



IMF Working Paper

Is China Over-Investing and Does it Matter?

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Asia and Pacific Department

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Abstract

Now close to 50 percent of GDP, this paper assesses the appropriateness of China's current investment levels. It finds that China's capital-to-output ratio is within the range of other emerging markets, but its economic growth rates stand out, partly due to a surge in investment over the last decade. Moreover, its investment is significantly higher than suggested by cross-country panel estimation. This deviation has been accumulating over the last decade, and at nearly 10 percent of GDP is now larger and more persistent than experienced by other Asian economies leading up to the Asian crisis. However, because its investment is predominantly financed by domestic savings, a crisis appears unlikely when assessed against dependency on external funding. But this does not mean that the cost is absent. Rather, it is distributed to other sectors of the economy through a hidden transfer of resources, estimated at an average of 4 percent of GDP per year.

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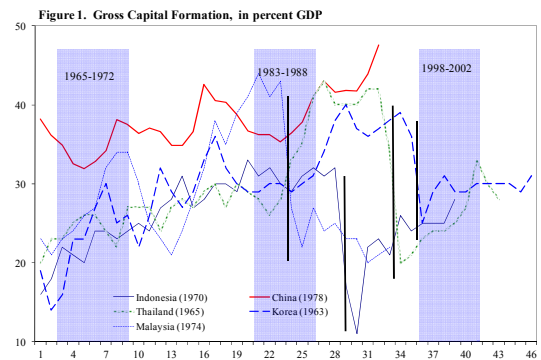
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I. INTRODUCTION

1. **In non-resource rich countries, most economic take offs are strongly associated with high levels of investment.** Asia, in particular, is a typical example of how high investment has facilitated rapid economic growth.² Investment alone, of course, does not explain the growth story. Total factor productivity (TFP), labor supply, and savings from the neoclassical sense, while market access and efficient financial intermediation from a macro aspect, all play important roles. Moreover, in Asia's case, economies have also benefited from exports. Even during periods when investment has been below its long-term trend, Asian economies have enjoyed rapid growth through access to expanding global markets, notably during most of the 1970s when the newly industrialized economies (NIEs) were taking off.

2. **However, high investment has also proven to be costly.** Although Asian countries usually have a high savings rate, several countries resorted to foreign financing to maintain even higher investment ratios. While such a strategy enabled them to achieve a faster growth path for some time, it typically eventually led to banking or foreign exchange crisis, from which it took them several years to recover (Figure 1). This is because the cost of financing such high rates of investment was often mispriced, only to be corrected abruptly. In emerging economies, mispricing often involved currency and maturity mismatches, whose risk was obscured by implicit guarantees or lack of information. In other words, an artificially low cost of financing supports excessive investment, including in property and manufacturing sectors, that eventually result in a crisis. Such a pattern was also observed in other emerging markets outside Asia, such as in Latin America during the 1980s.



3. **This paper compares China's current investment level against comparator economies.** We find that China's capital-to-output ratio is within the range of other emerging markets, but its pace of growth stands out from the rest, partly due to a surge in investment over the last decade. Moreover, when measured against a norm estimated from a cross-country panel, its investment is too high. While a crisis appears unlikely when assessed against dependency on external funding, it raises concerns about the underlying domestic strain associated with financing such a high level of investment, which appears to be implicitly borne by households. In doing so, our paper also contributes to the literature by

² During 1970-2010, the correlation between a 5 year moving average investment to GDP ratio and economic growth was around 0.83 in developing Asia. The correlation is somewhat weaker at 0.74 for advanced economies, the G7, for example.

harnessing the insights, sparse assumptions and increased degrees of freedom that come from using an up-to-date panel of comparator economies, with both the country and time coverage carefully selected to match China's economic features and phase of development.

4. **The rest of this paper is structured as follows.** In Section II, a short review of current literature is provided. Section III motivates the analysis by using the neoclassical model approach to compare China's investment against a group of other emerging market economies. A simple welfare maximization model is introduced in Section IV to illustrate that assessing the appropriateness of the level of investment requires a more comprehensive approach than the neoclassical indicators. Thus in Section V, as a practical solution to the complexity of the issue, we use a panel estimation to derive an investment "norm" based on fundamentals across countries. In Section VI, the implicit cost of supporting China's high investment level is estimated and section VII concludes.

II. INVESTMENT IN CHINA: LITERATURE REVIEW

5. **Results of recent studies at the macro level on the question of whether China over-invests have been largely inconclusive.** On the one hand, Bai and others (2006) argue that while the return to capital did fall during the 1990s, it remains relatively high, suggesting that investment has not been excessive. Lu and others (2008) draw similar conclusions from their finding that after falling in the 1990s, corporate profitability has been rising. Dong and others (2006) are more nuanced, reporting that the marginal product of capital has been relatively high in the last two decades but cautioning that China is on a dynamically inefficient growth path. In particular, they find that the rate of investment has consistently exceeded the share of capital income in GDP since the early 1990s, suggesting that investment is too high and that social welfare could be improved by increasing consumption at the expense of investment. In a similar vein, Rawski (2002) finds low investment returns and widespread excess capacity across many sectors during the 1990s. Meanwhile, Barnett and Brooks (2006) report a rise in the capital-to-output ratio and fall in the marginal product of capital during 1990-2005, and Qin and Song (2009) find evidence of pervasive over-investment based on their calculation of the profit-maximizing level of capital spending using a production-function approach.

