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The Human Factor: China's Internal Migration and the Saving Puzzle

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Abstract

Filling a gap left by previous literature, this paper finds that many macroeconomic "puzzles" exhibited by the Chinese economy can be explained (at least partially) by the evolution of China's internal-migration policies. Such policies not only have a profound impact on China's labor market conditions, but also explain many China-specific phenomena such as its rising saving rate, persistent and increasing wage gap, and seemingly constant rate of urbanization that are contrary to the implications of traditional macroeconomic models. In this paper, we introduce a theoretical framework capturing how human-migration policies are formed by the authorities while retaining the main features and assumptions of traditional models. We show that by incorporating the government's decision in the theoretical framework, the model generates sensible implications consistent with Chinese data, hence adds to our understanding of the existing "puzzles." More importantly, we do not require the assumption that Chinese economic agents simply have different preferences than western agents but instead explain the puzzles as a natural outcome when the same agents face different policy constraints. Finally, by examining the experience of other economies in the past, the paper reveals that China's experience is not as unique as it initially seems and suggests an optimal path for migration-policy evolution. In particular, China should relax its migration barriers going forward and maintaining the Hukou system beyond the next decade would be detrimental to China's growth targets and urbanization goals.

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1 Introduction

Ever since the Open Door Policy was announced by Deng Xiaoping in 1978, China has taken great strides in economic growth. Averaging around 10% for the past 35 years, China's real GDP growth is one of the longest and greatest in modern economic history. In the meantime, China has witnessed a phenomenal yet puzzling macroeconomic trend: its household saving rate rose persistently from 15% in the early 1990s to 30% in 2012. This trend is at odds with standard off-the-shelf economic theories. Under such theories, high growth rates of income imply low saving rate, as households would borrow from their future income to smooth consumption.

China's saving rate puzzle is related to a host of macroeconomic issues in the past few decades, such as China's huge external balance, controversial exchange rate, the global savings glut, and the declining world interest rate. It is thus of great importance to understand why China's saving rate has been high and still rising. Many theories have been put forth to explain China's high and rising saving rate, but very few focus on China's labor market. In this paper, we argue that the key to understanding China's saving rate pattern is to account for trends in its labor market in the past three decades. These trends are: a convex path of the urban share of labor force and an increasing wage gap between rural and urban workers. Importantly, China's policy toward internal migration plays a key role in driving these two trends. To capture these two trends, we build a dynamic stochastic general equilibrium model of China's dual labor markets under government regulation. Using our model, we show that frictions in China's labor market are able to generate a saving rate pattern that is consistent with data in several dimensions.

Figure 1 shows that the urban share of total labor force in China has been increasing since 1978, but not at a constant speed. Roughly before the mid-1990s, the pace of urbanization had been slow. Over the course of almost two decades, the urban share of labor force had increased by only about 5%. However, urbanization started picking up speed since then: the urban share of labor force has increased dramatically from about 28% in 1995 to more than 50% in 2012. This is what we call the convex path of urbanization. Figure 2 shows that the wage gap between rural and urban workers has been widening over time. In the mid-1980s, an average urban household earns almost twice as much as an average rural household; in 2012, an average urban household earns three times as much. This is the second trend which we deem as an increasing wage gap.

These two trends are inconsistent with implications of a free labor market,[1] but

[1] In a free labor market, the initial wage gap implies that urbanization should happen more quickly at the beginning and that labor flow from rural to urban areas should shrink the wage gap over time.

they are telling of two aspects in China's labor market. The first one is an increasing productivity difference between urban and rural areas. Since 1978, the urban sector in China has been the engine of economic growth. Special economic zones have been set up in 1980 in China and a series of city ports have been opened to foreign businesses strategically in subsequent years. Self-innovations and adoptions of foreign technology in these areas boosted urban productivity growth, creating a gap between urban and rural productivity growth rates. Slow spillovers of technology from the urban sector to the rural sector resulted in a persistent and ever-increasing difference between urban and rural productivity. If labor was not able to move freely, the difference in productivity would have translated into an ever widening gap in wages.

The second aspect is large frictions in China's labor market. The frictions prevented rural-to-urban labor flow from happening too quickly, especially at the beginning of China's opening up. Consequently, labor flow was not nearly enough to close the wage gap. In fact, wage gap began to widen. Even in the 2000s when urbanization speeded up, frictions were still large enough to keep the wage gap increasing.

