosen as final year because the definition of “urban” changes in 2011 to include rural non-household investment (for which, previously, no detailed sectoral data were available), raising the share of urban in total investment from the 2003-2010 range of 82-87 percent to 97 percent.

expect three percent (30 out of approximately 1000 third- and fourth-digit sectors). I.e., the fastest-growing sectors tend to be relatively small sectors to begin with, and to grow fast from a small base. This suggests that fast-growing investment in a particular sector primarily serves to develop previously undeveloped sectors.

For Germany, the detailed GFCF data only extend to 100 first- through third-digit sectors (with the second- and third-digit sectoral data apparently non-exhaustive). Of these 100 sectors, the following ten sectors experienced the fastest growth in investment between 2003 and 2011: fisheries, repair and installation of machines and equipment, wholesale trade, storage, hospitality, telecommunications, financial services, architectural services, mediation and provision of personnel, and social welfare. Compared to China, some of these top performing investment growth sectors appear to be sectors that serve rich(er) societies (such as “social welfare”). The ten fastest-growing second and third-digit sectors (out of approximately 80) account for 11.4 percent of GFCF in Germany in 2011, i.e., account for a share of all investment that is little different from that of the average sector.

Starting 2012, Chinese investment data follow a new sectoral classification scheme. So far, data have been released only for the approximately one hundred second-digit sectors, through 2014. Between 2012 and 2014, the fastest growing sector was leasing business, with a 2014 investment value that was 3.4 times the 2012 value, but leasing business in 2014 accounted for only 0.14 percent of total investment (where the average, given approximately one hundred second-digit sectors, is one percent). This was followed by “capital market services” (2.7-fold value in 2014, with 0.07 percent of total investment), radio, television, motion picture and videotape program production services (2.3-fold value; 0.11 percent), science and technology popularization and application services (1.9-fold value; 0.26 percent), and software and information technology (1.9-fold value; 0.32 percent). This again suggests that investment grew across the board with little distinction by sector. Investment continued to grow fastest in very small sectors that were likely catching up.

### ***5.3 Sectoral distribution of investment per laborer***

Investment and laborer data for China can be matched at the level of the approximately one hundred second-digit sectors. In many of these second-digit sectors, investment per laborer in 2010 was relatively small (Figure 20, focusing on the year 2010 for which the population census provides employment figures, with a maximum breakdown by second-digit sector). It is high only in traditionally capital-intensive sectors such as the extraction of petroleum and natural gas, production and distribution of electric power and heat power, railway transport, the real estate sector, and management of public facilities. China's 36 mining and manufacturing sectors tend to systematically receive relatively high levels of investment per laborer (Figure 21).

Using the investment in fixed asset and employment data available from surveys of mining and manufacturing firms in Germany, it turns out that the frequency distribution of the 28 mining and manufacturing sectors is similar to that in China (Figure 22, covering the year 2013, for which the German data are richest). With the Euro categories in Figure 22 chosen to roughly match the RMB categories in Figure 21, the distribution of investment per laborer by investment size appears to be very similar in Germany to that of China, except that it has a more distinct peak in Germany. In sum, the broad sectoral distribution of investment in China appears perfectly plausible in cross-country comparison, as does the variation in investment per laborer across sectors.

#### ***5.4 The role of foreign firms***

In terms of investment by ownership form of the firm (rather than by source of investment funding), foreign-funded enterprises in 2014 accounted for 2.4 percent of total investment, and firms from Hong Kong, Macau, and Taiwan (HKMT) for another 2.2 percent, together 4.6 percent. Is investment by these non-domestic firms possibly located in the most promising growth industries, or providing crucial technology to China? Across the approximately 100 second-digit sectors, non-domestic firms' investment exceeds 10 percent in five sectors, with foreign firms by far dominating HKMT firms except in one sector (as noted below): processing of petroleum, coking and processing of nuclear fuel (11.4 percent), automobile manufacturing (15.5 percent), computer, communication and other electronic

equipment (21.7 percent), telecommunication, radio, television and satellite transmission service (13.1 percent), and internet and related services (22.8 percent, of which HKMT account for 17.4 percentage points).<sup>14</sup> While these five sectors are indeed growth or technology sectors, the non-domestic share in investment in these sectors is nowhere near dominant, and non-domestic firms don't breach the 10 percent barrier in any of the other promising sectors (from software and information technology to science and research related sectors).

## **6. The importance of size**

China's size is a new phenomenon in the study of developing economies. South Korea tried to develop a broad industrial base but soon began to specialize. Taiwan quickly abandoned plans for broad-based economic growth and focused on developing areas of comparative advantage, in many instances serving niche markets around the world. However, for China there are as yet no signs of significant specialization.

Across virtually all industries in China, the optimal firm size—the firm size with lowest per-unit production costs—is below market demand. I.e., there is sufficient market demand in every sector of the economy for several firms to co-exist and compete. The prospect of historically unprecedented domestic market size may yet lead to innovations in optimal firm sizes at lower per-unit production costs than hitherto experienced around the world.

Viewed from an international perspective, focusing on comparative advantage makes little sense for China: world demand may simply not be big enough to support any substantial degree of specialization in China. For example, for some electronics products China may already be the dominant world supplier, without, however, the electronics manufacturing industry dominating the Chinese manufacturing sector. In this case, world demand has driven specialization in production by China, except that in the Chinese economy the resulting

---

<sup>14</sup> For the data see *Statistical Yearbook 2015*, pp. 322-5.

degree of specialization is barely noticeable.<sup>15</sup> As a result, one can expect to see ongoing investment across virtually every sector of the Chinese economy.

If the experience of more developed countries is anything to go by, eventually production in some sectors will move from China to other countries. Perhaps labor-intensive low value-added jobs will move to less developed countries, while highly capital-intensive production may yet, thanks to increasing reliance on robots in place of labor, move back to some more developed countries. But at the current state, China's domestic investment patterns do not suggest a strategic focus on any particular sector of comparative advantage; instead, investment appears widespread across all economic sectors, supporting a broad and well-developed economic base.

## **7. Conclusions**

This paper has shown that investment has been an important driver of economic growth in China both in the short and in the long run, that a relatively large volume of further investment is needed to catch up with developed economies, and that China's high investment rate is quite in line with the experiences of other East Asian economies. Various concerns about the level of investment are unfounded. China is investing across all sectors of the economy leading to broad-based economic development rather than specialization.

Where does this all lead to? At the macro level, China is continuing the process of economic transition. Under the planned economy, investment and thereby growth were planned and dutifully implemented. In the reform period, state-driven investment has become a policy tool to steer economic growth. In the next step, investment may increasingly become dependent on market forces, with interest rates and industrial policy as main government economic policy tools.

---

<sup>15</sup> China's economic size may also be a powerful explanation for why the Industrial Revolution started in the UK rather than in China. The UK was able to (through its military occupation) extract cheap cotton from India, and impose a British monopoly on the sale of textiles in India. The cheap supply of resources and the availability of a very large market for the final product implied a high degree of profitability for UK manufacturers, while the size of the Indian market created incentives for high rates of investment leading to mass production. There existed no country big enough for China to colonize and extract the same scale of benefits. High rates of investment in China could not be facilitated through colonies (or war) but had to await a gradual process of economic development and state policies favouring investment.

Along with the gradual withdrawal of the state from direct participation in investment decisions will likely come structural change, in two respects. First, in terms of the structure of aggregate demand: following East Asian precedents, China's investment rate will fall. Given that it reached extraordinary high levels in recent years, it may yet fall significantly in a short period of time. But the Asian precedents also suggest that the investment rate will likely stabilize at a high level and then decline gradually over a period of decades. As driver of economic growth, consumption will likely return to be the mainstay, which will then also make for a more stable growth rate. The government's wage policies, including the consistent increases in minimum wages over the past five years, are just one sign suggesting that the Chinese government is giving more weight to consumption while not underestimating the importance of investment for expanding production and implementing technological change.