6. **Microeconomic studies have tended to find greater support for misallocation of investment.** Using data on 10,000 firms during 2000-07, Ding and others (2010) calculate measures of investment efficiency and find evidence for over-investment for all types of companies, even in the more efficient and profitable private sector. More generally, state-owned enterprises (SOEs) tend to be consistently implicated in the literature, with Liu and Siu (2006) finding them guilty of over-investment because their implied cost of capital is artificially low. Similarly, using a sample of 12,000 firms in 120 cities during 2002-04, Dollar and Wei (2007) report that even though SOEs have lower marginal returns to capital than private or foreign firms, China's banking system continues to be biased toward them in terms of capital allocation. If this bias were redressed, they contend that China's investment

rate could fall by as much as 8 percentage points without any adverse effect on economic growth. Meanwhile, Hsieh and Klenow (2009) argue that if capital and labor in China were reallocated to equalize marginal products to the extent observed in the United States, manufacturing TFP would rise by 30-50 percent. Finally, Geng and N'Diaye (2012) argue that investment is artificially propped up in China by low interest rates and an undervalued currency.

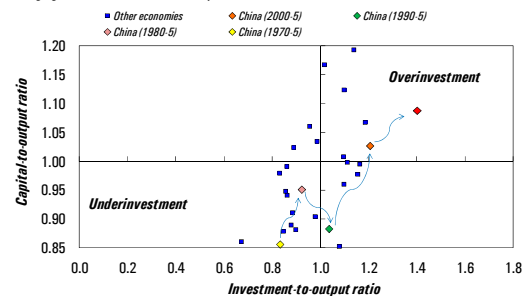
7. **Much of the literature imposes a number of strong assumptions and few papers compare China's investment to that in the rest of the world.** A variety of approaches taking to account for the plethora of potential factors that may be at play in determining investment trends in China. These factors include China's low initial capital endowment, its level of development, and favorable returns to capital. However, most of this work is based on calculations of investment efficiency that are assumption-based and prone to measurement error. In addition, many have adopted an indigenous approach focusing on China alone, with fewer attempts to use cross-country data to compare its investment trends against those of other economies. Other common limitations include relatively unrepresentative samples, short time periods, and the relative paucity of studies covering the post-2005 further surge in investment.

III. NEOCLASSICAL MODEL APPROACH

8. **Relative to the Golden Rule, China is currently over-investing.**³ As a first proxy to assess whether investment is too high or low, it is instructive to compare the investment and capital-output ratios in an economy with estimates of their long-run equilibrium (steady-state) levels.

According to the Golden Rule, such a level of investment is defined as $i^* = k^*(g+d)/(1+g)$, where (i^*) is the steady-state level of investment based on estimates of a steady-state capital-to-output ratio (k^*), the depreciation rate (d), and the rate of potential output growth (g). On this basis, China was under investing in the 1970s and to a lesser extent in the 1980s (Figure 2). China's investment has since picked up, especially after 2000. By 2005, China's capital-to-output ratio was close to its long-run level so that its investment to GDP ratio should theoretically have tended to fall back towards its steady-state value. However, during 2007-11, to counter the adverse effect from the global crisis, China raised its investment further. Depending on precise assumptions, over this period, China may have been over-investing by between 12 and 20 percent of GDP relative to its steady-state desirable value.

Figure 2. Capital- and Investment-to-Output Ratio
(Emerging economies, relative to steady-state level in 2007-11)



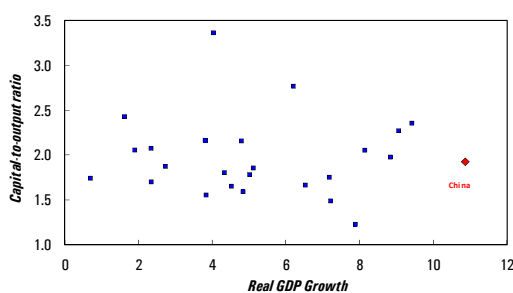
Sources: Penn World Tables; IMF, WEO database; and staff calculations.

³ See Appendix for details.

9. **There are, of course, a number of limitations with this approach in assessing the appropriateness of the level of investment.** In particular, the estimates do not capture structural changes such as a shift away from capital-intensive growth or in the efficiency of investment over time. Indeed, there is no a priori reason to presume that an economy growing faster in order to catch up with advanced economies should have a lower capital-to-output ratio, i.e., below its long-run level, or that its investment rate should be above its long-run level, as it will depend on several other factors, notably TFP.

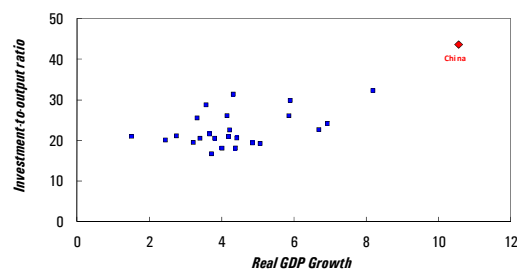
10. **On some simple metrics, China's investment efficiency is still broadly in line with other emerging economies.** As shown in Figures 3a and b, China has moved up in the capital-to-output ratio relative to other emerging markets over the two decades. However, it is still broadly within the average cross-country range. What stands out is China's growth, showing that its achievement over this period has been unique.

Figure 3a. Growth and Capital-to-Output Ratio
(Emerging economies, 1990-5)



Sources: Penn World Tables; IMF, WEO database; and staff calculations.

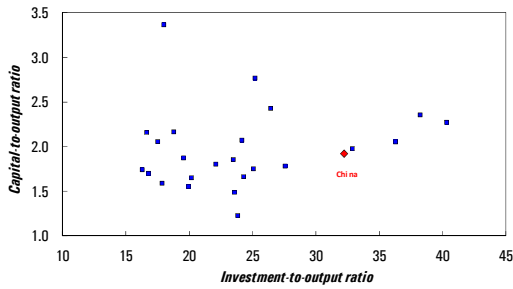
Figure 3b. Growth and Investment-to-Output Ratio
(Emerging economies, 2007-11)



Sources: Penn World Tables; IMF, WEO database; and staff calculations.

