

Understanding China: An Explanation for an Unusual Macroeconomy

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Abstract

China presents several macroeconomic patterns that appear inconsistent with standard stylized facts about economic development and hence inconsistent with the standard growth model. We show that Chinese macroeconomic patterns instead appear consistent with an objective of maximizing output in non-competitive factor markets. In short, China appears to successfully follow the stated output objectives in its five-year plans. We consider the micro-institutional features that can sustain this behavior and present a simple model built on these features. The model emphasizes the hukou system and state control over capital allocation, which allow a centralized output-maximizing objective to be effectively decentralized into profit-maximizing firms. The model can explain several puzzling facts about the Chinese economy while also showing how a shift toward a free-market system can initially take the economy further from global macroeconomic norms.

1 Introduction

Since 1978, China has recorded one of the fastest GDP growth rates ever known and has now become the second largest economy in the world. This economic success has led to substantial interest in China's development model, both as a potential guide for other countries and as an increasing force shaping the world economy. At the same time, many observers question whether China's

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growth can be sustained and whether the Chinese economic system is converging towards a free-market, capitalist model.

In this paper, we first document that China is currently an outlier on several core macroeconomic dimensions. These dimensions include an unusually low labor share of income coupled with unusually high investment and savings rates. These features, which are unusual compared to both global norms and the antecedent experience of other Asian miracles, create tension with the traditional macroeconomic growth model, where markets are competitive and factor shares are approximately constant. Given this tension, we then consider an alternative model where (1) the Chinese state seeks to maximize output and (2) factors are paid below their marginal products.

Building from a micro-institutional description of labor market policy (the hukou system) and investment policy (the five-year plans and incentive systems used to promote them), we build a simple model of the Chinese macroeconomy. The model shows how the state can depress the labor share of income and create unusually high domestic savings and investment rates, in successful pursuit of its output objectives. We further discuss, qualitatively, how this Chinese development model can allow trade surpluses as well as implications for Chinese growth in the years ahead. In sum, this paper presents a perspective where China's extraordinary macroeconomic features hinge partly on state institutions that deviate sharply from a competitive-market environment.

Section 2 of the paper considers China's macroeconomic aggregates, showing their unusual features and then argues that these features appear at odds with the traditional growth model. Section 3 introduces a perspective where China seeks to maximize output, aided by non-competitive factor markets, and grounds these ideas in micro-institutional features of the Chinese system. Section 4 presents a formal model. Section 5 summarizes the findings and discusses further extensions.

2 China: An Unusual Macroeconomy

Chinese macroeconomic behavior appears unusual on several dimensions. We document here macroeconomic facts about the Chinese economy and then highlight their tension with a traditional growth model.

2.1 Stylized Facts

In tandem with its high GDP growth rate, China features an unusually low labor share of income coupled with elevated saving rates, investment rates, and capital-output ratios. These features are unusual not only in comparison to the world distribution, but also to other East Asian growth miracles.

2.1.1 Labor Share

Figure 1A presents labor share estimates for China together with a broad sample of 54 countries analyzed by Bernanke and Gurkaynak (2002).¹ In the cross-country sample, the mean labor share is 0.66, with 72% of the countries showing estimates in the 0.60-0.80 range. Related evidence from long time series in the United States and United Kingdom shows labor shares remain within a 0.60-0.75 range over the 1935-1985 period (Gollin 2002).

By contrast, the Chinese labor share appears unusually low (Bai, Hsieh, Qian 2006; Lardy 2012). Kraay (2012) considers China's labor share based on four different sources: provincial data on employee compensation, flow of funds data, input-output tables, and household surveys. As shown in Figure 1B, all four sources agree that the Chinese labor share was approximately .51 in 1993, putting China in the bottom 10% of the world sample. By 2007, the average labor share from these four sources was .43, giving China the lowest observed labor share seen in the data. Note that Figure 1B also suggests that the Chinese labor has declined with time, although this finding is less consistent across sources.²

While imputing labor shares can be challenging, especially in countries with poor data quality and/or large informal sectors, available data suggests that China has an unusually low labor share by international standards, and, if anything, now appears to be an extreme outlier by most measures.

2.1.2 Saving Rates

Figure 2A shows the China's domestic saving rate compared to a world sample of 175 countries. Saving rates for each country are taken from the World Development Indicators and averaged over the 2000-2010 period. Figure 2B presents the same data, but excludes oil exporters (where fuels account for at least 75% of exports).

China's saving rate, averaging 46.4%, appears unusually high, exceeding saving rates in 94% of other countries. Leaving out oil exporters, China's average saving rate exceeds all but two other countries, which are both small and rich – Luxembourg and Singapore. Figures 2A and 2B further show that China's savings rate is especially high given its income level. In a regression of average savings on log income per-capita and the share of fuels in exports,

¹The Bernanke and Gurkaynak estimates are measured in the 1980-1995 period and consider labor shares making adjustments for self-employment income, building on Gollin (2002). Bernanke and Gurkaynak construct as many as three different estimates for each country; plotted points are means across the available estimates for each country. Chinese labor shares, which are not included in Bernanke and Gurkaynak, are averages across four methods analyzed by Kraay (2012), discussed in the text. Income per-capita (PPP) is taken from the Penn World Tables.

²Flow of funds data suggests the Chinese labor share in 2007 remains at approximately .51, while the other three sources put labor share around .40. Lardy (2012) discusses some challenges with the provincial aggregation in comparison to a flow-of-funds approach. Kraay (2012) considers these measures in addition to the input-output and household survey approaches.

which predict saving rates with an R^2 of 0.6, China's saving rate appears 32 percentage points higher than expected.

Figure 2C presents China's domestic saving rate over time, comparing it to the antecedent "Asian Miracles" of Korea, Japan, and Singapore. Like other Asian miracles, growth in income per-capita is associated with rising saving rates. Strikingly however, when comparing saving rates at similar levels of per-capita income, China's saving rate far outpaces those in the other miracle countries, exceeding Korea's savings rate by approximately 10 percentage points and Singapore's by approximately 20 percentage points. Thus China appears unusual not only in its absolute level of savings (now over 50%), but it appears especially unusually given its level of economic development, even in comparison to the history of other Asian miracles.

2.1.3 Consumption Rates

Unusually high saving rates are, not surprisingly, mirrored with unusually low consumption rates. Figure 3A presents China's consumption rate compared to the world sample. Averaging over the 2000-2010 period, China's consumption rate is 38.8%, which is unusually low and consistent with the unusually low labor share of income.³ Comparing China to other Asian Miracles, Figure 3B shows that China's consumption appears 20-40 percentage points lower at comparable states of development.

2.1.4 Investment Rates

Figure 4A shows China's average investment rate over 2000-2010, compared to a world sample. As with savings, consumption, and the labor share, China appears to be an outlier. With an average investment rate of 39.8%, China in the first decade of this century outpaced all other countries save two – Bhutan and Equatorial Guinea. Figure 4B shows the evolution of China's investment rate compared to other Asian Miracles. In each case, economic development has been associated with high and rising investment rates. However, as with the saving rate, China's investment rate at a given level of per-capita income sharply exceeds the historical precedent in these other high growth countries. In sum, China appears unusual in its high rate of investment (now over 45%) both compared to the world sample and to antecedent and remarkable growth experiences of other Asian countries.

Finally, unusually high investment rates imply that China's capital-output ratio will also appear unusually high. Using the perpetual inventory method, capital-output ratios can be calculated under various assumptions about capital depreciation rates and the initial capital stock. Generally, China's capital-output ratio will be elevated conditional on its level of development, with an upward shift compared to other Asian Miracles similar to that seen in Figure 4B.

³Those rare countries with even lower consumption rates than China, as with the saving rate analysis, are typically oil exporters.

2.2 The Standard Model

To see the challenges these facts impose on standard theory, consider that neo-classical growth theory often builds on two core assumptions. First, factors are paid their marginal products. Second, the aggregate production function can be approximated as Cobb-Douglas, $Y = K^\alpha (AL)^{1-\alpha}$. The first assumption corresponds to a setting where firms maximize profits and are price takers (markets are competitive), and the program becomes

$$\max_{K,L} K^\alpha (AL)^{1-\alpha} - RK - wL \quad (1)$$

where R is the rental price of capital and w is the wage.

In this environment, the capital and labor shares of income are constants. If labor is paid its marginal product, then the labor share of income is $wL/Y = 1 - \alpha$. This model is "standard" for several reasons, but most importantly for our purposes because, as reviewed above, estimates of labor shares typically remain within narrow bounds. This tendency constitutes one of the major stylized facts of macroeconomics.⁴

Given that China does not satisfy this macroeconomic regularity, one is left with three possible conclusions: (i) the Chinese data are not correctly measured; (ii) China's production function diverges substantially from the norm, and/or (iii) factors are not paid their marginal products. If one assumes that the data is sufficiently accurate to take the stylized facts above as broadly correct and that China's production function does not differ from the rest of the world, where Cobb-Douglas remains a reasonable stylization, then the last option remains. Namely, factor allocation in China departs from a competitive markets model.

This paper investigates this possibility.