Second, in terms of the structure of production, China's share of industry in GDP, at close to 40 percent, is still relatively large. Given typical development patterns, this share is likely to fall. Since industry has a relatively high ratio of capital to output, a reduction in the relative size of industry lowers the investment rate and puts downward pressure on the capital-output ratio. Within industry, technological upgrading and technological progress are likely to lead to changes in the relative shares of different industrial sectors in industrial value-added. The Chinese government is furthering these developments through its industrial policies, including its promotion of specific industries through industrial policies and its promotion of job creation in services. What one can expect to see in the coming years then is not 'more of the same,' i.e., straight-out capital accumulation, distributed across sectors as before, but an adjustment of investment across sectors towards the use of capital in ways most conducive to economic growth.

The drastic drop in the share of foreign funds in total investment funding from 12 to one percent over the past twenty years is a striking testimony to the development of the Chinese economy, which simply no longer needs foreign funding. It is hard not to conclude that China's growth story today is a predominantly domestic one. China appears to have transitioned from a period when foreign firms played an important role in China's economic



development to a period when China has the capability to sustain significant forward momentum on its own—perhaps the defining criterion of an economic superpower.

## References

BEA website. Database at [www.bea.gov](http://www.bea.gov).

*Investment Yearbook. Zhongguo guding zichan touzi tongji nianjian* (China Investment in Fixed Assets Statistical Yearbook). Beijing: Zhongguo tongji chubanshe, various years.

Holz, Carsten A. "China's Reform Period Economic Growth: How Reliable Are Angus Maddison's Estimates." *Review of Income and Wealth* 52, no. 1 (March 2006): 85-119.

Holz, Carsten A. "Understanding China's Investment Statistics." Mimeo, 2016.

NBS website: Database at <http://www.stats.gov.cn> (posted values may change slightly over time due to revisions).

NBS. *Zhongguo zhuyao tongji zhibiao quanshi* (Glossary on China's Major Statistical Indices). Second edition. Beijing: Zhongguo tongji chubanshe, 2013.

PWT 8.1. Penn World Tables 8.1, available at <http://www.rug.nl/research/ggdc/data/pwt/pwt-8.1>.

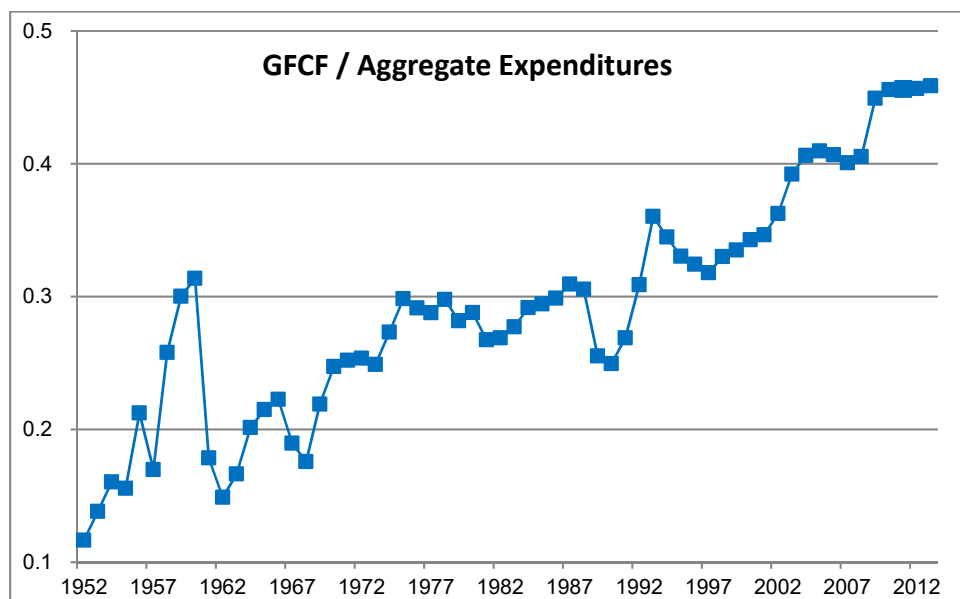
*Sixty Years. Xin zhongguo liushi nian tongji ziliao huibian* (Comprehensive Statistical Materials on 60 Years of the New China [1949-2008]). Beijing: Zhongguo tongji chubanshe, 2010.

*Statistical Yearbook. Zhongguo tongji nianjian*. Beijing: Zhongguo tongji chubanshe, various years.

ZHANG Jun, and ZHU Tian. "Debunking the Myth About China's Low Consumption." *China Economic Journal* 6, no. 2-3 (2013): 103-112.

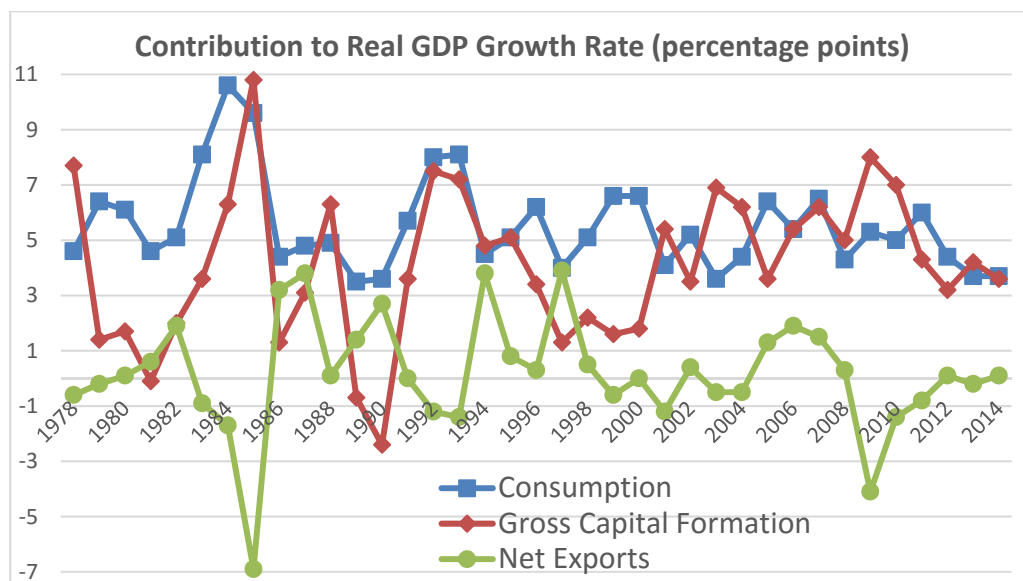
ZHANG Jun, and ZHU Tian. "Re-Estimating China's Underestimated Consumption." Undated working paper (2014a).

ZHU Tian, ZHANG Jun, and LIU Fang. "Zhongguo zhichufa GDP goucheng bili you duo kekao?" (How Reliable Is the Composition of China's Expenditure Approach GDP?) Mimeo, November 2014.