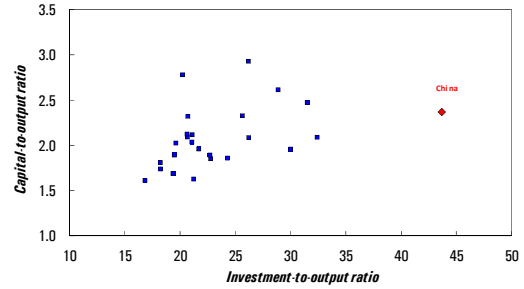
11. **However, China's strong performance comes at a price.** While in the 1990s, China was more or less within the bounds witnessed among emerging markets worldwide in terms of the relationship between investment rates and capital-to-output ratios (Figures 4a and b), it has since gravitated to an extreme outlier position that is suggestive of potential over-investment. China now requires ever higher investment to generate the same amount of growth. Unless there is a surge in TFP and with export performance expected to remain subdued over the medium term (given both sluggish demand overseas and diminishing opportunities for dramatic gains in China's market share), the contribution of investment to growth will need to reach 60-70 percent to support the same amount of growth (Figures 5a and b). Under such a strategy, vulnerabilities will likely grow in the form of hidden deadweight that will have to be paid in future in one form or another. The cost of financing such an elevated level of investment could undermine overall economic stability, a point that is further elaborated in Section VI.

Figure 4a. Capital- and Investment-to-Output Ratio
(Emerging economies, 1990-5)

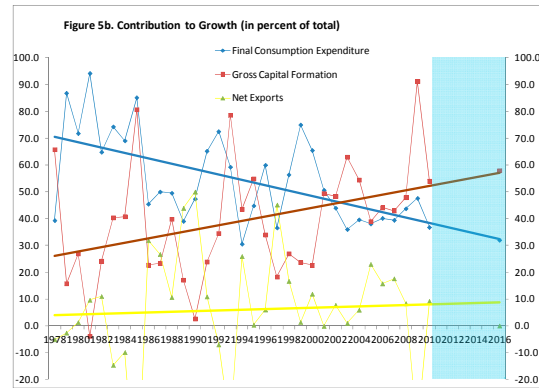
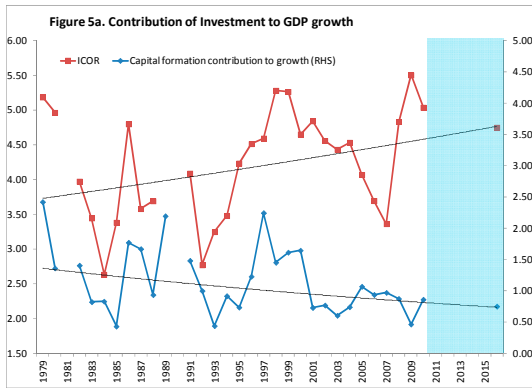


Sources: Penn World Tables; IMF, WEO database; and staff calculations.

Figure 4b. Capital- and Investment-to-Output Ratio
(Emerging economies, 2007-11)



Sources: Penn World Tables; IMF, WEO database; and staff calculations.



12. **Moreover, consumption has declined to about 40 percent of GDP partly due to the falling household income as share of GDP.** In fact, household income rose very rapidly except relative to overall GDP growth. The latter, as discussed above, was pulled up by an increasing contribution from investment. To the extent that growth is to improve the quality of living standard by providing more value added to households, a falling consumption share raises questions about the very purpose of the current investment-led growth model.

IV. A THEORETICAL FRAMEWORK OF OPTIMAL INVESTMENT

13. **The benefit of a rapid growth from higher investment is realized economy-wide only if it maximizes social welfare.** A typical model of welfare optimization is about inter-temporal optimization of consumption. Under this approach, investment is an endogenous outcome of inter-temporal consumption preference, which in turn is influenced by the factors specified in the model such as the rate of depreciation, marginal product of capital, and the cost of capital. Thus, it would be difficult to assess the appropriateness of the size of investment simply by comparing the marginal product of capital. Other variables also matter.

14. **To illustrate, a welfare optimization model can be generalized as:**⁴

$$W = \sum_{t=0}^{\infty} \beta^i u(c_t, l_t, n_t) \quad (1)$$

where c is consumption, l is financial assets, and n is labor (as against leisure). Without losing generality, this can be parameterized as:

$$E_t \sum_{i=0}^{\infty} \beta^i \left[\frac{c_{t+i}^{1-\sigma}}{1-\sigma} + \frac{\gamma}{1-\rho} (l_{t+i})^{1-\rho} - \frac{\chi n_{t+i}^{1+\eta}}{1+\eta} \right] \quad (2)$$

σ , ρ , γ , and η are all $[0, 1]$. With a typical budget constraint of:

$$y_t + (1-\delta)k_{t-1} + \frac{(1+i_{t-1})l_{t-1}}{(1+\pi_t)} = c_t + k_t + l_t \quad (3)$$

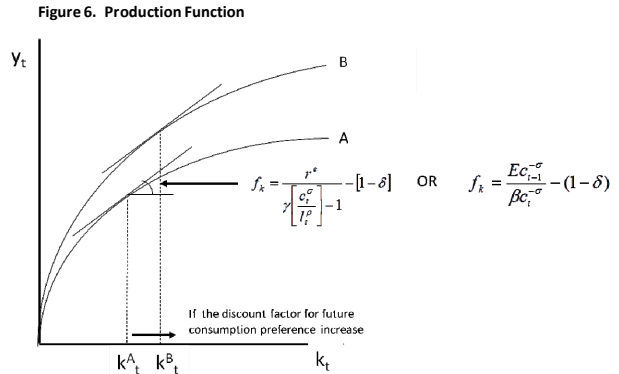
where k is capital stock, i is interest rate, π is inflation, and δ is depreciation, the first-order condition then is a question of a choice between consumption today versus tomorrow. Using a simple production function, the choice can be expressed as (where f_k is the marginal product of capital):

$$c_t^\sigma = \frac{1}{\beta(f_k + (1-\delta))} E c_{t+1}^\sigma \quad (4)$$

15. **A preference shift toward future consumption implies more investment and less consumption today** (Figure 6).