What are the frictions in China's labor market? One of the greatest frictions is China's household registration system.[2] In such a system, every citizen in China is marked as either rural or urban. Rural households officially need permits to work in cities and the number of permits is limited. Migrant workers are also excluded from city-wide social, economic and cultural welfares. The system largely determines the allocation of government benefits, giving a clear advantage to urban citizens.[3] As such, migrant workers effectively earn much less than native urban workers. Coupled with unemployment risk, it makes moving to cities less attractive for rural households.

The enforcement of household registration system after China's opening up can be rationalized by the objectives of the Chinese government: economic growth and political stability. Urban areas were at the heart of economic reforms and were prone to political instability. A companion idea of the Open Door Policy that has been embraced by the Chinese government since 1978 was to let part of the people become rich first. Naturally, those who were to become rich first in the mind of policy makers were native urban households[4]. A huge inflow of migrants from rural areas would certainly contribute to overall GDP growth, but inevitably dampen the wage growth prospect of urban households. Moreover, in light of the abundant labor force in rural

[2]This system has its historical tradition. The current household registration system was established in 1958 and has been relaxed since the 1990s.

[3]For a detailed description of China's household registration system, see Wang (2010)

[4]In fact, one of the achievements by which local officials were measured was the average income growth of urban households, where the definition of urban households excludes migrants. Another one was unemployment rate, where the official figure of the unemployed never included unemployed migrants

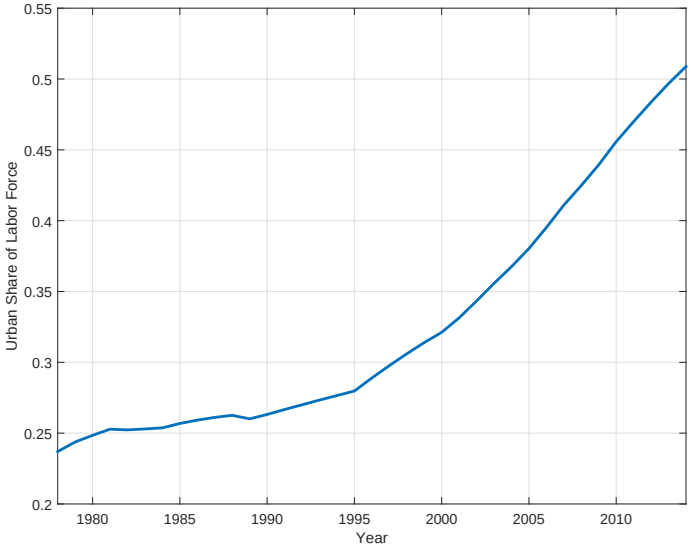

Figure 1: Urban Share of Total Labor Force

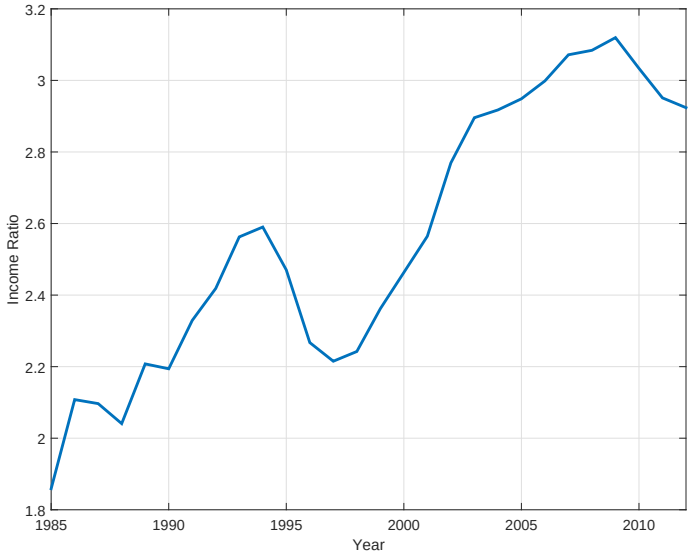

Figure 2: Ratio of Urban and Rural Household Real Disposable Income

areas, massive migration would have other dire economic and social consequences, such as enormous pressure on the provision of public goods, potential social unrest,

deterioration of environment and so on. The government therefore has an incentive to prevent migration from happening too fast. The household registration system, by lowering wages of migrants and partially denying them equal welfare enjoyed by native urban households, effectively prevented a rapid increase in urban population.