3 China: An Alternative Approach

Our approach departs from the paradigm represented in (1) on two dimensions. We assume instead that

1. The state attempts to maximize output
2. Factor markets are not fully competitive

The theory draws on explicit Chinese state policies, as discussed below. At a high level, we can connect this approach to the observed macroeconomic results

⁴A Cobb-Douglas production function, following Uzawa's steady-state growth theorem, also has the empirically appealing feature of allowing capital-augmenting technical progress in tandem with non-trending interest rates, both of which appear important features of economic growth. Nonetheless, the Cobb-Douglas description is still open to debate. Theoretically, constant labor shares can be consistent with non-unit elasticity of substitution between capital and labor, if capital- and labor-augmenting technical change proceed in the right way (see, e.g., Antras 2004). Relaxing the Cobb-Douglas assumption may be fruitful for understanding the Chinese economy, but this approach is not pursued in this paper.

along the following lines. Consider a program where China maximizes output

$$\max_{K,L} K^\alpha (AL)^{1-\alpha} \tag{2}$$

subject to constraints on (1) labor participation and (2) the capital accumulation process. Labor is paid a wage, $w(\theta)$, where θ is a policy parameter that creates distortions between wages and marginal products. Meanwhile, capital accumulation depends on investment, investment is limited by domestic savings (given China's capital controls), and domestic savings are in turn limited by factor payments to labor $S \leq Y - cw(\theta)L$. Thus development depends in a classic Marxist sense on the "surplus value of labor".⁵ If China sets an investment policy $I = \beta S$, then

$$\frac{I}{Y} = \beta \left(1 - c \frac{w(\theta)L}{Y} \right)$$

This set-up thus provides a straightforward approach for linking an unusually low labor share, unusually high domestic saving rate, and unusually high investment rate. In particular, labor market policy (θ) elevates the domestic saving rate, and capital market policy (β) directs these savings toward domestic investment, working in tandem to meet China's stated growth objectives.⁶

We thus have a candidate approach for understanding some unusual features of the Chinese macroeconomy. The next section discusses how the Chinese economy can implement this broad development approach, considering explicit state policies that can translate such a centralized "output-maximizing" objective into the actions of decentralized firms.

3.1 The Chinese System

We ground our theoretical approach in micro-institutional features of the Chinese political and economic system. In particular, we start with the labor market, emphasizing how the hukou system suppresses the wages of migrant workers. We then consider explicit state objectives, as emphasized in a succession of five-year plans, that work to direct available savings into investment.

⁵Domestic investment is limited by domestic savings due to China's capital controls. The term c can be interpreted as the average propensity to consume from household wage income.

⁶Naturally, this approach will also create elevated per-capita income along the growth path, given the level of productivity. For example, with the Cobb-Douglas production function per-capita income can generically be written as $y = A(K/Y)^{\frac{\alpha}{1-\alpha}}$, and in the standard competitive markets program the capital-output ratio is $K/Y = \frac{\alpha}{R}$. By contrast, an alternative "output-maximizing" program with $I = S$ provides a capital-output ratio $K/Y = \frac{\alpha + \Delta}{g + \delta}$ where Δ is the abnormal increase in the capital share (due to suppressed labor payments). Hence investment rates and output are elevated in the candidate Chinese model because (1) the labor share of income is suppressed ($\Delta > 0$), providing greater aggregate savings, and (2) the output-maximizing objective features a lower effective rental rate of capital ($g + \delta$) than the competitive market rental rate ($r + \delta$) since for finitely-valued economies we require $r > g$.

3.1.1 Labor Markets

China's hukou system, which controls internal migration within China, has long created a rural-urban divide among the workforce. In earlier periods, the hukou system featured outright prohibitions on migration from rural to urban areas, severe restrictions that were eventually relaxed, giving rise to the migrant labor phenomenon. Still, city governments employ numerous mechanisms to limit inward migration, including (1) quotas on the number of migrants that employers can hire, (2) fees levied on firms employing migrants (which have been estimated to reach 44% of the average monthly wage), (3) expensive licensing measures for the migrants themselves, including migrant identity cards, temporary resident cards, and employment registration cards, and (4) recruitment fees paid to government agencies (Knight et al. 1999). Much research has emphasized wage discrimination, where migrants earn far less than registered urban workers, even within the same occupation (e.g. Meng and Zhang 2001, Lu and Song 2006). Overall, these studies suggest that migrants are paid approximately half of their urban counterparts in the same occupation, which is also broadly consistent with the recorded difference in average monthly wages between migrants and urban-registered workers reported by China's National Bureau of Statistics, as shown in Figure 5.

Equilibrium unemployment search models provide a natural way to investigate the implications of the hukou system. With the hukou system limiting vacancies in urban areas for rural-registered workers, rural-registered workers can be viewed as the "unemployed" – a surplus labor supply for the migrant vacancies. Consequently, migrant wages can fall below their marginal product and fail to rise much above their outside option - the rural wage. With migrant wages below their urban marginal products, the labor share of income falls. This feature in turn provides large domestic savings, via firms' operating surplus, which can support very high investment rates.

3.1.2 Capital Markets

The second piece of our analysis governs the use of elevated savings in the economy to meet output-maximizing goals. China's five-year plans, at a high level, provide guidance for state objectives, giving explicit growth targets. Noting that national GDP growth has consistently met these targets over the last several decades suggests that these targets are implemented through effective micro-institutional measures.

In China's one-party system, centralized goals can be decentralized to local leaders through promotion incentives, where the Communist Party selects officials at all levels to serve a five-year term. Local leaders make decisions over "a substantial amount of resources, such as land, firms, financial resources, energy, raw materials, and others" (Xu 2011) while promotion incentives for local officials hinge on their success at bringing economic growth. As described in Vogel (2011, pp. 699-700): "[Deng] established a system in which governing teams, selected by the next higher level, were given considerable independence

as long as they managed to bring rapid growth... In Deng's era and in the decades after Deng, those judgments were based overwhelmingly on how much the team contributed to China's overall economic growth." This combination of decentralized decision-making and centralized promotion opportunities provide a means for centralized state growth objectives to be decentralized to local officials (Edin 2003, Xu 2011).

To meet output goals, major institutional foundations include (1) state ownership of all land; and (2) a repressed financial system. Only the state could alienate land out of agriculture into industrial and commercial use, which was necessary as urbanization proceeded. The repressed financial system included ceilings on deposit interest rates, which have frequently been negative in real terms; dominance by four big state-owned commercial banks; underdevelopment of stock and bond markets; and a closed capital account. The state's unusual power in land and capital markets meant that local governments could rapidly develop infrastructure (e.g., roads, ports, and power). Local government also had levers to encourage industrial firms to invest by providing access to land, reliable infrastructure, and low-cost financing.

Ultimately, one can model the decentralization of investment decisions in various ways. Most simply, the output maximization objective can be achieved indirectly by the state setting very low interest rates, elevating investment demand to make use of the domestic savings. Here, managers of firms may still seek to maximize profits, but they effectively act to maximize output given their subsidized borrowing costs. This approach may be especially consonant with China's centralized control of the financial system (see also Song et al. 2011). Alternatively, with promotion incentives based on meeting output targets, the managers of firms might be viewed as seeking to maximize output directly, recycling the enterprise's retained earnings into further capital accumulation. In this view, the incentive system decentralizes output maximization to the firm manager level. This approach may be especially consonant with public investments and state-owned enterprises. Both approaches, which are not mutually exclusive, achieve similar outcomes - the deployment of savings into domestic investment. For simplicity, we will take the former approach in the model below, decentralizing output-maximization through control of capital markets.

4 The Model

We use an equilibrium search model in the style of Pissarides (2000) to characterize the labor market. We focus on migrant labor – rural-registered workers seeking higher-paying jobs in cities, who are engaged in a search process. The central mechanism emphasizes that urban vacancies for rural-registered workers are scarce so that migrant workers have weak bargaining power over wages when offered jobs. Vacancies are scarce because the hukou system limits the employment of rural workers in cities, keeping would-be migrants in oversupply. Effectively, urban firms have a collective form of monopsony power over migrants, even though there are many urban firms who themselves are not col-

lusive.

4.1 Workers

Consider three types of workers, indexed $j \in \{u, a, m\}$, where u denotes urban workers with urban resident permits, a denotes rural workers with rural resident permits, and m denotes migrant workers, who have rural resident permits but work in cities.

Let there be L workers in China, where

$$L_m + L_u + L_a = L$$

and $s_j = L_j/L$ denotes the share of workers of each type. We let population grow at rate n , and treat the number of urban (L_u) and rural ($L_a + L_m$) registrations as policy parameters, which also grow at rate n . Thus, we take the total population L and registered-urban population $L_u < L$ as exogenous features.

Let wages be denoted w_j and let workers consume a fraction c of their wage income, which is their only income source.⁷ For simplicity, rural workers earn a competitive wage, w_a , when staying in the rural sector, while urban (registered) workers earn a competitive wage, w_u , in the urban sector. By contrast, migrant wages are determined through bargaining, where the share of migrant employment in urban firms is limited by policy as

$$L_m/L_u \leq \theta$$

This "hukou" policy parameter, θ , creates limited vacancies for rural workers in the city, which is the key to the wage behavior. It is taken as a simple way of modeling the various restrictions imposed on migrants.

4.2 Matching

Migrant job vacancies are filled when firms and migrant workers meet. If vacancies are scarce, then migrant workers find it hard to match. This scarcity worsens the outside option of the migrant worker, and their wage paid falls as a result.