However, assuming the usual concavity of the marginal product of capital curve, an increase in investment normally leads to lower marginal product of capital. From (4), at the equilibrium, the slope of the marginal product of capital will be equal to cost of capital (i.e., the real interest rate

adjusted by other variables including the relative amount between consumption and financial assets and the rate of depreciation). Thus, for the first-order condition to hold, a lower real interest rate is associated with a lower marginal product of capital, and, higher investment.



⁴ From L. Han and I. H. Lee (2012), which in turn was adapted from Walsh (2003).

16. **Cross country differences in capital productivity could also be due to the availability of other factors of production.** A large number of new entries into the labor market, for example, would shift the production curve upwards as shown above as B. Another important factor to investment decisions is the cost of financing, which in our model above is the real interest rate r . Ceteris paribus, higher savings would reduce the real interest rate (as in the Solow growth model), which in turn would imply higher investment and a lower marginal product of capital. Moreover, a firm with cost advantage will be able to enjoy temporary profit until new entries push out industry supply. However, if demand also continues to increase due to new market discoveries, then the firms will continue to make profit, attracting increasingly more entries. The expanding size of the market will most likely also ensure that firms produce at the lowest point in their long term average cost. During the market expansion period, investment will also be high reflecting new entries. Thus, strong export will likely be accompanied by growing investment, and faster overall economic growth.

V. WHAT CAN AGGREGATE CROSS-COUNTRY DATA TELL US?

17. **Under a welfare maximizing state, inter temporal consumption preference will determine the level of consumption.** However, the relative time preference is not directly observable. An indirect way of measuring such inter-temporal preference would be to assume that the average level of consumption, or investment, of a relatively large sample of countries approximates such a preference. Then, an optimal investment level, or a “norm”, could be defined as the level that would maximize social or household welfare. Based on Section IV, such a level of investment will be determined by economic fundamentals including the real interest rate, and the depreciation rate and can be estimated from regressions linking cross-country investment rates over time to a set of fundamentals.

18. **We ran dynamic panel data models for 36 economies over the period 1955-2009.** The panel was unbalanced, with one innovation being that the starting period for each economy was calibrated to capture its economic take-off (and associated elevated levels of investment). This ensures that our investment norm is not biased downwards and in fact represents a higher bar than usual for detecting any potential over-investment. The sample consists of emerging market economies, as well as Japan and Taiwan Province of China. Around one-third of the sample is made up of Asian economies. Our empirical strategy allows for changes in preferences over time, but imposes a “normal” preference for inter-temporal consumption across emerging markets relative to fundamentals. By carefully calibrating this around take-off periods and including China’s Asian peers that have also tended to rely heavily on investment, this average is likely to be adequately representative.

19. **The models relate investment-to-GDP in country x at time t to a host of explanatory variables motivated by our theoretical model.** These include the lagged dependent variable; savings-to-GDP and credit-to-GDP measures to capture the availability of financing; real lending rates to capture the cost of capital; exports-to-GDP to capture the

potential external contributions to investment; real growth rates as a proxy for the return to capital; the level of real GDP to capture the level of economic development; age dependency ratios to capture the potential impact of demographics; and macroeconomic uncertainty captured by the standard deviation of three-year rolling windows of real GDP growth and reserves-to-GDP to measure the need for countries to save in order to counter volatile capital flows. These variables are all grounded in our underlying model (as well as others developed in the literature), such that the estimation is better thought of being structural in nature, and not reduced-form.

20. **The models are estimated in first-differences** (to control for fixed effects) using GMM to account for the presence of the lagged dependent variable (which renders OLS fixed-effects inconsistent), measurement error and potential endogeneity of the regressors (by using their lagged values as instruments).⁵ The estimation also includes time dummies, covering both the Asian crisis and the latest global financial crisis. Provided there is no higher-order serial correlation in the residuals and the instruments are valid, this approach should yield unbiased and consistent parameter estimates. Both these conditions are tested using standard tests.

21. **The estimated investment equations fit the actual data well for most economies and suggest the following** (with column 5 of Table 1 being the preferred specification):

⁵ See Appendix for details.

Table 1. Investment Equations 1/ 2/

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged dependent variable	0.652** (0.07)	0.628** (0.06)	0.630** (0.07)	0.615** (0.06)	0.652** (0.08)	0.664** (0.07)
Real per capita GDP growth	0.372** (0.05)	0.339** (0.04)	0.350** (0.04)	0.329** (0.05)	0.364** (0.05)	0.390** (0.53)
Growth in credit (annual percent of GDP)		0.033** (0.01)	0.030** (0.01)	0.023* (0.01)	0.032* (0.02)	0.031* (0.02)
Real per capita GDP (US\$)			0.0002* (0.00)	0.0003* (0.00)	0.0002* (0.00)	0.0002* (0.00)
Age dependency ratio 3/			-0.560* (0.35)	-0.696* (0.39)	-0.612* (0.36)	-0.622** (0.36)
Uncertainty 4/				-0.271** (0.09)	-0.200** (0.07)	-0.203** (0.06)
Real interest rate					-0.043** (0.02)	-0.041** (0.02)
Exports-to-GDP						-0.036 (0.04)
p-value of specification tests						
m2 test (no second-order serial correlation in residuals)	0.201	0.241	0.239	0.266	0.25	0.23
Hansen test (instrument validity)	1.000	1.000	1.000	1.000	1.000	1.000
Number of economies	36	36	36	36	36	36
Number of observations	892	892	892	892	718	718
Time period	1955-2009	1955-2009	1955-2009	1955-2009	1955-2009	1955-2009

Source: WEO, WDI, and Fund staff calculations.