Importantly, the suppressed labor flow from rural to urban areas prolonged the process of urbanization, and as will be clear in our model, it would dramatically affect China's saving rate. Rural households, most of whom lived under poverty,[5] were essentially hand-to-mouth. As they moved to cities, high income lifted them well above the subsistence level while unemployment risk, among others, forced them to save to reach their target wealth level. As our model shows, the contribution of migrants' saving to total household total saving rose as wage gap continued to widen, and a continuous flow of migrants to urban areas drove the total saving rate up in a persistent manner. We show that the rise in saving rate, however, would not have been so dramatic, had urbanization happened quickly at the beginning, because the share of migrants' saving in total saving would then be small. Thus, our model implies that it is the combination of slow urbanization and widening wage gap that gave rise to the high and rising saving rate in China. Frictions in the labor market is the key to our results.

The correlation between urbanization and rise in saving rate may not be necessarily unique in China, as governments in many developing countries focus on measurable statistics of welfare, such as GDP and wage growth. Thus, the policy implication of our model is twofold. First, governments' priorities on growth and equality, might greatly affect the path of urbanization and hence wages and saving rate. Second, current labor market's reform in China, in particular the relaxation of household registration system, will drive up migrants' wage and dampen the rise in saving rate.

While we believe that frictions in the labor market is an important aspect underlying China's macroeconomic trends, particularly the high and rising household saving rate, we acknowledge that other channels also have their roles. Our model abstracts from saving for life cycle considerations, and thus does not rely on channels of financial frictions or cultural difference. Financial constraints and China's cultural endorsement of frugality might as well be factors behind the high saving rate. However, it is hard to reconcile a rising saving rate with a general improvement of China's financial markets and with a cultural explanation because preference is a persistent feature.

The rest of the paper is organized as follows. Section 2 discusses related literature. Section 3 describes our model. In section 4, we use our model to show how frictions

[5]According to the World Bank, 84% of China's population in 1987 lived under $2 at 2005 international prices.

in China's labor market relate to its urbanization path and wage gap, and why a high and persistently rising saving rate naturally emerges from such frictions. Section 5 discusses some international evidence and policy implications of labor market reform. Section 6 concludes.

2 Related Literature

Our paper is mainly related to three strands of literature. First, we contribute to the literature on explanations of high saving rate in China. Chamon and Prasad (2010) attribute China's high saving rate to increasing private burden of education, health and housing. Wei and Zhang (2009) find that half of the increase in China's household saving rate comes from increased pressure in the marriage market due to rising sex ratio imbalance. Coeurdacier, Guibaud, and Jin (2015) show that the interaction between growth differentials and household credit constraints explains 40% of the divergence between aggregate saving rates in China and the United States. While these papers focus on saving for different life cycle aspects, we complement their studies by emphasizing frictions in the labor market, with a particular focus on urbanization and internal migration. We show that under government regulation, persistent labor flow from rural to urban areas could lead to persistent rise in saving rate. Quantitatively, the rise in China's saving rate could be explained under quite reasonable parameter choices.

Second, our paper is connected to the literature on the relation between saving and growth since Houthakker (1961) and Modigliani (1970). While a large body of empirical evidence[6] suggests that growth causes saving, it has been difficult for growth to cause saving in standard growth models. Carroll, Overland, and Weil (2000) shows that a standard endogenous growth model with habit formation can generate growth-to-saving causality qualitatively similar to that observed in the data. We provide an alternative model. In our model, a continuous flow of labor from rural to urban areas under productivity difference contribute to the rise in saving rate. Frictions in the labor market prolong this process, and the resulting wage gap further reinforces the rise in saving rate. Horioka and Wan (2007) find that China's household saving rate is consistent with the existence of inertia or persistence. We show that this unobserved persistence factor could be the persistent process of urbanization.

[6]For instance, Deaton and Paxson (1994); Carroll and Weil (1994) and more recently, Attanasio, Picci, and Scorcu (2000); Loayza, Schmidt-Hebbel, and Servén (2000); Hausmann, Pritchett, and Rodrik (2005); Gourinchas and Jeanne (2013).