For simplicity, let employment be forever – there is no job destruction.⁸ The "unemployed" are the mass of rural workers, L_a . The mass of urban vacancies for rural workers is V . Let the matching function be $M(L_a, V)$, which is constant returns to scale and has the following natural properties. First, $M(0, x) = M(x, 0) = 0$, so that matches are impossible in the absence

⁷That is, workers have no capital income. This stylization is broadly consistent with the observation that property and most enterprises remain owned by the state, while real interest rates on consumer deposits in China are typically near zero. Flow of funds data suggest for example that household income outside of labor compensation in 2008 amounted to only 2.4% of GDP (Lardy 2012).

⁸Job destruction could easily be introduced.

of vacancies or job-seekers. Second, $M_1 > 0$ and $M_2 > 0$, so that increasing the number of vacancies or job-seekers increases the rate of matching. Third, $\lim_{x \rightarrow \infty} M(x, 1) = \infty$ and $\lim_{y \rightarrow \infty} M(1, y) = \infty$, so that vacancies are filled immediately when there are infinitely many job-seekers per position and job-seekers find work immediately when there are infinitely many vacancies per worker.

Define the ratio of vacancies to rural workers as $z = V/L_a$. The rate at which rural workers find urban jobs is

$$b(z) = \frac{M(L_a, V)}{L_a} = M(1, z)$$

and the rate at which vacancies are filled is

$$d(z) = \frac{M(L_a, V)}{V} = M(1/z, 1)$$

It follows that $b'(z) > 0$, $d'(z) < 0$, $b(0) = d(\infty) = 0$, and $b(\infty) = d(0) = \infty$.

4.3 Value Functions

As a baseline, we consider a balanced growth setting, where the rural and urban sectors have common productivity growth rates, g . The Bellman equations for the migrant workers and the firms that employ them are

$$\tilde{r}V_m = w_m \tag{3}$$

$$\tilde{r}V_a = w_a + b(V_m - V_a) \tag{4}$$

$$\tilde{r}V_F = v_m - w_m \tag{5}$$

$$\tilde{r}V_V = d(V_F - V_V) \tag{6}$$

where V_m is the net present value of being employed as a migrant worker, V_a is the net present value of rural employment, V_F is a firm's net present value from filling a job with a migrant, and V_V is the net present value of a vacancy. The flow value v_m is the marginal value-added of a migrant worker for the urban firm. In equilibrium, this will be the same as the registered urban wage, w_u . Note that the "effective" discount rate is $\tilde{r} = r - g$, where the real discount rate is $r > g$ and taken as exogenous.

4.4 The Migrant Wage

The rural wage, w_a , and the value-added of the migrant worker, v_m , are known. They come from the production functions and optimization behavior in agricultural firms and urban firms, which we will consider below.

Using a standard (Nash Bargaining Solution) bargaining concept, we'll assume that the wage w_m is determined such that firm and worker have the same net gain against their outside option

$$V_m - V_a = V_F - V_V$$

From (3), (4), (5) and (6) we can determine the migrant wage as

$$w_m = (1 - q)w_a + qv_m \quad (7)$$

where we define the migrant worker's "bargaining power" as

$$q = \frac{b + \tilde{r}}{b + d + 2\tilde{r}} \quad (8)$$

and note that $q \in [0, 1]$. The migrant's wage is thus a weighted average of the worker's outside option wage, w_a , and the migrant's value-added in urban work, v_m . The migrant's capacity to extract her additional value-added through urban work depends on whether vacancies are more or less scarce compared to the rural population (via the b and d terms), which determines the migrant worker's relative bargaining power, q . Increasingly scarce vacancies ($z = V/L_a$ falls) mean that d rises and b falls. Thus lots of rural labor compared to urban vacancies will cause the wage to fall toward the outside option, the rural wage. This outcome is the main point of this labor market model. It follows naturally to the extent that Chinese policy successfully limits urban vacancies for rural workers.

4.5 Firms

We let the urban and rural sectors have Cobb-Douglas production functions, with decentralized firms seeking to maximize profits, given capital market prices and given any bargaining power vis-a-vis migrants.

4.5.1 Rural Sector

Let rural sector firms solve the problem

$$\max_{K_a, L_a} K_a^\alpha (A_a L_a)^{1-\alpha} - w_a L_a - R K_a$$

where time subscripts are suppressed. Rural workers are paid their marginal products while capital is employed given the available rental price. The rural labor share is then $1 - \alpha$ and capital is employed such that $K_a = A_a \left(\frac{\alpha}{R}\right)^{\frac{1}{1-\alpha}} L_a$. In practice, the state will set R to clear the savings market. With lots of savings, R can be set low, elevating capital intensity and output.⁹ In this manner, state control of the capital market acts to decentralize the state's output-maximizing objective into firm-level profit maximizing decisions.

⁹Note that a similar outcome could be achieved if we turn off capital markets and instead let the firms take an output maximizing objective directly. This approach may make sense especially for state-owned firms, where managers incentives may indeed be based on maximizing output rather than profits, as discussed above. The approach based on a low R , via the capital market, is a simple way to reach the same outcome.

4.5.2 Urban Sector

Let urban sector firms solve the problem

$$\begin{aligned} & \max_{K_u, L_u, L_m} K_u^\alpha (A_u [L_u + L_m])^{1-\alpha} - w_u L_u - w_m L_m - R K_u \\ L_m & \leq \theta L_u \end{aligned}$$

where urban productivity exceeds rural productivity, $A_u > A_a$, and firms are price takers on w_u but not on w_m .¹⁰ In particular, registered urban workers earn a competitive wage (the firm is a price taker) while the migrant wage is determined via the matching model above. In equilibrium, the registered urban wage is the marginal product $w_u = (1 - \alpha)Y_u / (L_u + L_m)$ while the migrant wage, as defined in (7), falls between the urban marginal product above and the (lower) rural wage. Therefore, since $w_m < w_u$, the urban firm will hire as many rural-registered workers as possible, so that

$$L_m = \theta L_u$$

and the total urban workforce is thus $(1 + \theta) L_u$. According to the population constraints, the allowable range for the hukou policy parameter, θ , is then

$$\theta \in [0, \frac{1}{s_u} - 1]$$

and we will denote $\theta_{\max} = \frac{1}{s_u} - 1$. At any higher θ , the hukou policy no longer constrains migration, because all workers become free to move to cities.

Meanwhile, price-taking in the capital market means that capital is employed such that $K_u = A_u \left(\frac{\alpha}{R}\right)^{\frac{1}{1-\alpha}} (1 + \theta) L_u$.

4.6 Macroeconomic Aggregates

In this section we define the main macroeconomic aggregates that result from the above policies and relate them back to the stylized facts of Section 2.

4.6.1 The Labor Share

Define the labor share of income as $\Lambda = \bar{w}L/Y$, where \bar{w} is the mean wage paid in China. In the above model, the labor share in China falls due to the urban sector, and China's overall labor share is the GDP-weighted average of the urban and rural labor shares.¹¹ In particular, we have

$$\Lambda = (1 - \alpha) - \frac{(w_u - w_m) \theta L_u Y_u}{Y_u Y} \quad (9)$$

¹⁰Note the implicit assumption that rural and urban output are perfect substitutes (i.e. have the same price); this assumption could of course be relaxed.

¹¹This feature proposes an additional test for the theory, although data quality will be an issue: using provincial data, can the rural labor share be shown to exceed the urban labor share? If not, one could also consider whether the rural wage is itself competitive. An extension to the model would allow the rural wage to also fall below the rural marginal product (e.g. through state control of rural enterprises). This decline in the rural wage would further reduce the migrant wage in cities, as migrants' outside option gets worse.

so that China's labor share will decline (compared to its standard value of $1 - \alpha$) through three forces: (i) the extent to which migrant workers are paid less than their marginal products, $w_u - w_m$; (ii) the mass of migrant workers, θL_u ; and (iii) the relative importance of urban GDP in China's GDP, Y_u/Y . These forces can be expressed in terms of the model's exogenous parameters as follows

Lemma 1 *China's labor share is $\Lambda = (1 - \alpha) \left[1 - \frac{\theta}{1+\theta} \frac{(1-q)(1-\frac{A_u}{A_u})}{1+\frac{A_u}{A_u}(\frac{1}{(1+\theta)s_u}-1)} \right]$, where $q = \frac{\frac{n\theta s_u}{1-(1+\theta)s_u} + \bar{r}}{\frac{n\theta s_u}{1-(1+\theta)s_u}(1+\frac{1}{z}) + 2\bar{r}}$ and $z = b^{-1}(\frac{n\theta s_u}{1-(1+\theta)s_u})$.*

Proof: See appendix.

4.6.2 Saving, Investment, and Capital

The saving and investment rates follow as in Section 3. The saving rate is

$$\frac{S}{Y} = 1 - c \frac{\bar{w}L}{Y} \quad (10)$$

where c is households' consumption rate from their labor payments. The saving rate can thus be expressed in terms of underlying parameters using the labor share expression in the Lemma, and the comparative statics properties of the savings rate are the opposite of those for the labor share.

The aggregate investment rate in this model, following the "output-maximizing" rule $I = \beta S$, then follows directly from above

$$\frac{I}{Y} = \beta \left(1 - c \frac{\bar{w}L}{Y} \right) \quad (11)$$

where again the labor share is expressed in terms of underlying parameters using the Lemma.