1/ Dependent variable is investment-to-GDP ratio. First-differenced GMM specifications, with year dummies.

Instruments are lagged values of regressors.

2/ Robust t-statistics in parentheses, with * indicating significance at 10 percent and ** at 5 percent level.

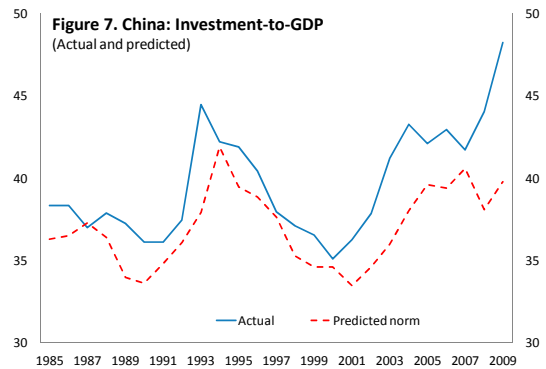
3/ Population over 65 to population aged 15-64.

4/ Standard deviation of three-year rolling window of real GDP growth.

- **Investment tends to be persistent.** The lagged dependent variable is large and highly significant, indicating a significant degree of inertia in aggregate levels of investment.
- **Stronger output growth leads to higher investment.** Including exports to this specification does not lead to a significant coefficient (column 6), suggesting that the primary route through which globalization affects investment is by leading to stronger overall economic growth and hence raising returns to capital.
- **An increase in the cost of capital lowers investment.** Higher real interest rates reduce investment, as expected.
- **Increased availability of credit is associated with higher investment.** We tried using both change in credit and savings-to-GDP as the relevant measure, and found the former to render the latter insignificant.

- **As economies develop, they typically need higher investment.** To capture potential non-linearities and thresholds beyond which this positive relationship no longer holds, we also included a squared per capita GDP term. However, this was not significant, suggesting that the economies in our sample are on average still “taking-off.” This is not surprising since the majority remain in the middle-income category.
- **Macroeconomic uncertainty leads to lower investment.** Conditioning for the standard deviation of three-year rolling windows of GDP growth, our alternative proxy variable of changes in reserves was not significant. This suggests that higher uncertainty does lead to lower investment but that this effect is better captured by the volatility of growth rather than the accumulation of reserves (which, after all, may be driven by other considerations besides precautionary motives).
- **Aging of the population reduces investment,** possibly as this leads to slower growth and thus reduces the returns to investment. Investment will consequently fall in the absence of technological progress and other structural changes that raise labor productivity. Our results suggest that this effect dominates any short-run increase in investment as firms invest more to substitute capital for labor as a means of coping with a growing shortage of workers.⁶

22. **Using these parameter estimates, investment in China may currently be around 10 percent of GDP higher than suggested by fundamentals** (Figure 7). Even allowing for elevated investment levels associated with most economic take-offs, the econometric evidence suggests that China is over-investing. China’s predicted investment norm over the last thirty years has ranged between 33-43 percent of GDP. In reality, it has fluctuated in a much broader band of 35-49 percent of GDP. The model consistently predicts a lower norm for China, but until 2000, the deviations were usually not that significant and typically closed over a 5-year time horizon.



⁶ The relative magnitude of impact is, of course, smaller than the size of the estimated coefficients because of the different scales of the explanatory variables. With estimation in first-differences, the annual change in the demographic variable is very small. As a result, the actual impact of the other variables on investment is significantly larger. For example, excluding the demographic variable from the specification only increases the predicted level of investment in China by 1 percent of GDP in 2009.

23. **Using a probit model, we find that our error term is positively associated with the probability of a crisis** (Table 2). We use the error terms of the above regression as a measure of over-investment, as well as a number of other variables previously considered to have explanatory power for predicting economic crises. Crises are dated in our sample according to the year when they occurred, based on the dating of banking crises by Reinhart and Rogoff (2008). On average, other things being equal, over-investment by 1 percent of GDP as measured in our cross-country regression leads to a 0.03 percentage point increase in the probability of an economy encountering a crisis.

Table 2. Probit: Probability of crisis

	(1)	(2)
Real interest rate	-0.016** (0.003)	-0.016** (0.003)
Real per capita GDP growth	-0.015** (0.011)	-0.015** (0.011)
Growth in credit (annual percent of GDP)	-0.001 (0.003)	-0.002 (0.003)
Current account (percent of GDP)	-0.022** (0.008)	-0.026** (0.008)
Over-investment (percent of GDP)		0.031** (0.013)
Number of economies	36	36
Number of observations	752	752
Time period	1955-2009	1955-2009

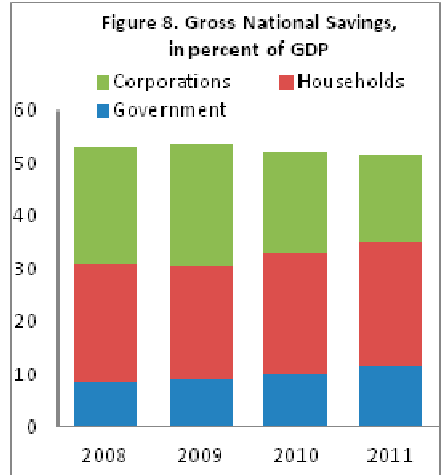
Source: WEO, WDI, and Fund staff calculations.