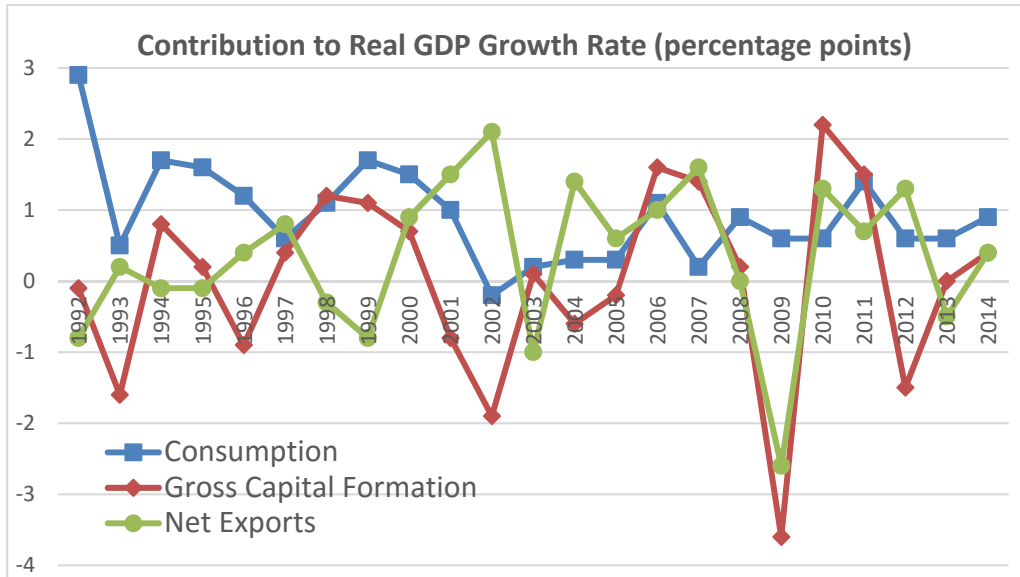
Sources: *Sixty Years*, *Statistical Yearbook*, *Investment Yearbook*.

Figure 1. Gross Fixed Capital Formation Relative to Aggregate Expenditures



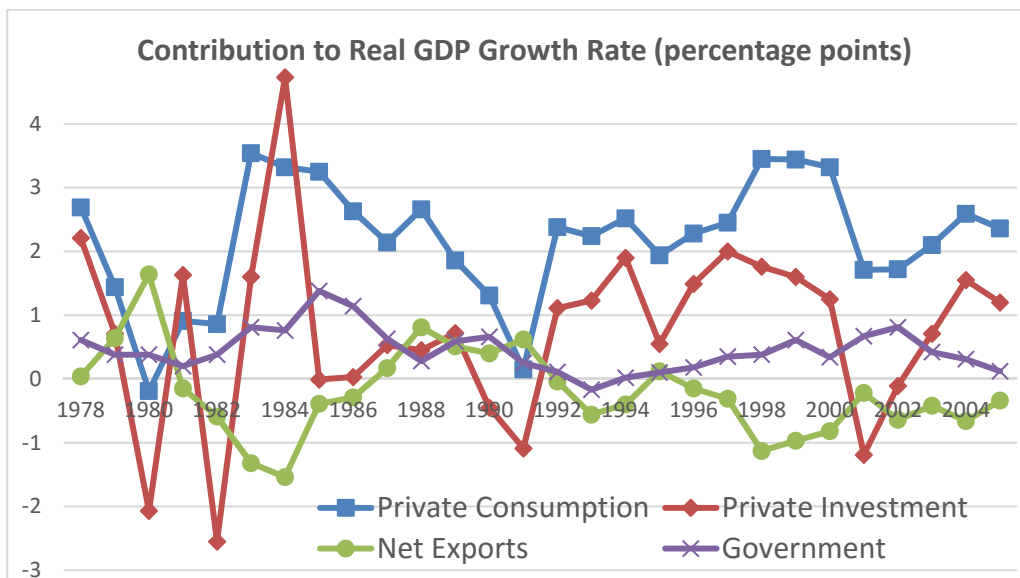
Source: NBS website.

Figure 2. Annual Contributions to the Real GDP Growth Rate, China



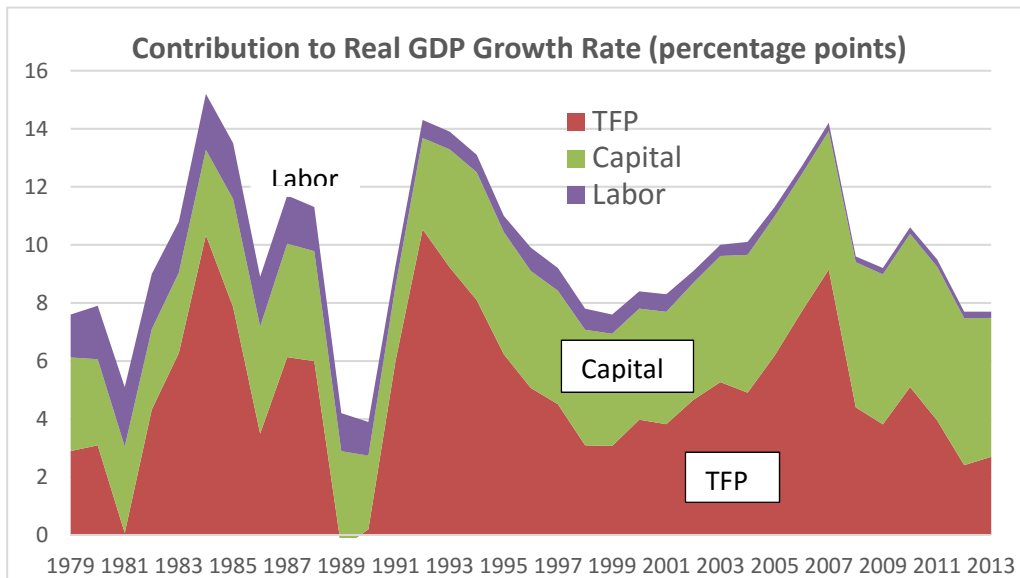
Source: Statistisches Bundesamt Deutschland, Table 81000-0029, <https://www-genesis.destatis.de/genesis/online>. Data for 2012-2014 are preliminary; first values available for 1992.

Figure 3. Annual Contributions to the Real GDP Growth Rate, Germany



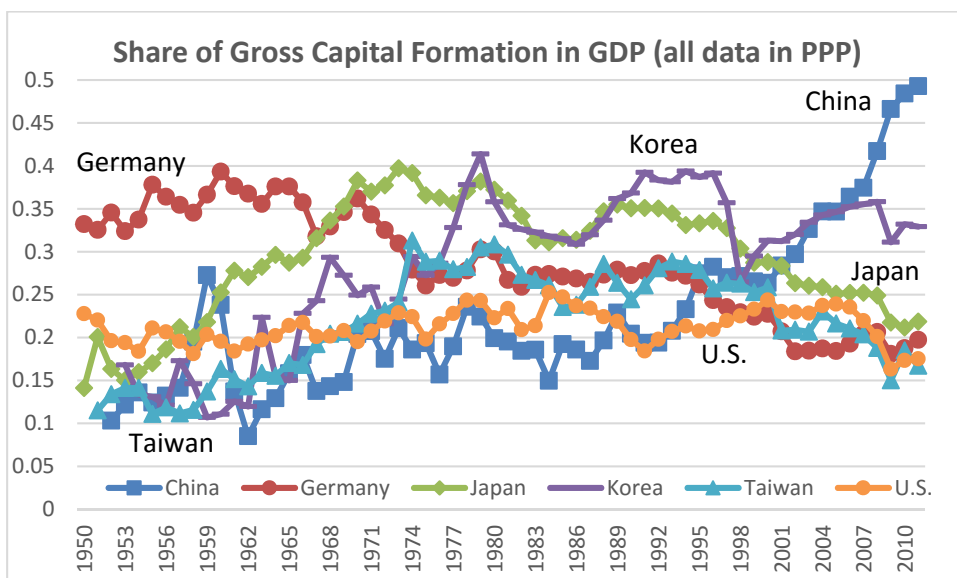
Source: BEA website, Table 1.1.2 Contributions to Percent Change in Real Gross Domestic Product.

Figure 4. Annual Contributions to the Real GDP Growth Rate, U.S.