Finally, our paper is related to a literature at the confluence of economics and political science on the effect of urban bias. Lipton (1977) and Lipton (1984) argue that urban bias is the moving force behind slow and inequitable growth in developing countries after World War II. Yang (1999) finds that urban-biased policies are responsible for the long-term rural-urban divide in China. Oi (1993) argues that urban biased policies are insurance policies that China's central government buys to ensure that those in urban areas will refrain from political activity that endangers the stability of the regime. We discuss the inherent trade-off between growth and stability under urban biased policies, and the consequence on the household saving rate of such policies. As our paper suggests that government policies in the labor market might be an important factor in affecting the household saving rate, the picture of global imbalances is not complete with a pure focus on household finance.

3 Model

In this section, we develop a dynamic stochastic general equilibrium model of China's dual labor markets under government regulation. The economy has two sectors, rural and urban, and we distinguish three groups of households: rural households, migrants, and native urban households. The government's objectives affect labor flow from rural to urban areas, and therefore wages of all three groups of households and eventually the path of urbanization. We abstract from saving for life cycle reasons and focus on the transition between the dual labor markets. We discuss each component of the model in turn.

3.1 Production

For simplicity, we assume that the only input in production is labor and that there is decreasing returns to scale. The production of urban and rural sectors follow

$$Y_t^u = Z_t^u \left(L_t^u\right)^\alpha$$

and

$$Y_t^r = Z_t^r \left(L_t^r\right)^\alpha$$

where Z is productivity, L is labor, u and r denote urban and rural respectively, and $\alpha < 1$. The total labor force is normalized to be 1.

$$L_t^r + L_t^u = 1$$

Denote urban and rural productivity growth rate by z_t^u and z_t^r, then

$$Z_t^u = Z_{t-1}^u e^{z_t^u}$$

$$Z_t^r = Z_{t-1}^r e^{z_t^r}$$

Furthermore, we assume that urban productivity growth is constant:

$$z_t^u = z^u$$

while rural productivity growth catches up with urban productivity growth over time:

$$z_t^r = \phi z^u + (1-\phi) z_{t-1}^r \tag{1}$$

where $0 < \phi < 1$. The rationale here is that the urban sector in China took off first and innovations in urban areas trickled down to rural areas in a gradual manner: China's reform since 1978 boosted urban productivity growth to a level much higher than the rural one, $z^u > z_{1978}^r$, in the following few decades, rural productivity growth has been catching up with urban productivity growth. Technically, this assumption also ensures that the ratio of urban and rural productivity Z_t^u/Z_t^r does not wander off to infinity.

3.2 The Labor Market

There are three kinds of labor force in the economy: rural households (r), native urban households (nu), and migrants (m). Total urban labor force consists of native urban households and migrants,

$$L_t^u = L_t^{nu} + L_t^m$$

The initial gap in urban and rural productivity will ensure that $L_t^m \geq 0$. Wages of native urban households and rural households are just the sector-wise marginal product of labor

$$W_t^{nu} = \frac{\partial Y_t^u}{\partial L_t^u} = \alpha Z_t^u \left(L_t^u\right)^{\alpha-1}$$

$$W_t^r = \frac{\partial Y_t^r}{\partial L_t^r} = \alpha Z_t^r \left(L_t^r\right)^{\alpha-1}$$

Wages of migrants, however, are subject to the government's policies, which we will explain later. In particular, migrants in each period only earn a fraction of native urban household wage:

$$W_t^m = (1-\tau_t) W_t^{nu} \tag{2}$$

where τ_t is a wedge between wages of migrants and native urban households induced by frictions in the labor market.

3.3 The Government

Urban areas were in the forefront of economic reforms in China in the 1980s and 1990s. While growth prospect might be promising, reform by its nature was also risky. The central government in China therefore had practical needs for ensuring both production growth and wage growth in urban areas. In particular, wage growth was important for maintaining political stability and winning ensuing support for subsequent reform policies. Urban wage growth, however, was narrowly confined to native urban households, as they were relatively wealthy and had much political influence,[7]. To capture this in the model, we assume that the per-period objective function of the government follows,

$$u^G(g_t^u, w_t^{nu}) = \frac{(g_t^u)^{1-\gamma}}{1-\gamma} + \theta \frac{(w_t^{nu})^{1-\sigma}}{1-\sigma}$$

where g_t^u is the growth rate of urban production and w_t^{nu} is the wage growth rate of native urban population, γ and σ reflect the intertemporal elasticities that the government associates with production growth and wage growth. We assume that $\gamma > 1$ and $\sigma > 1$ to make zero or negative growth intolerable for the central government.