24. **The current deviation is the largest ever and has been accumulating over the last decade.** While the further widening of the deviation since 2009 could be regarded as temporary due to the 2009 stimulus package, the divergence started before then, and is also larger and persistent than the implied over-investment in other Asian economies leading up to the Asian crisis or in Japan in 1980 before the onset of its lost decade (Table 3). Both these episodes were followed by protracted growth and investment declines. Credit growth (particularly post-crisis) and the cost of capital in China in recent years also appear to be in dangerous territory compared to these other country experiences. Mechanically applying the coefficient estimates from our probit model to China's estimated over-investment, the probability of a crisis would rise from 8 percent in 2005 to around 20 percent today. These numbers are only indicative however. Not only is there the usual uncertainty around our parameter estimates but, as discussed below, the nature of China's investment model is very different from that of other emerging markets and tends to reduce the probability of a crisis relative to the average country in our sample.

Table 3. Evolution of variables in the lead-up to crisis (5-years)

	i-j* (average)	i-j* (cumulative)	Number of years i>j*	Credit/GDP (annual percent change)	Real cost of capital (annual average)	Real GDP per capita (annual percent change)
Indonesia	1.6	7.9	4	6.0	9.2	5.3
Japan	1.0	4.9	5	2.9	3.7	4.1
Malaysia	2.1	10.6	4	8.1	5.7	6.2
Philippines	-2.4	-12.1	1	22.6	6.9	2.3
Thailand	1.7	8.3	4	11.0	7.7	5.1
China (2005-9)	4.3	21.6	5	5.6	1.5	10.8

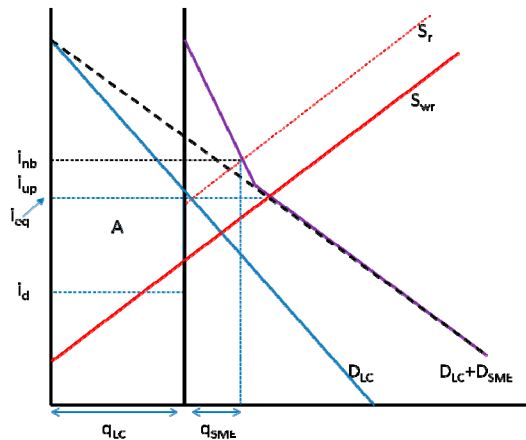
25. **However, the trigger of a crisis, if ever, in China will likely be different from other countries.** What distinguishes China from the rest is its self-reliance on the resources of investment. In large part, this is due to its high savings (Figure 8). However, various studies indicate that savings are arbitrarily high because of remaining controls in the financial sector that de facto entail a subsidy transfer from households and SMEs to large corporates. Whereas in other countries the high cost from excess investment has been exposed in the form of bank stress or foreign exchange market crisis, in China, it will likely be captured in, or triggered by, any one of the weak links of this implicit subsidy system.



VI. ESTIMATING THE HIDDEN COSTS OF CHINA’S INVESTMENT

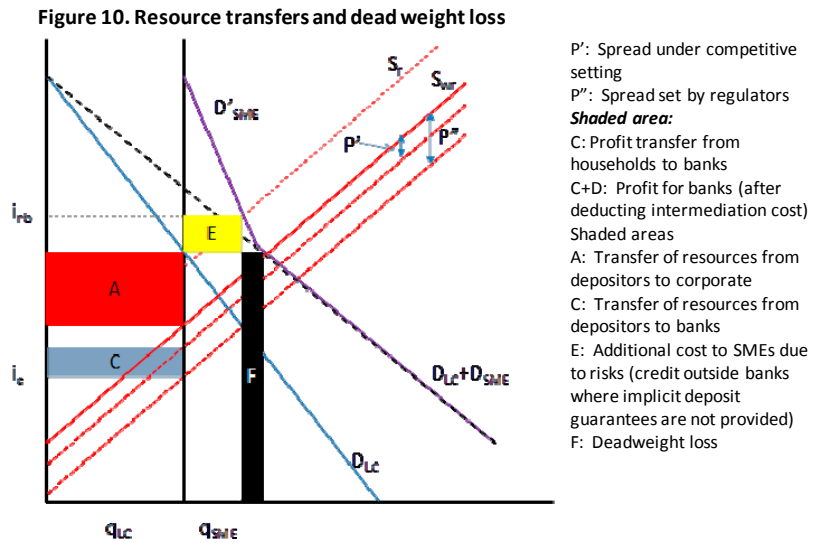
26. **The cost of over-investment is implicitly borne by households through the financial sector.** Resource allocation can be described, in a highly simplified way, as a two stage process with credit initially allocated to large corporations (LCs) at around the benchmark rate (Figure 9). The remaining credit is then allocated to small- and medium-sized enterprises (SMEs) largely through the nonbank financial sector. As such, the demand curve of SMEs faced by the financial sector is kinked. Large corporations, therefore, enjoy a large profit margin relative to a competitive environment, benefiting from a de facto resource transfer from the rest of the economy (i.e., households) and represented by the shaded area A. SMEs, on the other hand, pay higher interest as they have to procure capital from the nonbank sector where risk is higher.

Figure 9. Profit Margin and Credit allocation between LCs and SMEs

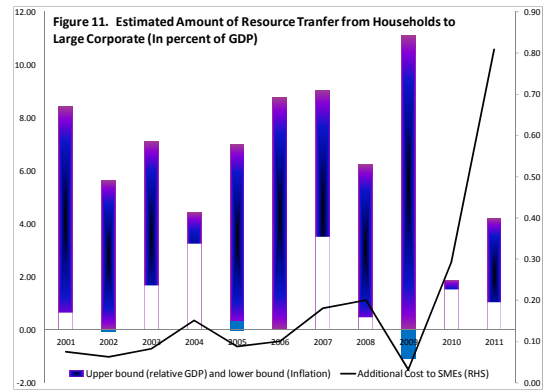


Swr: Supply of funds without risk (implicit guarantee from the government)
 Sr: Risk adjusted supply of funds
 DLC: Demand from large corporate
 DSME: Demand by SMEs
 iup: Reservation price (interest rate which corporations are willing to pay for qLC)
 id: Deposit rate
 ieq: Market clearing interest rate
 inb: interest rate charged by nonbanks (assume zero spread)
 qLC: Lending quota
 qLC: quantity of credit extended to large corporate
 qSME: quantity of credit extended to SMEs
 Shaded area:
 A: Profit margin (depending on mark up above the benchmark lending rate, profit is divided between banks and non-financial corporate)