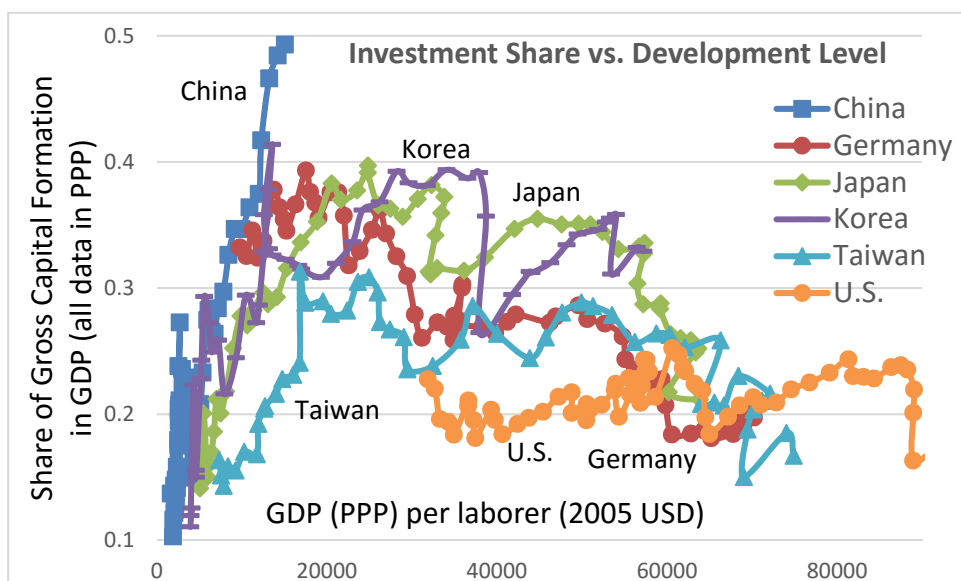
Source: NBS website, author's own calculations for capital stock. Average annual TFP growth and coefficients of capital and labor are first estimated in a Cobb-Douglas production function estimation with a constant-returns-to-scale constraint. In a second step, using the estimated coefficients of capital and labor as well as the known values of output, capital, and labor, year-specific TFP growth (reported in the figure) is obtained as residual.

Figure 5. Long-run Contributions to the Real GDP Growth Rate



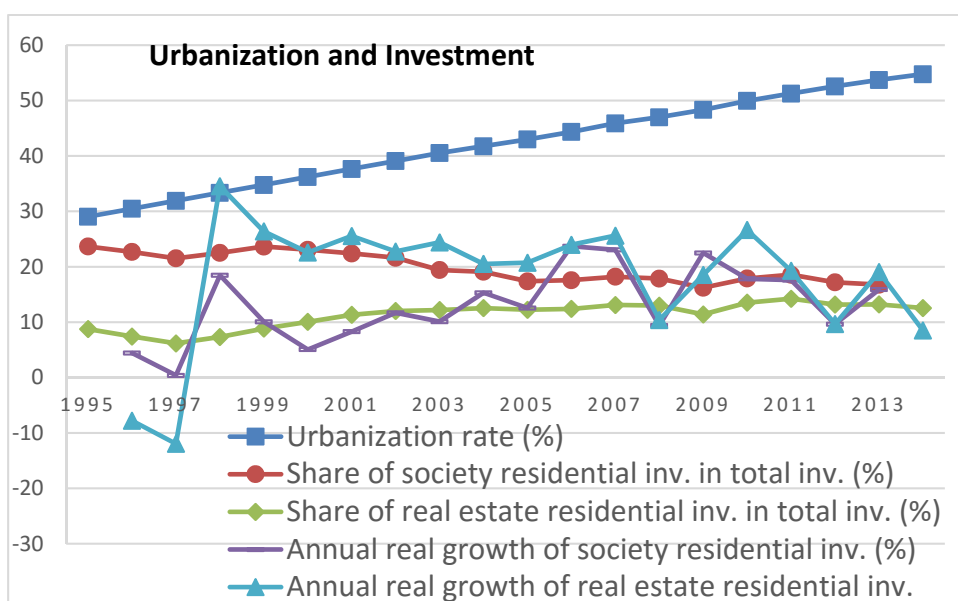
Source: PWT 8.1. Variable: share of gross capital formation at current PPPs in output-side real GDP at current PPPs (in 2005 USD).

Figure 6. Investment Share in GDP



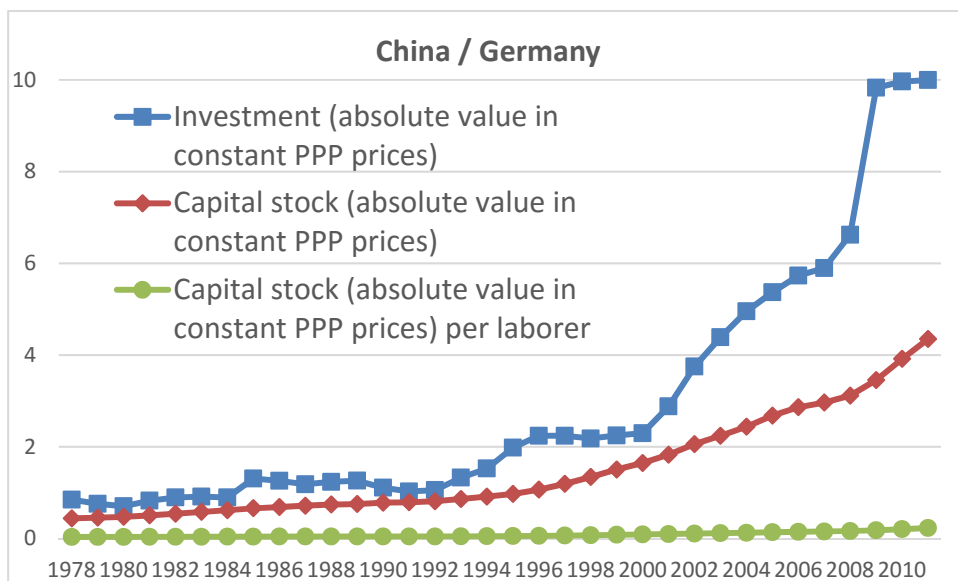
Source: PWT 8.1. Variables: share of gross capital formation at current PPPs in output-side real GDP at current PPPs (in 2005 USD); output-side real GDP at chained PPPs (in 2005 USD) per person engaged.

Figure 7. Investment Share in GDP by Level of Output Per Laborer



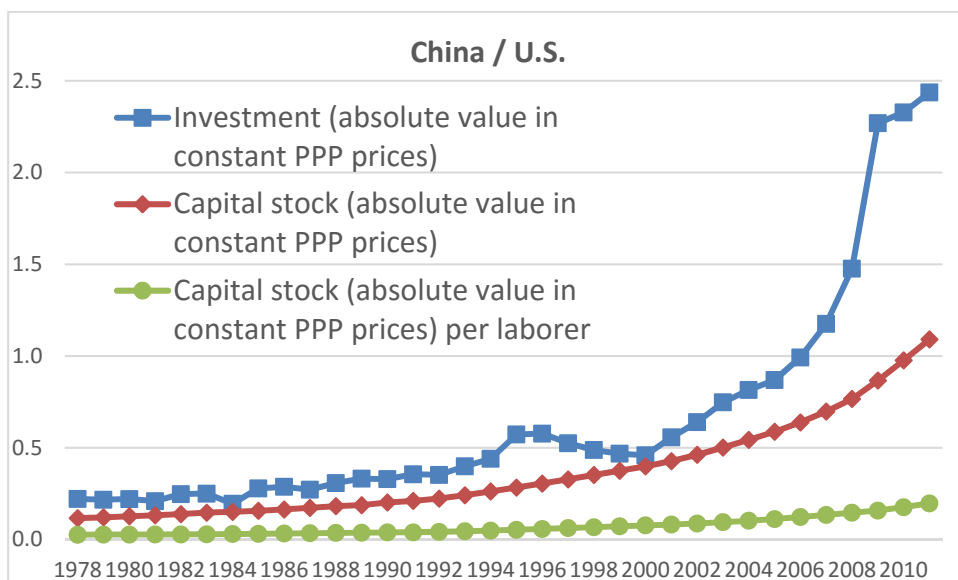
Source: NBS website (raw data). Investment is official Fixed Asset Investment (unlike the national income accounts measures of GFCF and GCF used in the earlier charts and in the immediately following charts). The definition of “urban” is revised repeatedly in the reform period, with the data series not accompanied by corresponding explanations. The coverage of investment changes on a near-annual basis, partly documented with the data series in the data source. Data on residential investment start in 1995. The deflator to obtain real growth rates is the investment in fixed asset price index sub-index “Structures.”