Note that urban production growth is influenced by two factors,

$$\begin{aligned} g_t^u &= d\log Y_t^u \\ &= d\log Z_t^u + \alpha\left(d\log L_t^u\right) \\ &= z_t^u + \alpha n_t \end{aligned}$$

where z_t^u is the productivity growth rate and n_t is the urban labor force growth rate, which reflects mainly the rate at which rural households flow to urban areas. The wage growth rate of native urban households is influenced by the same factors, albeit differently,

$$\begin{aligned} w_t^{nu} &= d\log W_t^{nu} \\ &= d\log Z_t^u - (1-\alpha) d\log L_t^u \\ &= z_t^u - (1-\alpha) n_t \end{aligned}$$

The government therefore faces a trade-off between the growth rate of urban production and the wage growth rate of urban households. A faster urban labor force growth contributes to urban production growth, but at the same time reduces

[7]Urban bias were pervasive in almost all developing countries see for instance Lipton (1977). For arguments about the case in China, see Oi (1993).

the wage growth prospect of native urban households.[8] Hence there is an incentive for the government to control the flow of labor force. In reality, it is primarily the household registration system that controls labor flow. However, the effects of such a system depends on the extent to which it is strictly enforced and the extent to which welfare systems in urban areas are set up in favor of native urban households. In our model, we introduce a wedge in the labor income of migrants, as we see in Equation 2. Such a wedge is a theoretical simplification of various policies that reduce the effective payment to migrants, such as those that restrict migrants' access to unemployment insurance, health care, and education for their children.

In a dynamic setting, the government chooses a set of wedges $\{\tau_{t+i}\}_{i=0}^{\infty}$ to maximize expected discounted utility from urban production growth and urban wage growth, with a target urbanization rate $\bar{L^u}$.

$$\max_{\{\tau_{t+i}\}_{i=0}^{\infty}} E_t \left[\sum_{i=0}^{\infty} \beta^i u^G(g_{t+i}^u, w_{t+i}^u) \right]$$

where

$$g_t = z_t^u + \alpha n_t(\tau_t)$$

and

$$w_t = z_t^u - (1-\alpha) n_t(\tau_t)$$

subject to

$$\exp\left\{ \sum_{i=0}^{\infty} n_{t+i} \right\} \leq 1 + \bar{n} \qquad \text{and} \qquad n_{t+i} \geq 0 \qquad \forall i \tag{3}$$

where

$$\bar{n} = \frac{\bar{L^u}}{L_t^u} - 1$$

is the overall growth rate of urban population that urbanization will reach asymptotically. Note that $\bar{n} \leq \frac{1}{L_t^u} - 1$.

[8] While in our specification of the government objective function we focus on urban areas exclusively, these objectives are compatible with broad objectives for the economy. For instance, labor flow from rural to urban areas boosts total production, as productivity in urban areas is higher. Labor flow also drives up wage in rural areas, so ultimately reform policies hinge on the weight the central government gives to different sectors of the economy.

3.4 Households

We assume that households inelastically supply their labor. Because there were mass poverty in rural areas in China in the 1980s and 1990s, we make the further assumption that rural households are hand-to-mouth. As China transitioned from a command economy to a market economy, urban households who used to have work guaranteed for their lifetime started to face unemployment risk. Thus we assume that households in urban areas face idiosyncratic uncertainty in wages, and for simplicity, we assume that unemployment risk is the only risk that urban households face. Appendix B provides further justifications of our assumptions.