The aggregate capital-stock, K , and market clearing rental price, R , are then determined based on the supply and demand for capital. Capital accumulates in both the urban and rural sectors as $\dot{K}_i = I_i - \delta K_i$ where i denotes the sector. The steady-state growth path of the capital stock is then $K = I/(g + n + \delta)$, which implies

$$\frac{K}{Y} = \frac{\beta}{g + n + \delta} \left(1 - c \frac{\bar{w}L}{Y} \right)$$

On the demand side, firms are price-taking on capital in both rural and urban sectors and thus set $K_i = (\alpha/R) Y_i$, which implies that the total capital stock is $K = (\alpha/R) Y$. The rental price that clears the capital market is then

$$R = (g + n + \delta) \frac{\alpha}{\beta} \left(1 - c \frac{\bar{w}L}{Y} \right)^{-1} \quad (12)$$

so that a lower labor share, leading to elevated savings, causes the Chinese state's capital market to clear at a lower rental price.

4.7 Comparative Statics

We can now consider comparative statics on the steady-state macroeconomic aggregates. First, we consider a relative shock to the urban/rural productivity ratio.

Corollary 1 *The labor share is decreasing in A_u/A_a , while the saving rate and investment rate are increasing in A_u/A_a .*

Proof: See appendix.

Intuitively, widening the productivity gap between the urban and rural sector, other things equal, will increase the gap between the migrant's wage and their marginal product, which causes the labor share to fall. Hence, productivity-enhancing reform targeted at urban-areas will ultimately raise savings, investment, and capital stocks, while reform targeted at rural-areas can have the opposite effect.

Secondly, we consider the implications of relaxing the hukou policy, which has non-monotonic effects. There are two offsetting features. First, as the hukou policy is relaxed (θ rises), the bargaining power of migrant workers increases and their wage rises toward their marginal product. This "migrant-wage" mechanism is captured in the following Lemma, where we recall that $q \in [0, 1]$ is the migrant's bargaining power and we define $\omega = w_m/w_u$ as the share of their marginal product that migrant workers capture.

Lemma 2 *$q'(\theta) \geq 0$, and $\{q(0), q(\theta_{\max})\} = \{0, 1\}$. Moreover, $\omega'(\theta) \geq 0$, and $\{\omega(0), \omega(\theta_{\max})\} = \{w_a/w_u, 1\}$.*

Proof: See appendix.

This increase in the migrant's wage (toward their marginal product) causes the labor share of income to rise, other things equal.

On the other hand, as the hukou policy relaxes, more rural workers take up migrant work, causing a greater share of the labor force to be paid below their marginal product. This "migrant-quantity" effect causes the labor share to decline, other things equal. Interestingly, in the contest between the migrant-wage effect (the intensive margin) and the migrant-quantity effect (the extensive margin), relaxing the hukou policy – moving towards a freer labor market – can actually cause the labor-share to decline, moving further from the competitive market baseline. We encapsulate this non-monotonicity as follows.

Lemma 3 *$\Lambda(0) = \Lambda(\theta_{\max}) = 1 - \alpha$, but $\Lambda(\theta) < 1 - \alpha$ for all $0 < \theta < \theta_{\max}$.*

Thus the labor share of income must initially be falling as migration is initially allowed but eventually be rising.

Proof: See Appendix.

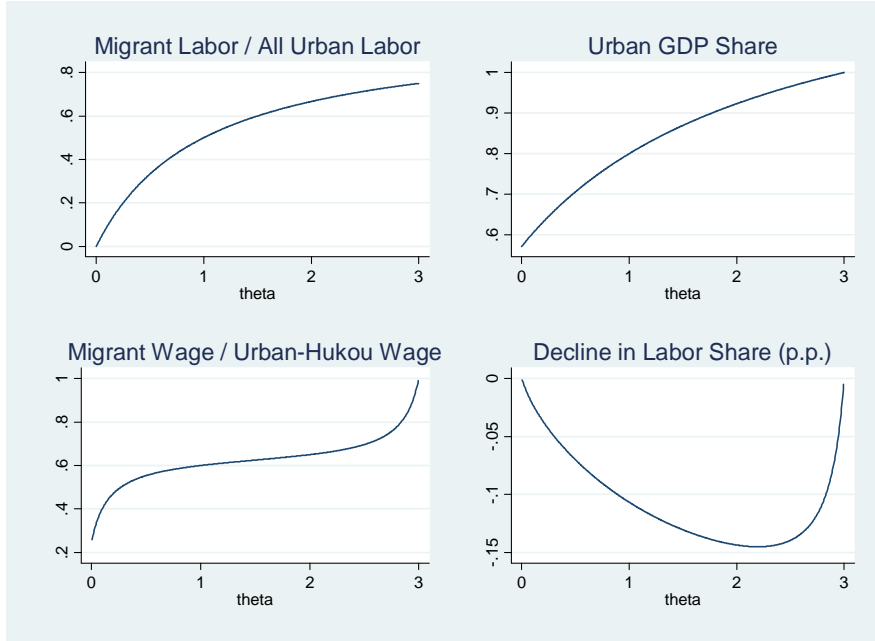


Figure 1: Model Calibration

4.8 Calibration

Looking at current wage data (see Figure 5), the migrant wage is approximately 55% of the urban-registered wage, using National Bureau of Labor Statistics data. Meanwhile, current estimates suggest that the migrant labor population is of similar magnitude to the urban-registered workforce, suggesting that the key parameter of the model, θ , is approximately 1. Lastly, as shown in Figure 6, which uses National Bureau of Statistics data, the enterprise savings rate has risen by about 10 percentage points in the last decade, which has been the primary driver of increased aggregate savings over that period (as seen in Figure 2C).

With these numbers in mind, we can turn to a specific calibration exercise. In particular, we consider specific relationships between the hukou policy, θ , and labor market outcomes by making assumptions about the matching function $M(L_a, V)$ and other exogenous parameters. Taking we take the registered urban labor share as $s_u = .25$, the population growth rate as $n = .01$, the ratio of urban to rural productivity as $A_u/A_a = 4$, the capital elasticity of output as $\alpha = 1/3$, and the effective discount rate as 0.1. Let the matching function be $M(L_a, V) = \kappa L_a^{1/2} V^{1/2}$, where $\kappa = .01$. Then the relationship between the hukou policy parameter and the labor market outcomes is as summarized in the following figure below.

This plot shows, as is generally true by Lemma 3, the interesting result that the labor share declines when the migration restrictions are initially relaxed (lower right panel). While a less restrictive migration policy is associated with higher wages for migrants (lower left panel), the increasing number of workers subjected to wages below their marginal products (upper left panel) depresses the labor share on net. This plot also shows, for migrant-urban wage differentials and migrant labor volumes that are consistent with observed evidence, that the labor share can decline by substantial amounts through the hukou mechanism alone, broadly consistent with the declines seen in Figure 1A or 1B, and the rise in saving seen in Figures 2C and 6.¹²

5 Discussion

5.1 Summary

This paper shows that China’s macroeconomic performance is an outlier with respect to (i) global norms and (ii) the prior experience of other Asian miracle economies. In particular, China shows highly elevated savings and investment rates, coupled with depressed consumption and a depressed labor share. The paper then considers micro-institutional features of the Chinese system that can lead to these unusual aggregate phenomena. The model shows how the hukou system, limiting migration from rural to urban areas, can create surplus labor supply for higher-productivity jobs in cities, depressing the labor share and expanding savings. Meanwhile, government control of capital markets, including cross-border capital controls and state-controlled domestic lending, directs these elevated savings into unusually high domestic investment rates. In addition to suggesting an explanation for unusual macroeconomic aggregates, the model is also broadly consistent with the large wage discount for migrant workers in cities, the lower labor share in cities, and elevated enterprise savings rates, which are all observed in China.

5.2 Additional Applications

The model may also help inform other macroeconomic phenomena. For example, China’s current account surplus follows automatically when domestic investment rates do not absorb all domestic savings, and while earlier periods featured more neutral trade positions, China has seen large trade surpluses in recent years. Fixing an investment path, the trade surplus could be seen as a

¹²To the extent that the observed deviation in the labor share from international norms is thought to be larger than this calibration delivers, one simple extension would be to introduce wage suppression in the urban and/or rural sector as well, given for example state control of property rights and state-owned enterprises, which disproportionately employ workers with hukou.

Note also that, returning to 1978 and communist policies, one may not want to start with an assumption, historically, where urban and rural registered workers were paid their marginal products. Hence the overall transition dynamics in labor markets, especially historically, may wish to consider more general non-competitive foundations as starting points.

side effect of increased savings as the hukou policy relaxes. More generally, the current account surplus follows if Chinese policymakers set $\beta < 1$. While the determination of this parameter is left outside the model, two natural explanations for setting $\beta < 1$ may be consistent with the growth objectives in the five-year plans. First, Chinese policy may explicitly favor export-led growth in pursuit of technology spillovers or other productivity benefits. Second, having observed the Asian financial crisis in 1997-1998, Chinese leaders may have explicitly built foreign reserves as self-insurance. Both motives compete with a pure domestic investment strategy (where $\beta = 1$), choosing additional avenues to facilitate growth.

Lastly, the model suggests views on China's path forward. As Chinese leaders wrestle with tradeoffs between investment growth and inequality, and consider methods to increase domestic consumption, they may naturally consider both (i) productivity-enhancing rural reforms and (ii) relaxing the hukou system. Rural reforms will help meet inequality goals, but the model of this paper suggests that they will also cut against savings and limit investment growth. In contrast, further relaxing the hukou system may, surprisingly, raise migrant wages and yet further suppress the labor share and elevate the saving rate. Here, reducing inequality among urban workers may actually facilitate investment growth. Ironically, additional moves toward a freer labor market may initially drive China yet further from antecedent macroeconomic norms.