Figure 8. Urbanization and Investment



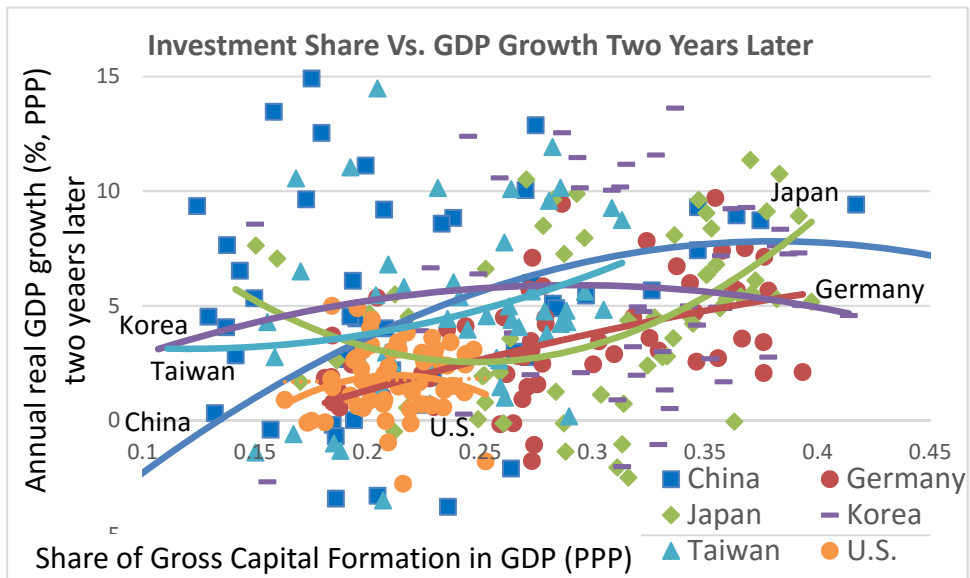
Source: PWT 8.1. Variables: share of gross capital formation at current PPPs in output-side real GDP at current PPPs (in 2005 USD) times output-side real GDP at current PPPs (in 2005 USD); capital stock at current PPPs (in 2005 USD); capital stock per number of persons engaged.

Figure 9. Investment and Capital Stock in China, China Relative to Germany



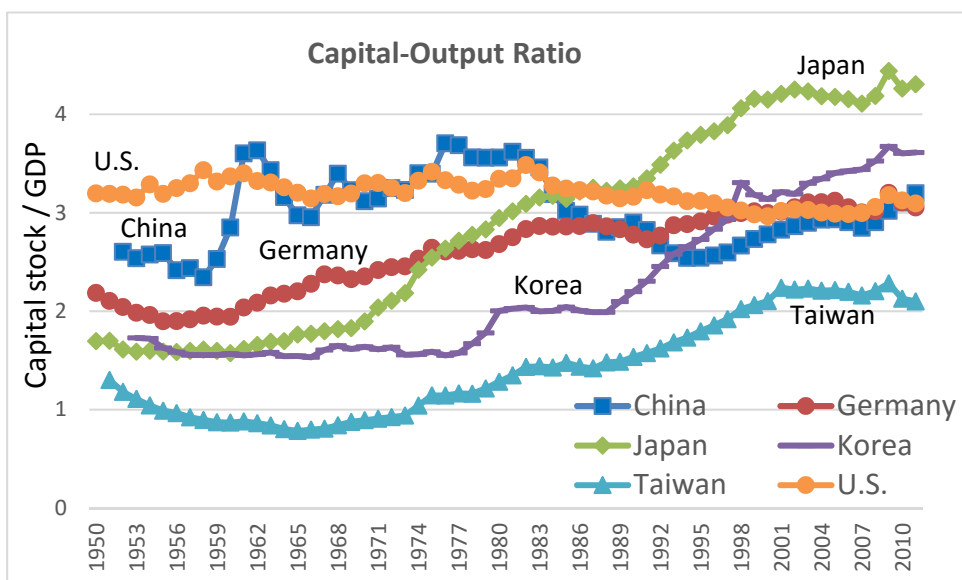
Source: PWT 8.1. Variables: share of gross capital formation at current PPPs in output-side real GDP at current PPPs (in 2005 USD) times output-side real GDP at current PPPs (in 2005 USD); capital stock at current PPPs (in 2005 USD); capital stock per number of persons engaged.

Figure 10. Investment and Capital Stock in China, China Relative to the U.S.



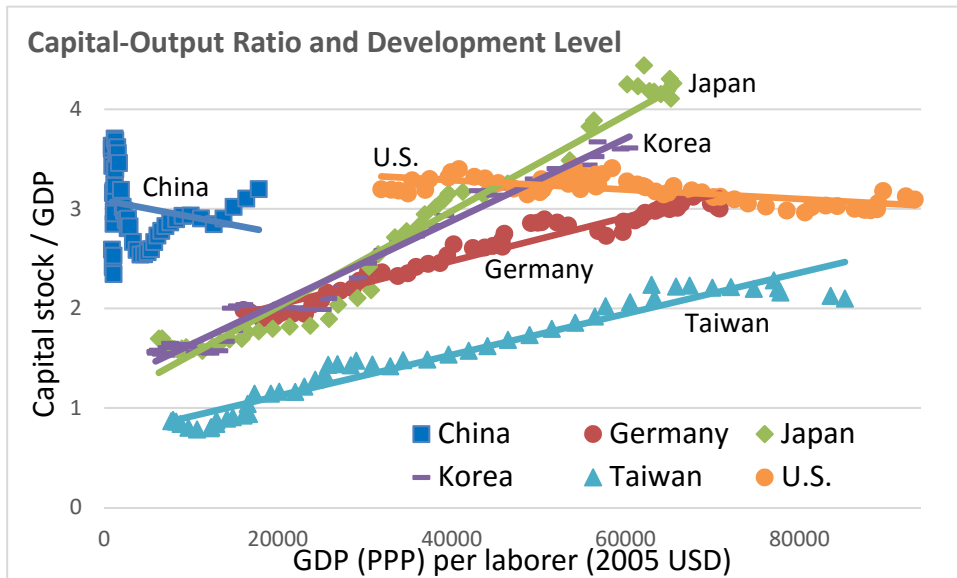
Source: PWT 8.1. Variables: share of gross capital formation at current PPPs; output-side real GDP at chained PPPs (in 2005 USD) per person engaged. Values are for 1950-2011 as available.