For native urban households, their wages follow

$$W_{jt}^{nu} = \begin{cases} \frac{1}{1-\mho} W_t^{nu} & \text{w. prob.} \quad 1-\mho \\ 0 & \text{w. prob.} \quad \mho \end{cases}$$

where $\mho$ is the probability of becoming unemployed and j is the household index that indicates the jth household from a continuum of native urban households. The idiosyncratic component of wages of native urban households vanishes when their wages are averaged,

$$EW_{jt}^{nu} = W_t^{nu}$$

Migrants' wages are similar to those of native urban households but are subject to a wedge induced by government policies,

$$W_{jt}^{m} = \begin{cases} \frac{1-\tau_t}{1-\mho} W_t^{nu} & \text{w. prob.} \quad 1-\mho \\ 0 & \text{w. prob.} \quad \mho \end{cases}$$

Similarly, their average wage is the marginal product of labor with a wedge.

Native Urban Households' Problem

Native urban households maximize their expected discounted utility from consumption

$$\max_{\{C_{jt}^{nu}\}} E_t \left[\sum_{i=0}^{\infty} \beta^i u(C_{j,t+i}^{nu}) \right]$$

subject to

$$\begin{aligned} A_{jt}^{nu} &= M_{jt}^{nu} - C_{jt}^{nu} \\ M_{j,t+1}^{nu} &= RA_{jt}^{nu} + W_{j,t+1}^{nu} \\ W_{t+1}^{nu} &= W_t^{nu} e^{z_{t+1}^u - (1-\alpha) n_{t+1}} \end{aligned}$$

where C_{jt}^{nu} is consumption for a native urban household j in period t, A_{jt}^{nu} is her net worth at the end of period t, $M_{j,t+1}^{nu}$ is their market resources at the beginning of period $t+1$, $R = (1+r)$ is the gross interest rate, and n_{t+1} is the urban labor force growth during period $t+1$. Note that we use variables with a subscript j to indicate a household and variables with such subscript to indicate the average. Households have CRRA utility with the coefficient of relative risk aversion ρ, i.e., $u(C) = C^{1-\rho}/(1-\rho)$.

Migrants' and Rural Households' Problem

Rural households optimally choose either to stay in rural areas or to move to cities. While wages for natives in urban areas are high, rural households understand that their share of wages are limited and that there is unemployment risk. We assume that once rural households move to cities, they do not go back.

The value function of migrants is

$$V_{jt}^{m} = \max_{\{C_{jt}^{m}\}} E_t \left[\sum_{i=0}^{\infty} \beta^i u(C_{j,t+i}^{m}) \right]$$

subject to

$$\begin{aligned} A_{jt}^{m} &= M_{jt}^{m} - C_{jt}^{m} \\ M_{j,t+1}^{m} &= RA_{jt}^{m} + W_{j,t+1}^{m} \\ W_{j,t+1}^{m} &= (1-\tau_{t+1}) W_{j,t+1}^{u} \end{aligned}$$

In choosing consumption, rural households take into account that they might become migrants in the future. The value function of rural households is therefore

$$V_{jt}^{r} = \max\{u(C_{jt}^{r}) + \beta E_t V_{j,t+1}^{r}, u(C_{jt}^{rm}) + \beta E_t V_{j,t+1}^{m}\}$$

where the first term inside the brackets is the value function conditional on staying in rural areas next period and the second term is the value function conditional on moving to cities. In each period t, labor markets clear and rural households at the margin are indifferent between staying and moving to cities.

3.5 Equilibrium

An equilibrium at time t is given by a set of government policies $\{\tau_t\}$, consumption and wages of three groups of households, $\{C_t^i\}$, $\{W_t^i\}$, where $i = r, nu, m$, and urban labor force growth $\{n_t\}$ such that

(i) The government maximizes its utility under the choice of $\{\tau_t\}$
(ii) Given government policies, households maximize their expected utility by choosing consumption $\{C^i_{jt}\}$
(iii) Labor markets clear. Wages are consistent with urban labor force growth.
(iv) Overall urban population growth rate $\bar{n}$ is consistent with the path of urban population growth rate.

4 The Path of Urbanization and the Saving Puzzle

In this section, we first simplify our dynamic general equilibrium model to a static model and develop the intuition that control on labor force flow can be achieved through the imposition of a wedge in migrants' wage. Then we numerically solve the dynamic model where we show that frictions in the labor market induced by the government's policies on migrants' wage make a huge impact on the path of urbanization, the path of urban production growth and the path of wage growth. Finally, we simulate our model under moderate parameter choices and show that it is able to generate a high and rising saving rate that is qualitatively similar to that observed in the data.