Over the longer term, however, if China fully relaxes the hukou policy, the hukou-savings mechanism identified in this paper will ultimately cause a steep reduction in available savings. In crossing this tipping point, investment rates will come under increased downward pressure, suggesting challenges for a "soft landing", and pushing China to a choice between substantially lowering investment rates or turning to a large current account deficit to finance domestic expansion.

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6 Appendix

6.1 Proofs

Proof of Lemma 1

China's labor share is $\Lambda = (1 - \alpha) \left[1 - \frac{\theta}{1+\theta} \frac{(1-q)(1-\frac{A_a}{A_u})}{1+\frac{A_a}{A_u}(\frac{1}{(1+\theta)s_u}-1)} \right]$, where

$$q = \frac{\frac{n\theta s_u}{1-(1+\theta)s_u} + \bar{r}}{\frac{n\theta s_u}{1-(1+\theta)s_u} (1+\frac{1}{z}) + 2\bar{r}} \text{ and } z = b^{-1} \left(\frac{n\theta s_u}{1-(1+\theta)s_u} \right).$$

Proof. From (9), and noting that per-capita urban output is $y_u = Y_u / [(1 + \theta) L_u]$, we can write the labor share as

$$\Lambda = (1 - \alpha) - \frac{w_u}{y_u} \frac{\theta}{1 + \theta} \left(1 - \frac{w_m}{w_u} \right) \frac{Y_u}{Y} \quad (13)$$

With urban-registered workers paid their marginal products, we have

$$\frac{w_u}{y_u} = 1 - \alpha \quad (14)$$

Meanwhile, from (7), and noting that $w_a/w_u = A_a/A_u$

$$\frac{w_m}{w_u} = (1 - q) \frac{A_a}{A_u} + q \quad (15)$$

Lastly, the urban GDP share is

$$\frac{Y_u}{Y} = \frac{y_u(1 + \theta)L_u}{y_u(1 + \theta)L_u + y_a L_a} = \frac{1}{1 + \frac{A_a}{A_u} \left(\frac{1}{(1 + \theta)s_u} - 1 \right)} \quad (16)$$

where we have divided through by the numerator, replaced $L_a = L - (1 + \theta) L_u$, and used $s_u = L_u/L$.

Hence, putting (14), (15), and (16) into (13) we can write

$$\Lambda = (1 - \alpha) \left[1 - \frac{\theta}{1 + \theta} \frac{(1 - q) \left(1 - \frac{A_a}{A_u} \right)}{1 + \frac{A_a}{A_u} \left(\frac{1}{(1 + \theta)s_u} - 1 \right)} \right]$$

proving the first part of the Lemma.

The second part of the Lemma considers the value of q . With state policy setting the registered urban worker population as L_u , population growth at rate n , and the hukou policy set to achieve $L_m = \theta L_u$, then the rate of matching is $\dot{L}_m = M(L - (1 + \theta) L_u, V) = n\theta L_u$. From the definition of $b(z)$, we can then write

$$b(z) = \frac{n\theta s_u}{1 - (1 + \theta) s_u} \quad (17)$$

It then follows from (8) that

$$q = \frac{\frac{n\theta s_u}{1 - (1 + \theta) s_u} + \tilde{r}}{\frac{n\theta s_u}{1 - (1 + \theta) s_u} \left(1 + \frac{1}{z} \right) + 2\tilde{r}}$$

where we recall that $d(z) = b(z)/z$. Further, since $b(z)$ is monotonically increasing, we can write

$$z = b^{-1} \left(\frac{n\theta s_u}{1 - (1 + \theta) s_u} \right)$$

completing the proof. ■

Proof of Corollary 1

The labor share is decreasing in A_u/A_a , while the saving rate and investment rate are increasing in A_u/A_a .

Proof. Note that the migrant's bargaining power q does not depend on A_u/A_a . From Lemma 1, it is then clear by inspection that a rise in A_u/A_a causes $\frac{1 - \frac{A_a}{A_u}}{1 + \frac{A_a}{A_u} \left(\frac{1}{(1+\theta)s_u} - 1 \right)}$ to rise. Hence, the labor share falls. By (10) and (11), the saving and investment rates then rise. ■

Proof of Lemma 2

$q'(\theta) \geq 0$, and $\{q(0), q(\theta_{\max})\} = \{0, 1\}$. Moreover, $\omega'(\theta) \geq 0$, and $\{\omega(0), \omega(\theta_{\max})\} = \{w_a/w_u, 1\}$.

Proof. The migrant's bargaining power, from (8), is $q = \frac{b+\tilde{r}}{b+d+2\tilde{r}}$. By the chain rule $\frac{\partial q}{\partial \theta} = \frac{\partial q}{\partial z} \frac{\partial z}{\partial \theta}$ where

$$\frac{\partial q}{\partial z} = \frac{b'd - bd' + (b' - d')\tilde{r}}{(b + d + 2\tilde{r})^2} \geq 0$$

This expression is signed recalling that $b'(z) \geq 0$ and $d'(z) \leq 0$.

Meanwhile, the function $z(\theta)$ is defined implicitly by (17), which implies that

$$z'(\theta) = \frac{1}{b'(z)} \frac{ns_u(1-s_u)}{(1-(1+\theta)s_u)^2} \geq 0$$

We therefore have $q'(\theta) \geq 0$.

Next, note that $z(\theta)_{\theta=0} = 0$. This follows because $b(z)_{\theta=0} = 0$ (from (17)), while the properties of matching function tell us that $b(z) = 0$ only when $z = 0$. Hence

$$\lim_{\theta \rightarrow 0} q(z(\theta)) = \lim_{z \rightarrow 0} \frac{b(z) + \tilde{r}}{b(z) + d(z) + 2\tilde{r}} = 0$$

where we use $b(0) = 0$ and $d(0) = \infty$.

Next, note that $z(\theta_{\max}) = \infty$. This follows from (17), where $b(z(\theta_{\max})) = \infty$, which in turn implies $z = \infty$ from the properties of the matching function. Hence

$$\lim_{\theta \rightarrow \theta_{\max}} q(z(\theta)) = \lim_{z \rightarrow \infty} \frac{b(z) + \tilde{r}}{b(z) + d(z) + 2\tilde{r}} = 1$$

where we use $b(\infty) = \infty$ and $d(\infty) = 0$.

Turning to the migrant wage, we note from (7) that $\omega = w_m/w_u = (1 - q)w_a/w_u + q$. Since $\theta = 0$ implies $q = 0$ (above) it also follows that $\theta = 0$ implies $\omega = w_a/w_u$. Furthermore, $\theta = \theta_{\max}$ implies $q = 1$ (above), which implies $\omega = 1$.

Lastly, since $w_a/w_u = A_a/A_u$, which is not a function of the hukou policy, it follows from $q'(\theta) \geq 0$ and $A_a/A_u < 1$ that $\omega'(\theta) = q'(\theta)(1 - A_a/A_u) \geq 0$, completing the proof. ■

Proof of Lemma 3

$\Lambda(0) = \Lambda(\theta_{\max}) = 1 - \alpha$, but $\Lambda(\theta) < 1 - \alpha$ for all $0 < \theta < \theta_{\max}$.

Proof. Recall that

$$\Lambda(\theta) = (1 - \alpha) \left[1 - \frac{\theta}{1 + \theta} \frac{(1 - q) \left(1 - \frac{A_a}{A_u}\right)}{1 + \frac{A_a}{A_u} \left(\frac{1}{(1 + \theta)s_u} - 1\right)} \right]$$

Noting that (i) $A_a < A_u$, (ii) $s_u < 1$, (iii) $\theta \leq \theta_{\max} = \frac{1}{s_u} - 1$, and (iv) $q(\theta) \in [0, 1]$ it follows by inspection of $\Lambda(\theta)$ that the expression in square brackets is weakly less than 1. Hence $\Lambda(\theta) \leq 1 - \alpha$. At any value of the hukou parameter, θ , the labor share is weakly less than the competitive market norm.

It also follows by inspection that $\Lambda(0) = 1 - \alpha$. (In this circumstance, there are no migrant workers, so that all laborers are paid their marginal products.) Similarly, noting from Lemma 2 that $q(\theta_{\max}) = 1$, it also follows by inspection that $\Lambda(\theta_{\max}) = 1 - \alpha$. (In this circumstance, there are many migrant workers but they receive their full marginal product.) Hence we have shown that $\Lambda(0) = \Lambda(\theta_{\max}) = 1 - \alpha$.

We can show that $\Lambda(\theta) < 1 - \alpha$ for all $0 < \theta < \theta_{\max}$ as follows.

First, we have just observed that $\Lambda(\theta) \leq 1 - \alpha$.

Second, by contradiction, assume there exists some $0 < \hat{\theta} < \theta_{\max}$ where $\Lambda(\hat{\theta}) = 1 - \alpha$. Inspection of $\Lambda(\theta)$ above shows we then require that $q(\hat{\theta}) = 1$. However, from Lemma 2, we know that $q(\theta_{\max}) = 1$ and $q'(\theta) \geq 0$. Therefore, if $q'(\theta_{\max}) > 0$, then it must follow that $q(\theta) < 1$ for all $\theta \in (0, 1)$, which is a contradiction. The proof can thus simply establish that $q'(\theta_{\max}) > 0$.