Figure 11. Investment Share Vs. GDP Growth Two Years Later



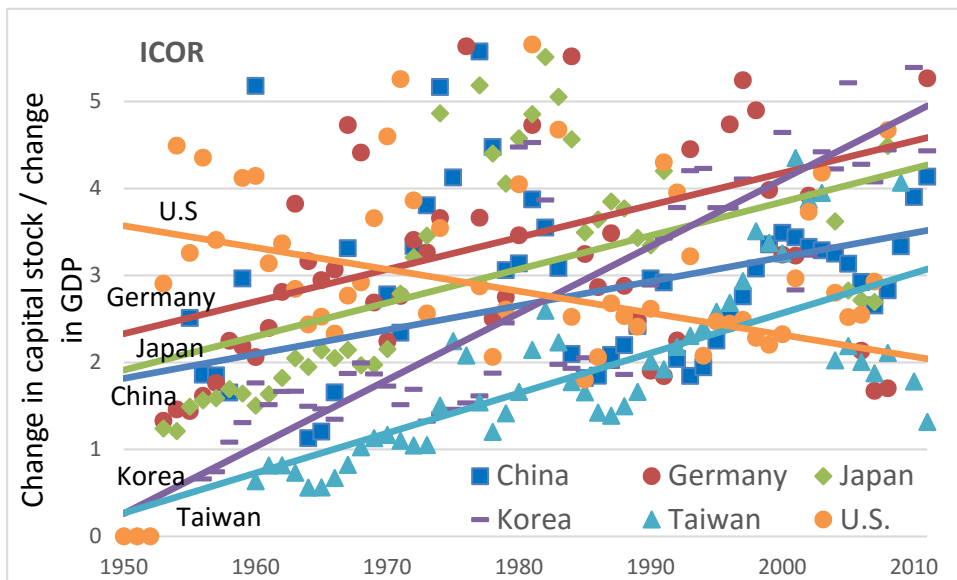
Source: PWT 8.1. Variable: capital stock at constant 2005 national prices (in 2005 USD) divided by real GDP at constant 2005 national prices (in 2005 USD). Values are for 1950-2011 as available.

Figure 12. Capital-Output Ratio



Source: PWT 8.1. Variables: capital stock at constant 2005 national prices (in 2005 USD) divided by real GDP at constant 2005 national prices (in 2005 USD); real GDP at constant 2005 national prices (in 2005 USD) per person engaged. Values are for 1950-2011 as available.

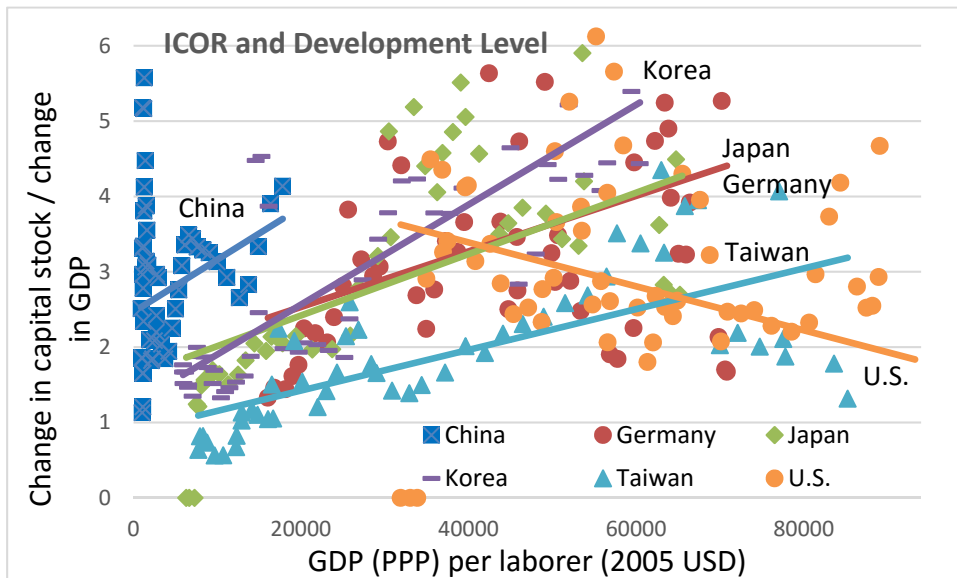
Figure 13. Capital-Output Ratio Vs. GDP Per Laborer



Source: PWT 8.1. Variables: capital stock at constant 2005 national prices (in 2005 USD); real GDP at constant 2005 national prices (in 2005 USD). Changes are three-year absolute changes. Values are for 1950-2011 as available. A linear trend is imposed. Across the six countries and close to sixty years, approximately one dozen observations with absolute values above 10 were removed.

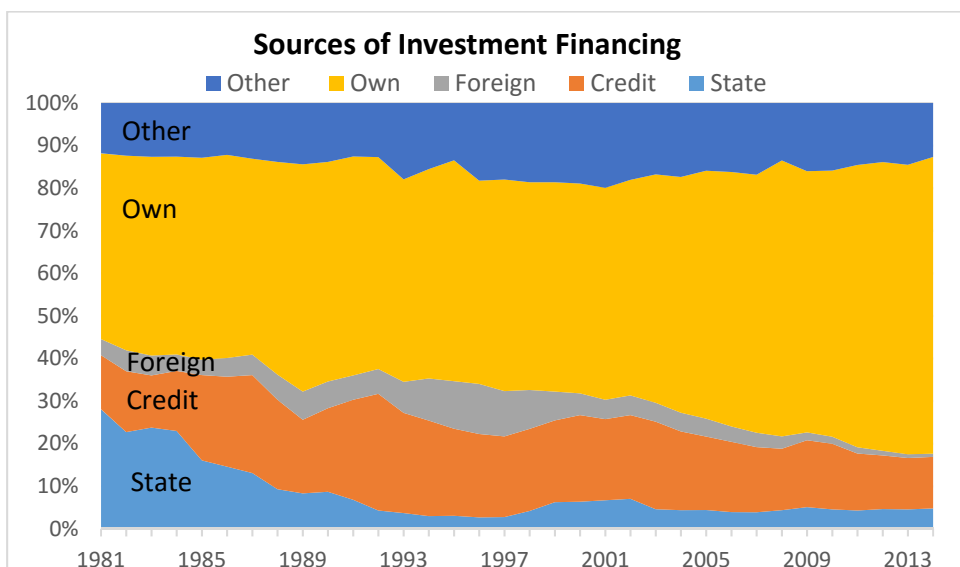
Figure 14. Three-Year Incremental Capital-Output Ratio With Outliers Removed





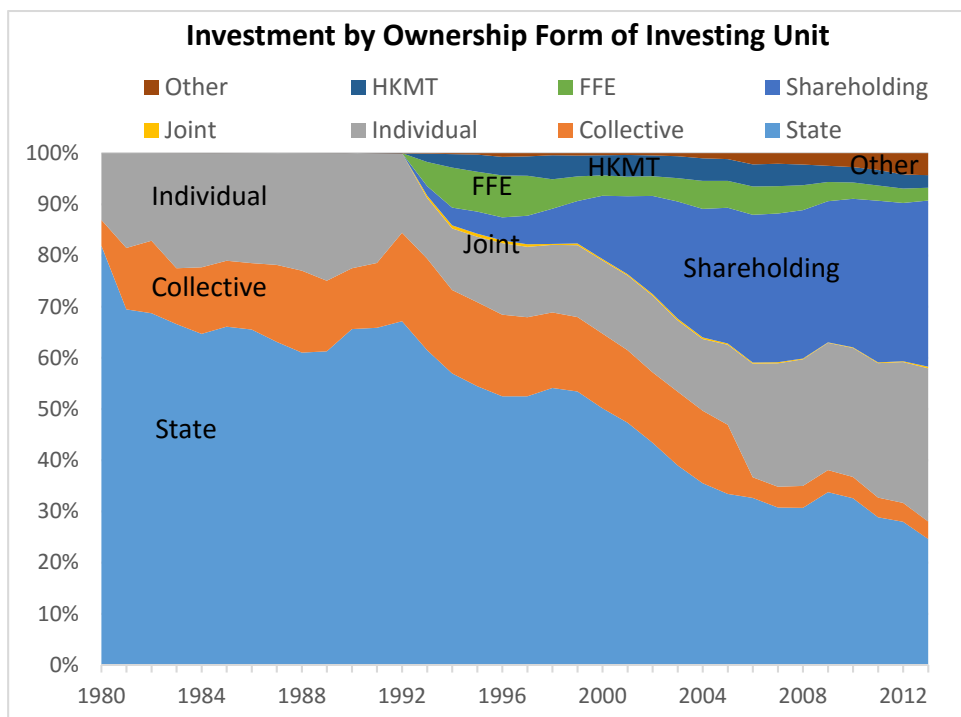
Source: PWT 8.1. Variables: capital stock at constant 2005 national prices (in 2005 USD); real GDP at constant 2005 national prices (in 2005 USD); real GDP at constant 2005 national prices (in 2005 USD) per person engaged. Changes are three-year absolute changes. Values are for 1950-2011 as available. A linear trend is imposed. Across the six countries and close to sixty years, approximately one dozen observations with absolute ICOR values above 10 were removed.