27. **The total resource transfer and higher cost from the regulated two tier financial sector can potentially be large** (Figure 10). In addition to the resource transfer from households to corporations (area A), resource transfer also takes place from household to banks. The precise amount will depend on the size of the spread set by the regulators relative to the nonconstrained spread, i.e., area C. Meanwhile, the higher cost paid by SMEs is represented by area E; and the deadweight loss, in addition to the usual loss from inefficient financial intermediation, can be represented as area F.



28. **While the exact amount of these transfers, higher costs, and deadweight loss are very difficult to estimate, rough approximations suggest they could be very large in China's case.** As a rough proxy for i_{eq} (market clearing rate) and P'' (interest rate spread) that would have prevailed under unconstrained equilibrium conditions, we use the average value of those of the ASEAN-4, Hong Kong SAR, and Korea. To account for country differences when estimating the transfer of resources from household to corporations (area A), we adjust these average rates by real GDP growth differences (upper bound) to capture differences in the rate of return on capital, as well as simply by inflation differences (lower bound). The amount varies year to year, with lower bounds sometimes in negative territory. The average of the mid-points of these ranges over the last 10 years was about 4 percent of GDP (Figure 11).



29. **The additional cost borne by SMEs over the large corporations, on the other hand, is smaller, reflecting the smaller share of bank credit used by SMEs.** The additional cost arises from their need to raise capital outside the banking system, i.e., from nonbanks. The funding costs are higher as no implicit guarantees are provided to the funding sources of nonbanks (unlike banks). For our calculation, the funding cost is assumed to be the interbank market. The true cost will be even higher as many SMEs have to raise capital also from the informal sector where the risk premium is much higher. Thus, based on this conservative assumption, the additional cost averaged about 0.2 percent of GDP, but went up

to 0.8 percent of GDP in 2011, reflecting tightened liquidity conditions.

30. **The amount of resource transfer from households to banks, however, was on average negative.** Specifically, the difference in bank spreads between China and the average of the Asian economies was -0.5 percent in nominal terms, and -0.3 percent in real terms (adjusted for inflation differentials). This is in large part due to the benchmark used to estimate the market clearing interest rates for China, given that Asian banks on average have larger spreads than non-Asian banks. Finally, we failed to calculate an estimate of the dead weight loss due to the usual identification problem.

VII. CONCLUSION

31. **There is little doubt that China's extraordinary economic performance over the past three decades is in large part attributable to investment.** Despite the prolonged period of heavy investment, China's capital-to-output ratio is still in the range of those of other emerging market economies while its growth rate has far outpaced others over the last two decades. Nevertheless, the marginal contribution of an extra unit of investment to growth has been falling, necessitating ever larger increases in investment to generate an equal amount of growth. Now with investment to GDP already close to 50 percent, the current growth model may have run its course.

32. **Measured against a norm estimated from a panel data on a large number of countries, China is over-investing.** Moreover, the deviation that has been accumulating over the last decade is larger and more persistent than the estimated over-investment in other Asian economies leading up to the Asian crisis. The latest divergence was understandably the result of the 2009 measures used to contain the spillover from the global financial crisis. In this regard, the government is well aware of this challenge and is thus accelerating its effort to reorient the economy, moderating investment growth while promoting consumption.

33. **While a crisis appears unlikely when assessed against dependency on external funding, potential strains from financing high investment still exists and could be quite large.** Assuming the conditions that prevailed in other emerging market economies during their pre- and post-crisis periods also apply to China, the probability of a crisis in China would mechanically be about one in five. However, because of the differences in the modality of financing of investment, an external crisis of the kind experienced by many other emerging market economies appears very unlikely to occur in China. But this does not mean that the cost is also absent. Rather, it is distributed to other sectors of the economy in the form of a hidden and implicit transfer of resources. In China, a large burden of the financing of over-investment is borne by households, estimated at close to 4 percent of GDP per year, while SMEs are paying a higher price of capital because of the funding priority given to larger corporations.

34. **Going forward, the challenge is to engineer a gradual reduction in investment to a path that would maximize social welfare.** Since that path is not identifiable, the norm

estimated using a large sample of emerging markets could provide some guidance. Based on cross-country regressions, lowering China's investment by 10 percentage points of GDP over time would bring it to levels consistent with fundamentals. Otherwise, vulnerabilities will continue to build. To the extent that elevated levels of investment during the post-crisis period in China were somehow abnormal and necessitated by the sharp external slowdown, the challenge now is how to return to a more "normal" level of investment without compromising growth and macroeconomic stability. Obviously, reaching the level itself should not be the only goal, but it should be accompanied by reforms that would raise productivity and efficiency, while ensuring that the fruits of China's remarkable growth are shared more equitably across different economic agents, in particular ordinary Chinese households. International experience shows that these are prerequisites for sustainable growth in any country.

DATA APPENDIX

Implementing the Neo-Classical Approach

Neo-classical model: Steady-state level of investment (i^*) is given by: $i^* = k^*(g + d)/(1 + g)$, based on estimates of a steady-state capital-output ratio (k^*), the depreciation rate (d), and the rate of potential output growth (g).