After some algebra, write $q'(\theta)$ as

$$q'(\theta) = \frac{b'(\theta) - d'(\theta)}{b(\theta)} \frac{\left(1 + \frac{\tilde{r}}{b(\theta)}\right)}{\left(\frac{1}{z(\theta)} + 1 + \frac{\tilde{r}}{b(\theta)}\right)^2}$$

Noting that $b(\theta_{\max}) = \infty$, $z(\theta_{\max}) = \infty$, and $d'(\theta) < 0$, it follows that

$$\lim_{\theta \rightarrow \theta_{\max}} q'(\theta) \geq \lim_{\theta \rightarrow \theta_{\max}} \frac{b'(\theta)}{b(\theta)}$$

From (17), we know that $b'(\theta)/b(\theta) = \frac{1}{\theta} + \frac{s_u}{1 - (1 + \theta)s_u}$. Hence

$$\lim_{\theta \rightarrow \theta_{\max}} q'(\theta) = \infty$$

which establishes, by contradiction, that $\Lambda(\theta) < 1 - \alpha$ for all $0 < \theta < \theta_{\max}$. ■

6.2 Relaxing the Cobb-Douglas Approach

This paper has investigated China's unusual macroeconomy by departing from the assumption that factors are paid their marginal products. An alternative point of departure would allow China to deviate in its production technology. This section considers this alternative, generalizing from a Cobb-Douglas to a CES production function, while maintaining the assumption that markets are competitive. In particular, let the production function be

$$Y = \left[(AL)^{\frac{\varepsilon-1}{\varepsilon}} + (BK)^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}$$

where ε is constant and the factor-augmenting productivity terms, A and B , evolve with time. If factors are paid their marginal products, then the labor share of income is

$$\frac{wL}{Y} = \frac{1}{1 + \left(\frac{BK}{AL}\right)^{\frac{\varepsilon-1}{\varepsilon}}}$$

An unusually low labor share of income could thus emerge if China's production function parameters differ, at a given capital-labor ratio, from global norms. Consistent with the literature allowing factor-biases in technology, one departure point is to assume that ε is common across economies while the productivity terms may differ. One then needs an explanation for why China's factor ratio B/A differs from the rest of the world.

The empirical literature allowing deviations from Cobb-Douglas typically estimates $\varepsilon < 1$ (e.g. Antras 2004). To explain China's unusual labor share behavior under this assumption, we then require $\frac{BK}{AL}$ to be unusually low (and declining, to capture a declining labor share) compared to other countries. In this case, we need China's productivity, and its evolution, to be unusually labor-biased (i.e. B/A in China exceeds B/A in other countries). That is, both productivity and productivity increases in China would need to be heavily labor-biased. Moreover, noting that the rise in K/L (especially rapid in China) suggests a rising labor share, other things equal, one must assume that B/A is rising very fast to counterbalance this effect.

In sum, a micro-founded mechanism in which China's markets are competitive but productivity is heavily labor-biased compared to the rest of the world, and other Asian miracles, could provide another potential avenue for understanding the low labor share. Such an avenue is an interesting possibility for future work. Note that such labor-bias would not explain elevated investment rates, which require additional mechanisms and may be challenging if the marginal products assumption continues to be maintained.

Figure 1A: Labor Shares, China versus Rest of World

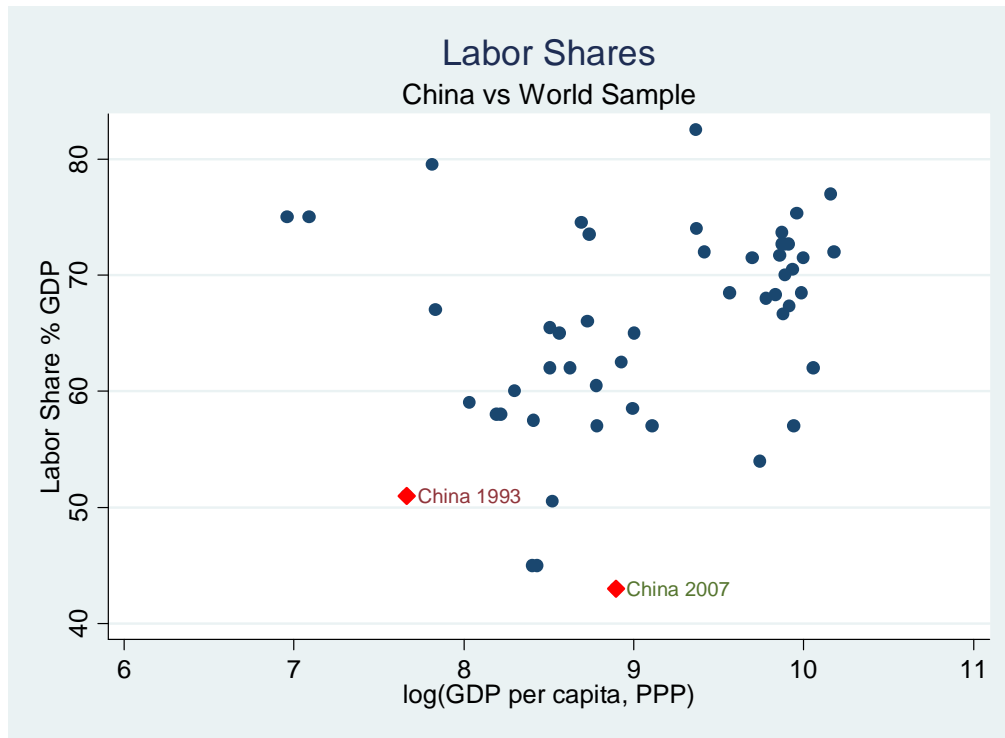


Figure 1B: China's Labor Share, Various Sources

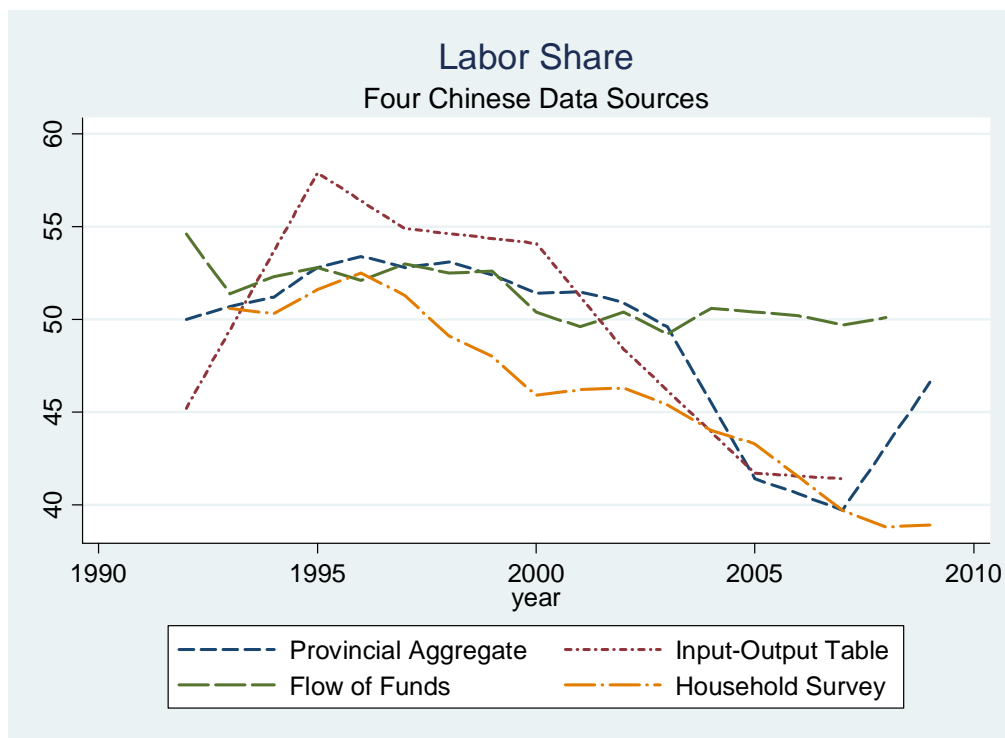


Figure 2A: Saving Rates, China versus Rest of World

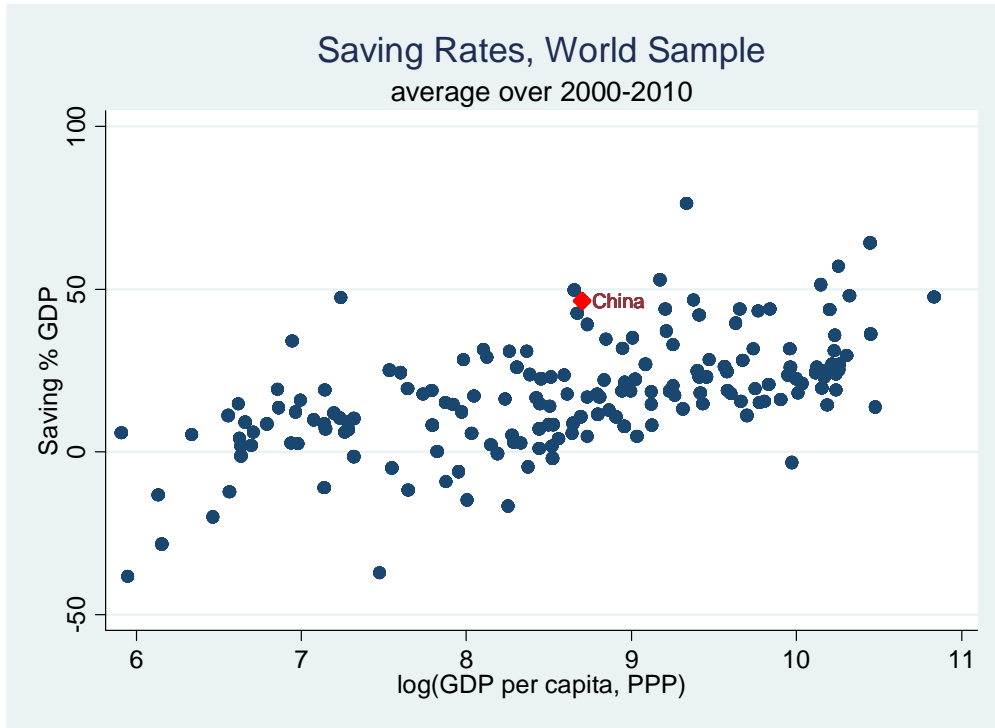


Figure 2B: Saving Rates, China versus Rest of World Excluding Oil States and States with Less than 1 Million Inhabitants