Figure 15. Three-Year Incremental Capital-Output Ratio (With Outliers Removed) Vs. GDP Per Laborer



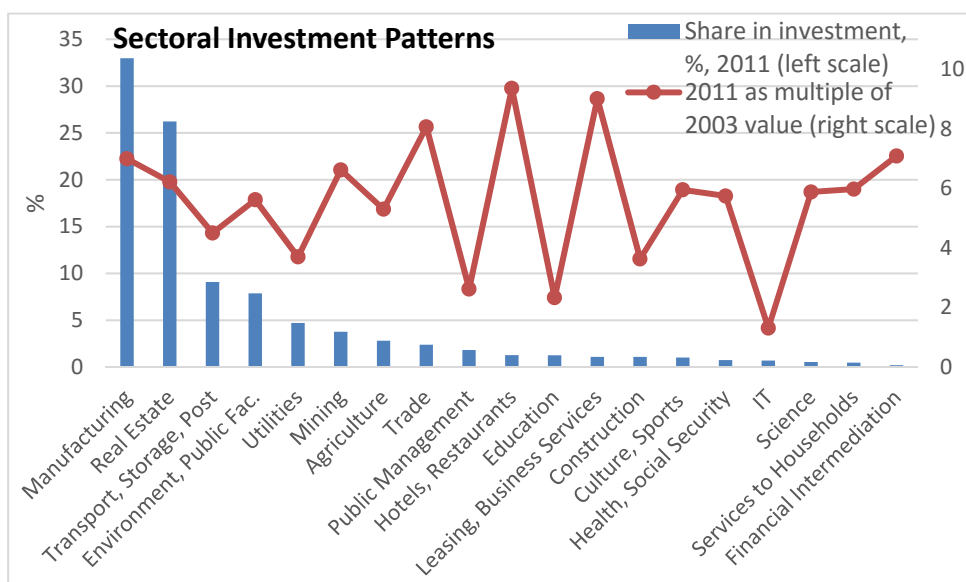
Source: NBS website. For 1981-1984 and 1994, the two financing sources “own” and “other” are only available as one joint value; in 1985 and 1998, the joint value equals the values for “other” with no values available for “own.” 1981-1985 values are obtained by splitting the joint value using the average proportions of 1986-1990 (which range, for “own,” from 0.78 to 0.80). 1988 and 1994 values of “own” and “other” are obtained by applying the average shares of “own” and “other” in the joint values of the previous and next year. An implicit residual in the data of 1986, 1987, and 1989-1993 was included in “other.” Total investment *financing* equals total *reported* investment in fixed assets in 1981 through 1993, and in the years since falls short by 1-12 percent, with a steady trend towards the biggest discrepancy in 2010, followed by a steady reduction in the gap since then.

Figure 16. Sources of Investment Financing



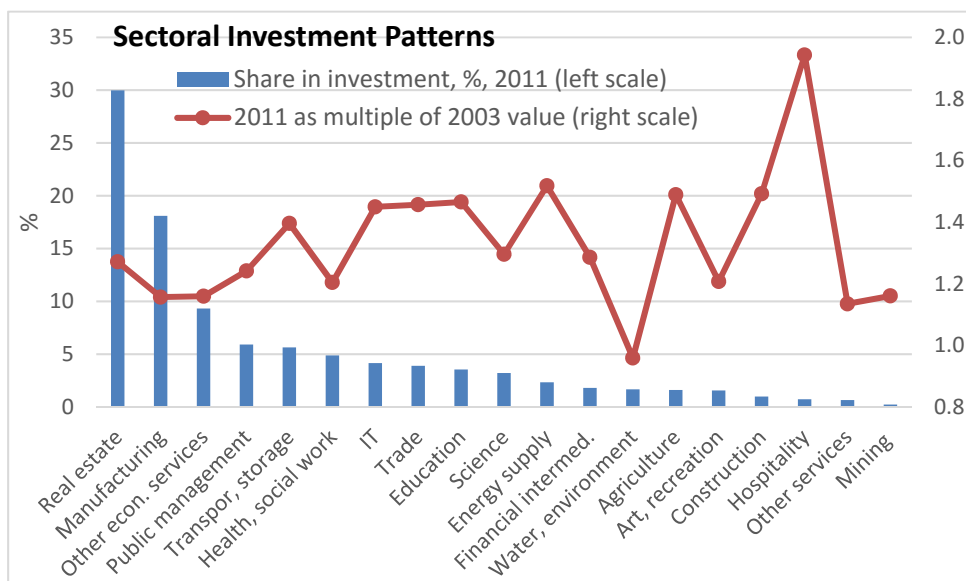
Sources: *Statistical Yearbook* and *Investment Yearbook*, various issues. Total investment in fixed assets by ownership form in the years 1986-1994, 1996, and 2010 differs slightly from the total investment in fixed asset values published on the NBS website (it is less by up to 6 percent, except for 2010, when it is 11 percent more, presumably due to the change in the coverage of the investment in fixed assets statistics).

Figure 17. Investment by Ownership Form of the Investing Unit



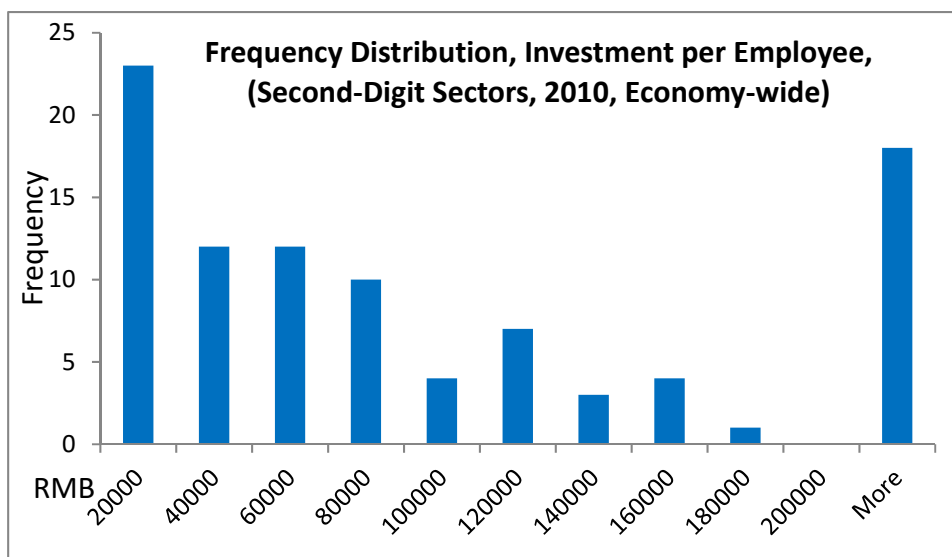
Sources: *Investment Yearbook*; own calculations to obtain an approximation of economy-wide values by sector (covering both urban and rural investment).