- **Capital stock:** Derived from the standard perpetual inventory method. Data on gross fixed real investment during 1950–80 is obtained from Penn World Tables, and from 1980 onwards from the IMF World Economic Outlook (WEO) database. The initial estimate of capital stock was obtained assuming that the country is at steady-state capital-output ratio in 1950. To obtain this ratio, the averages of k , g , and d over 1950–60 were used (Easterly and Levine, 2001 adopt a similar methodology). Alternative assumptions were used (e.g., setting it equal to 10 times the initial level of investment), and the results show that the guess at the initial capital stock becomes relatively unimportant decades later.
- **k^* :** For a given depreciation rate, k^* is found as the maximum value of the capital-output ratio on average over long (15- and 20-year periods) between 1950 and 2011. This helps ensure robustness, particularly vis-à-vis boom and bust periods. The average capital-output ratio for the countries in our sample was around 2½ during 1950-2011 and for industrial countries it was similar during 1970-2011.
- **d :** A number of **depreciation rates** were used—5, 7, and 10 percent. Results shown in the text are for a 7 percent depreciation rate, but results were robust to alternatives.
- **g :** Two sets of assumptions were used for potential growth: using the maximum growth rate over long periods between 1950 and 2011 for each country (capped at 5); or using medium-term projections for growth from the latest WEO database (which, at around 8 percent, are higher for China). Results shown in the text rely are based on the latter, but were generally robust. Since these growth rates are higher in the case of China, they present a stricter test of over-investment since i^* is larger.

Cross-country investment regressions

Aggregate-level panel data was used to estimate the following investment model:

$$\Delta\left(\frac{I}{GDP}\right)_{it} = c_i + b\Delta Z_{i,t} + \Delta\varepsilon_{it} \quad (1)$$

where I/GDP is the investment-to-GDP ratio (from the WEO database) and Z is a vector of additional variables, including the lagged dependent variable, real per capita GDP growth, uncertainty (measured as the standard deviation of three-year rolling windows of real GDP), (all from the WEO); growth in credit as a percent of GDP, real GDP per capita in US dollar terms, the age dependency ratio (defined as the population aged over 65 to the working-age

population) and the real interest rate (all from the World Bank World Development Indicators database). The sample was unbalanced, covering the period 1955-2009, and the following emerging market economies (starting year in parentheses): Albania (1993); Algeria (1994); Argentina (1970); Armenia (1995); Belarus (1995); Bolivia (1979); Brazil (1970); Bulgaria (1991); Chile (1970); China (1982); Colombia (1970); Croatia (1994); Czech Republic (1997); Egypt (1970); Hungary (1989); India (1970); Indonesia (1971); Iran (2004); Israel (1980); Japan (1955); Korea (1963); Malaysia (1970); Mexico (1971); Morocco (1978); Pakistan (2004); Peru (1986); Philippines (1970); Poland (1991); Romania (1994); South Africa (1964); Sri Lanka (1978); Taiwan Province of China (1965); Thailand (1970); Turkey (1973); Venezuela (1984); and Vietnam (1993).

REFERENCES

- Bai, Chong-en, Chang-Tai Hsieh, and Yingyi Qian, 2006, "The Return to Capital in China," *Brookings Papers on Economic Activity*, No. 2, pp. 61-88.
- Barnett, S. and R. Brooks, 2006, "What's driving investment in China?" IMF Working Paper 06/265 (Washington: International Monetary Fund).
- Ding, S., A. Guariglia, and J. Knight, 2010, "Does China Overinvest? Evidence from a Panel of Chinese Firms," Economics Series Working Papers 520 (Oxford: University of Oxford).
- Dollar, D., and S.J. Wei, 2007, "Das (Wasted) Capital: firm Ownership and Investment Efficiency in China," IMF Working Paper 07/9 (Washington: International Monetary Fund).
- Dong, H., W. Zhang, and J. Shek, 2006, "How Efficient Has Been China's Investment? Empirical Evidence from National and Provincial Data," HKMA Working Papers 0619 (Hong Kong: Hong Kong Monetary Authority).
- Easterly, W. and R. Levine, 2001, "It's Not Factor Accumulation: Stylized Facts and Growth Models", *World Bank Economic Review*, No. 15, no. 2.
- Geng, N. and P. N'Diaye, 2012, "Determinants of Corporate Investment in China: Evidence from Cross-Country Firm Level Data," IMF Working Paper 12/80 (Washington: International Monetary Fund).
- Han, L. and I. Lee, 2012, "Optimal Liquidity and Economic Stability," IMF Working Paper 12/135 (Washington: International Monetary Fund).
- Hsieh, C. T. and P.J. Klenow, 2009, "Misallocation and Manufacturing TFP in China and India," *Quarterly Journal of Economics*, CXXIV, No. 4, pp. 1403-48.
- Liang, H., 2006, "China's Investment Strength is Sustainable," Global Economics Paper No. 146.
- Liu, Q. and A. Siu, 2006, "Institutions, Financial Development, and Corporate Investment: Evidence from an Implied Return on Capital in China". SSRN: <http://ssrn.com/abstract=965631>.
- Lu, F., G. Song, J. Tang, H. Zhao, & L. Liu, 2008, "Profitability of China's Industrial Firms (1978-2006)". *China Economic Journal*, 1, No. 1, pp. 1-31.
- Qin, Duo, and H. Song, 2009, "Sources of Investment Inefficiency: The Case of Fixed Asset Investment in China," *Journal of Development Economics*, No. 90: pp. 94-105.

Rawski, T., 2002, "Will Investment Behavior Constrain China's Growth?" *China Economic Review*, No. 13, pp. 361–72.

Reinhart, C. M., and K. S. Rogoff, 2008, "Banking Crises: An Equal Opportunity Menace," NBER Working Paper 14587 (Cambridge, Massachusetts: National Bureau of Economic Research).

Walsh, C. E., 2003, "*Monetary Theory and Policy, 2nd Edition* (Cambridge, Massachusetts: MIT Press).