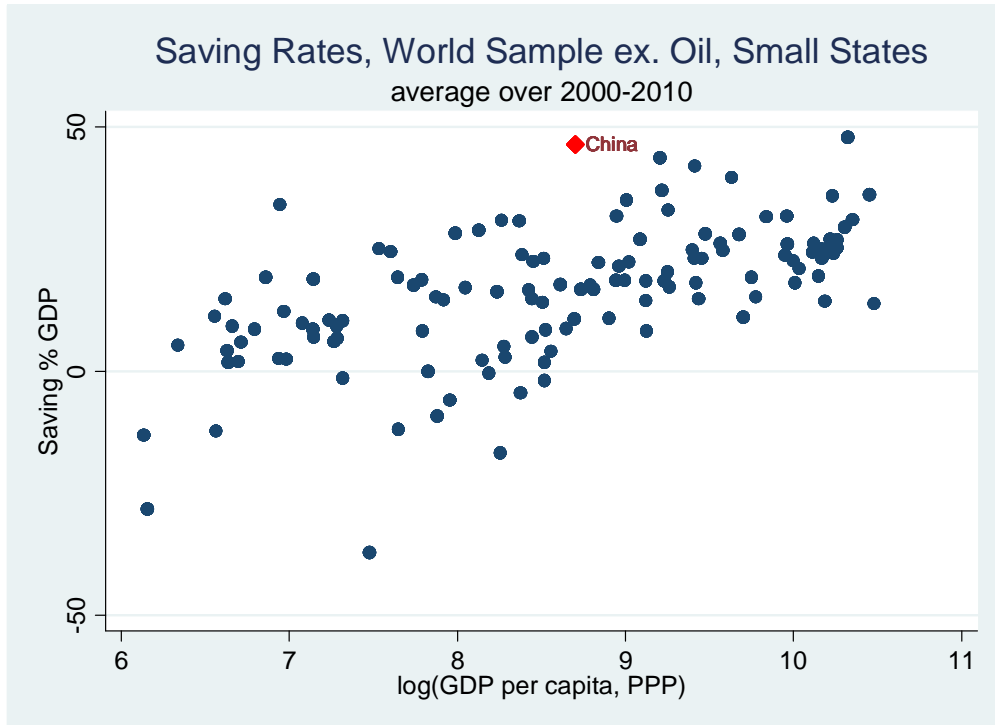


Figure 2C: Saving Rates, China versus Other Asian Miracles

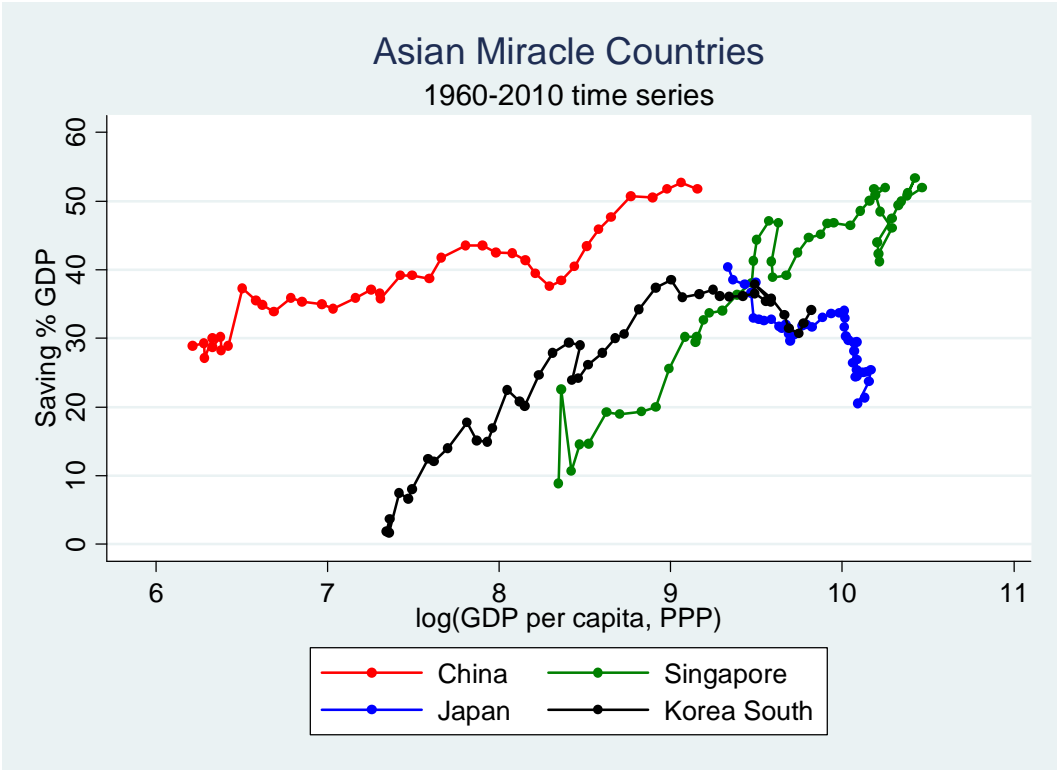


Figure 3A: Consumption Rates, China versus Rest of World

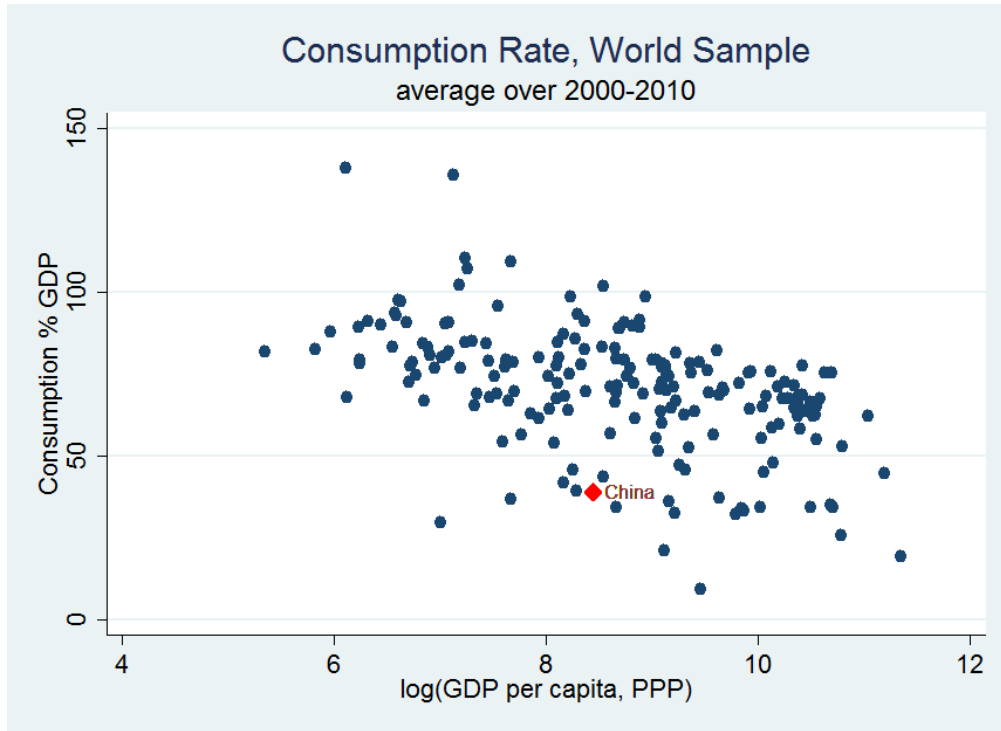


Figure 3B: Consumption Rates, China versus Other Asian Miracles

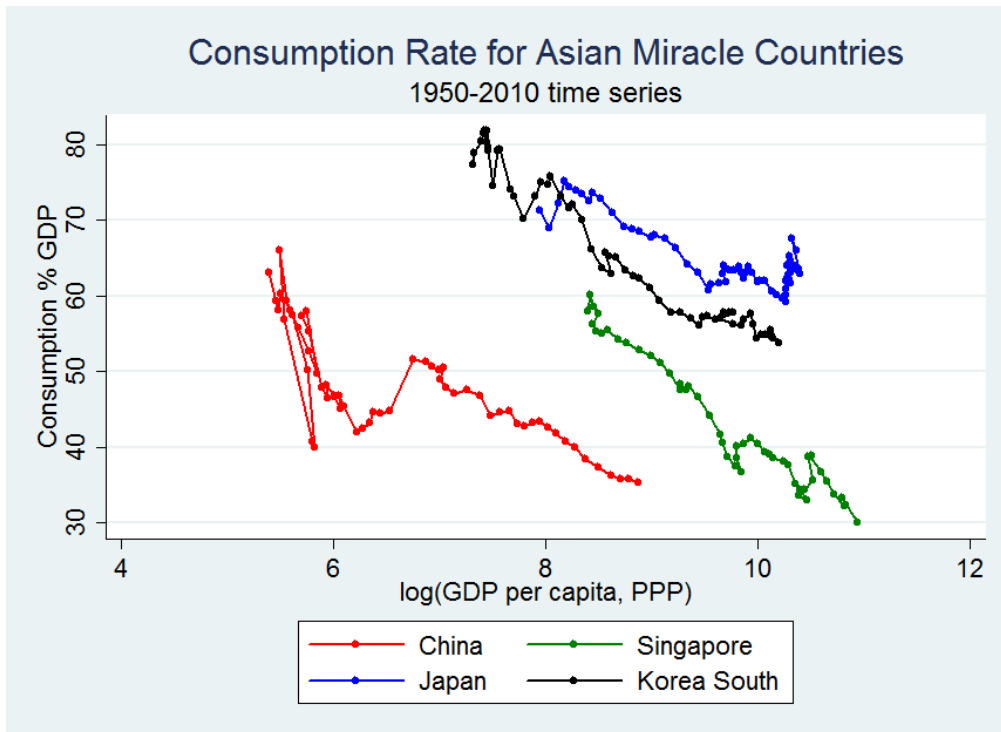