Figure 18. Sectoral Investment Patterns, China



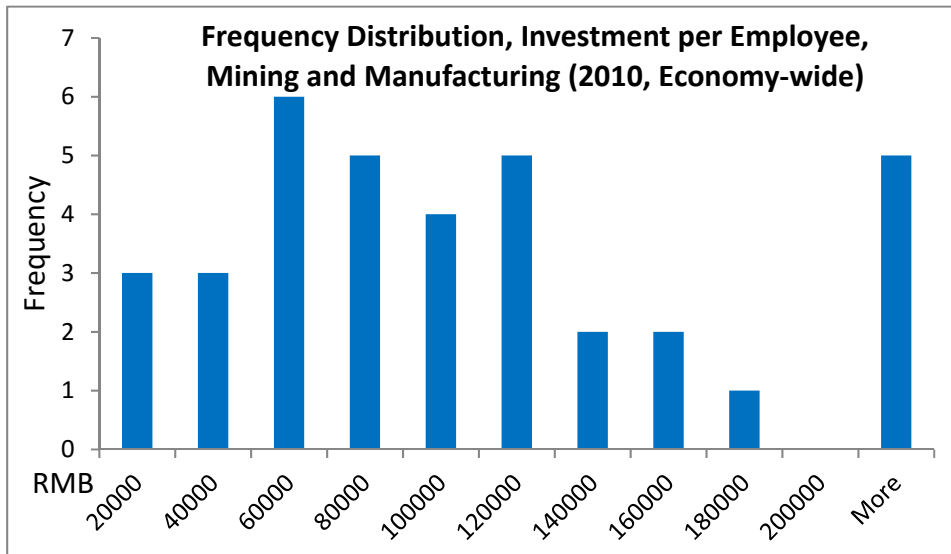
Sources: Statistisches Bundesamt, Destatis database, <https://www-genesis.destatis.de/genesis/online>, Table 81000-0015.

Figure 19. Sectoral Investment Patterns, Germany



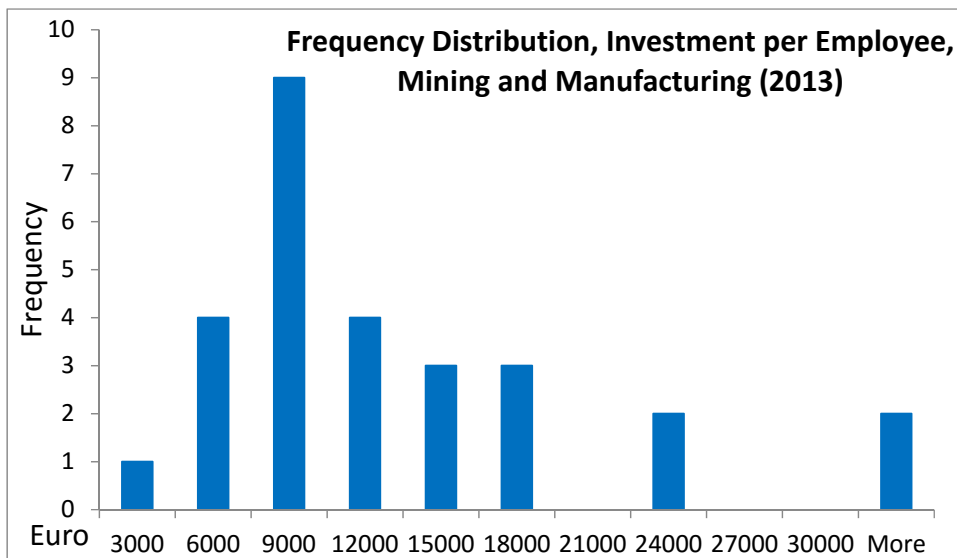
Sources: *Investment Yearbook*; own calculations to obtain an approximation of economy-wide values by sector (covering both urban and rural investment). 2010 Population Census data from NBS website; long-form employment values by sector are approximated to the whole population using the ratio of total employment to long-form employment.

Figure 20. Frequency Distribution of Investment per Employee, All Second-Digit Sectors, 2010, China



Sources: *Investment Yearbook*; own calculations to obtain an approximation of economy-wide values by sector (covering both urban and rural investment). 2010 Population Census data from NBS website; long-form employment values by sector are approximated to the whole population using the ratio of total employment to long-form employment.

Figure 21. Frequency Distribution of Investment per Employee, Second-Digit Sectors in Mining and Manufacturing, 2010, China



Sources: Statistisches Bundesamt, Destatis database, <https://www-genesis.destatis.de/genesis/online>, Table 42231-001.

Figure 22. Frequency Distribution of Investment per Employee, Mining and Manufacturing, 2010, Germany

Table 1. Thirty Fastest-Growing Third- or Fourth-Digit Sectors, 2010 vs. 2003

<i>First digit sector (sometimes with second-digit sector)</i> Third- or fourth-digit sector	% of invest-ment 2010	Mul- tiple 2010 / 2003
<b><i>Agriculture, forestry, animal husbandry, fishery – cereals and other crops</i></b> 谷物及其他作物的种植		
Tobacco cultivation 烟草的种植	0.009	126
Bamboo harvesting 竹材的采运	0.000	68
Inland fishery 内陆捕捞	0.001	156
<b><i>Mining – non-ferrous metal industry</i></b> 有色金属矿采选业		
Antimony ore mining 锑矿采选	0.005	65
Aluminum mining and dressing 铝矿采选	0.020	81
Magnesium dressing 镁矿采选	0.005	67
Other commonly used non-ferrous metals 其他常用有色金属矿采选	0.033	87
Other precious metals mining and dressing 其他贵金属矿采选	0.011	3681
Radioactive metal ore mining 放射性金属矿采选	0.002	160
<b><i>Manufacturing – general equipment manufacturing</i></b> 通用设备制造业		
Guns and similar appliances 喷枪及类似器具制造	0.005	113
<b><i>Manufacturing – special equipment manufacturing</i></b> 专用设备制造业		
Oil drilling equipment 石油钻采专用设备制造	0.113	66
Feed production equipment 饲料生产专用设备制造	0.008	61
Postal machinery and equipment 邮政专用机械及器材制造	0.000	90
Traffic safety and control equipment 交通安全及管制专用设备制造	0.007	69
<b><i>Manufacturing – transportation equipment manufacturing</i></b> 交通运输设备制造业		
Aids to navigation equipment and other floating devices 航标器材及其他浮动装置的制造	0.008	253
<b><i>Manufacturing – electrical machinery and equipment manufacturing</i></b> 电气机械及器材制造业		
Generators and generator sets 发电机及发电机组制造	0.189	65
<b><i>Manufacturing – waste resources and materials recycling and processing</i></b> 废弃资源和废旧材料回收加工业		
Metal waste and scrap processing 金属废料和碎屑的加工处理	0.083	74
<b><i>Utilities – electricity and heat, production and supply</i></b> 电力、热力的生产和供应业		
Other energy production 其他能源发电	1.015	66

<b><i>Transportation, storage and postal services 交通运输、仓储和邮政业</i></b>		
Freight trains 货运火车站	0.006	68
<b><i>Trade – retail trade 零售业</i></b>		
Audiovisual products and electronic publications 音像制品及电子出版物零售	0.003	58
Photographic equipment 照相器材零售	0.001	588
Medical supplies and equipment 医疗用品及器材零售	0.006	57
Other electronic products 其他电子产品零售	0.005	80
Paint 涂料零售	0.002	138
<b><i>Financial intermediation 金融业</i></b>		
Financial companies 财务公司	0.001	224
<b><i>Leasing and business services 租赁和商务服务业</i></b>		
Other machinery and equipment rental 其他机械与设备租赁	0.034	270
Notary services 公证服务	0.000	93
Other unlisted business services 其他未列明的商务服务	0.110	62
<b><i>Resident services and other services 居民服务和其他服务业</i></b>		
Office equipment maintenance 办公设备维修	0.002	209
<b><i>Cultural, sports and entertainment 文化、体育和娱乐业</i></b>		
Audiovisual production 音像制作	0.018	71
<b><i>Sum shares</i></b>	<b><i>1.706</i></b>	

Sources: *Investment Yearbook*. Total number of first- through fourth-digit sectors: 1182. (For some second-digit sectors, only third-digit sector values are available, for others, also fourth-digit sector values. Therefore, in the search for the fastest-growing sectors all levels of sectoral classification were retained.) About one dozen sectors saw no investment in 2003; these sectors are omitted from the search for the fastest-growing sectors.