Figure 4A: Investment Rates, China versus Rest of World

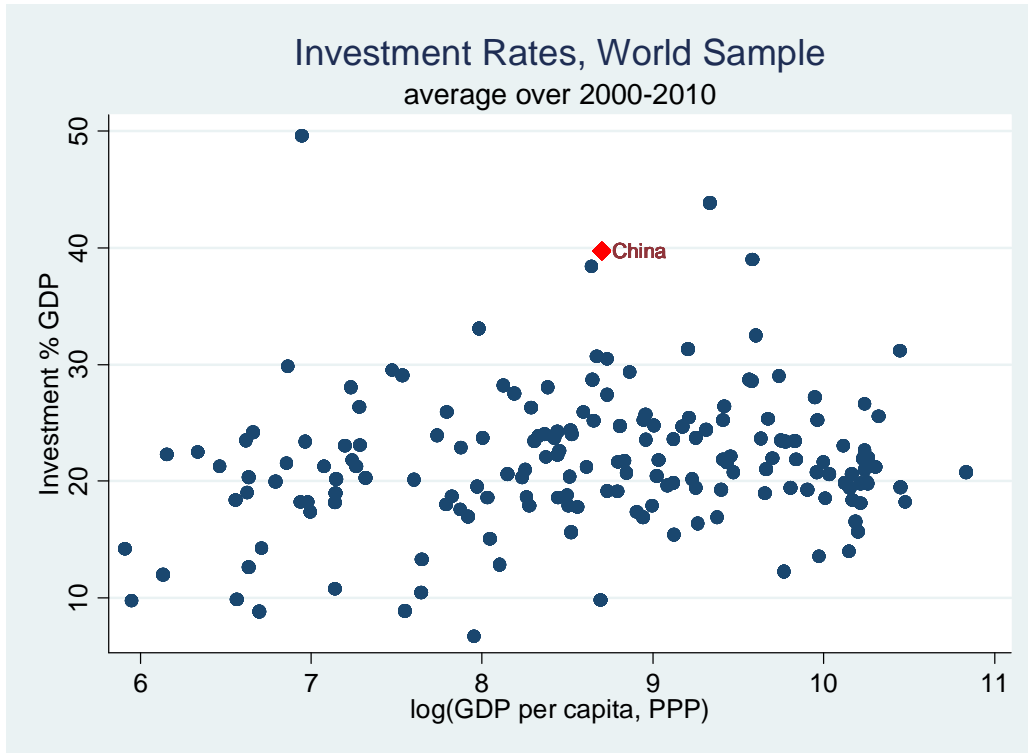


Figure 4B: Investment Rates, China versus Other Asian Miracles

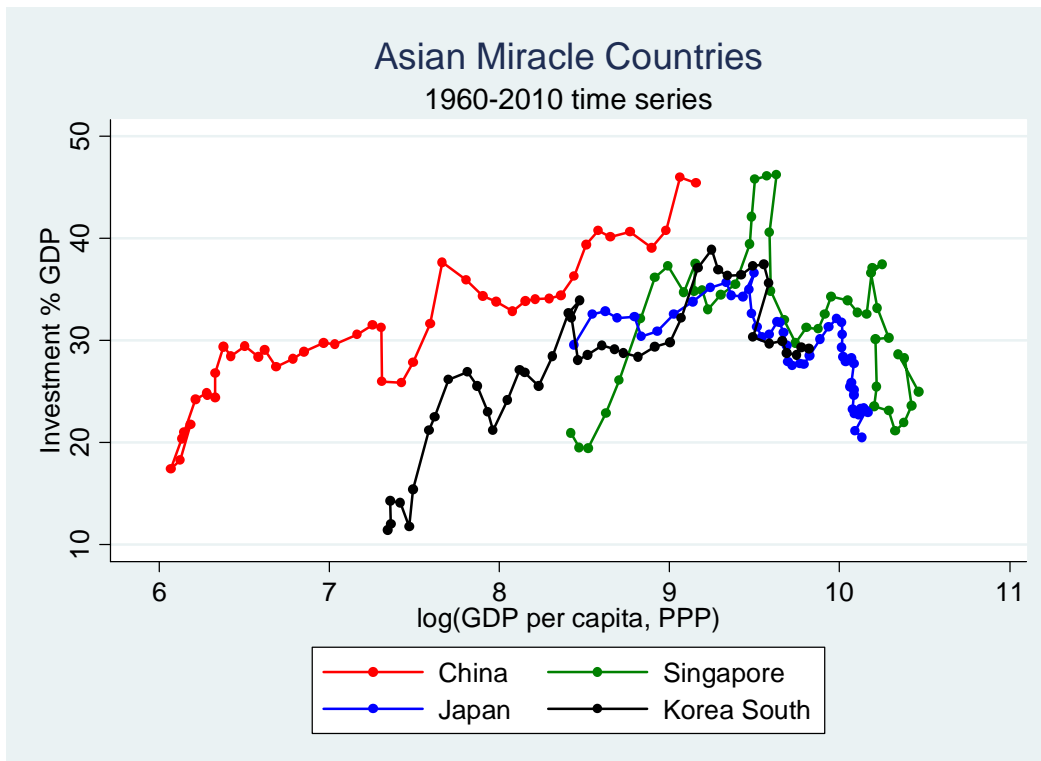


Figure 5: Urban, Rural, and Migrant Wages in 2010

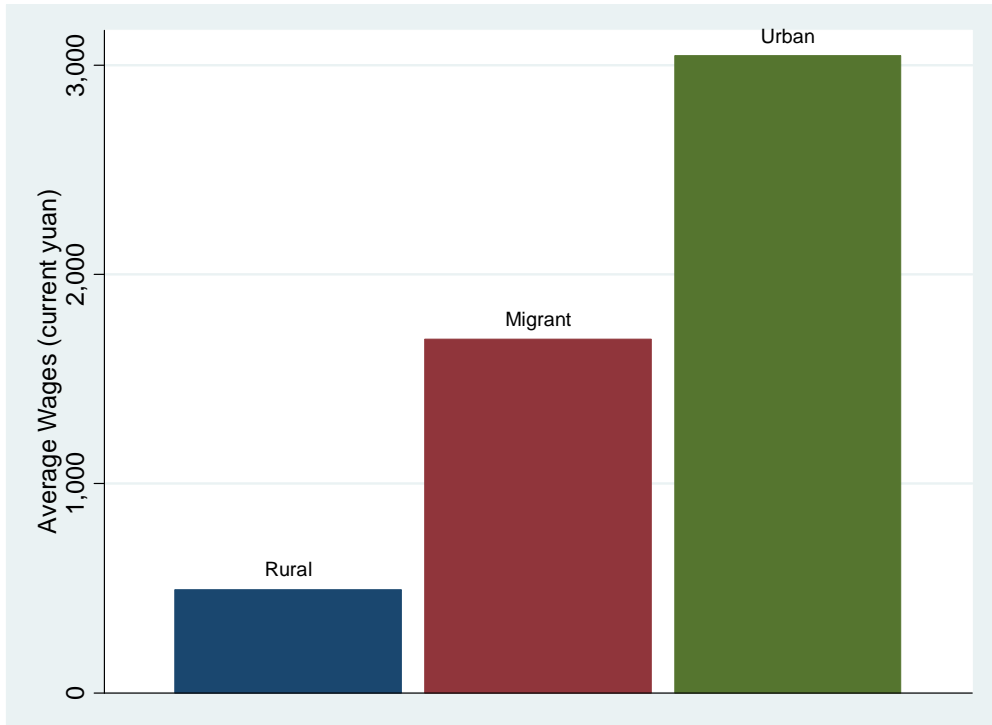


Figure 6: Enterprise Savings Rates in China