4.1 A Simple Static Model

Let us assume that there is only one period. We use $t = 0$ and $t = 1$ to indicate the beginning and the end of the period. Households are only able to move between $t = 0$ and $t = 1$.

At $t = 0$, rural share of labor force is L^r_0, productivity is Z^r_0, and wage is W^r_0. Urban counterparts are $\{L^u_0, Z^u_0, W^u_0\}$. We assume that $W^r_0 << W^u_0$ so rural people would like to move to cities. During the period, part of rural people move to cities, becoming migrants. Migrants contribute to urban population growth rate by n.

First, to see why there exists an optimal urban population growth rate for the government, plug g^u_1 and w^{nu}_1 in the utility function of the government,

$$u^G(g^u_1, w^{nu}_1) = \frac{(z^u_1 + \alpha n)^{1-\gamma}}{1-\gamma} + \theta \frac{(z^u_1 - (1-\alpha)n)^{1-\sigma}}{1-\sigma}$$

The first order condition with respect to n is

$$\frac{\partial u^G}{\partial n} = \alpha(z^u_1 + \alpha n)^{-\gamma} - \theta(1-\alpha)(z^u_1 - (1-\alpha)n)^{-\sigma} = 0$$

The optimal interior solution n^* is the root of

$$f(n) = \sigma \log(z^u_1 - (1-\alpha)n) - \gamma \log(z^u_1 + \alpha n) + \log \alpha - \log\left(\theta(1-\alpha)\right)$$

which is a decreasing function of n. The urban population growth is not unbounded. When no rural people move to urban areas, $n = 0$; when all of them move,there is maximum population growth $\bar{n} = \frac{1}{L_0^u} - 1$. Therefore it is guaranteed that there be an optimal n^*.

Next, to see how the introduction of a wedge τ on the wage of migrants helps the government achieve its desired population flow, we note that the growth rates of rural and native urban wages[9] are

$$\begin{aligned} w_1^r &= z_1^r - (1-\alpha)n^r \approx z_1^r + (1-\alpha)\frac{L_0^u n}{L_0^r} \\ w_1^{nu} &= z_1^u - (1-\alpha)n \end{aligned}$$

Labor flow from rural to urban areas have the opposite effect on rural and urban wage growth rates, as n^r and n have different signs. Rural and urban wages are

$$\begin{aligned} W_1^r &= W_0^r \exp(z_1^r - (1-\alpha)n^r) \\ W_1^{nu} &= W_0^u \exp(z_1^u - (1-\alpha)n) \end{aligned}$$

and due to the wedge, wage of migrants is

$$W_1^m = (1-\tau)W_1^{nu}$$

In equilibrium, rural households are indifferent between staying and moving to cities. As a result, wages are equalized[10]

$$W_1^r = W_1^m$$

which implies that

$$n \approx \frac{\log(1-\tau) + \log\left(\frac{W_0^u}{W_0^r}\right) + (z_1^u - z_1^r)}{(1-\alpha)(1-\frac{L_0^u}{L_0^r})}$$

[9]Note that the labor force growth rate n_t^r in rural areas is related to urban labor force growth by

$$L_{t-1}^r \exp(n_t^r) + L_{t-1}^u \exp(n_t) = 1$$

Hence,

$$n_t^r = \log\left(\frac{1 - L_{t-1}^u \exp(n_t)}{L_{t-1}^r}\right) \approx -\frac{L_{t-1}^u n_t}{L_{t-1}^r}$$

[10]This is not true in the dynamic model discussed later, as forward-looking households are not just comparing wages between rural and urban areas in the same period, but their decision is based on the comparison of the expected discounted utility upon stay and migration.

Note that urban labor force growth depends on the initial wage gap between migrants and rural workers, the initial composition of the labor market, productivity difference and the government's policy. It is clear that the government is able to choose the desired level of n^* through the choice of τ.

4.2 Implications of the Dynamic Model

To make things clear, we first characterize the equilibrium path of urbanization absent government intervention. Next, we calculate the desired urbanization path of the government. We show that the two paths are quite different, making it desirable for the government to introduce a wedge on migrants' wages. Finally, we solve the general equilibrium problem and show that the dynamic model generates the path of urbanization we observed in the data. Our parameter choices are in Table 1

Parameters	z^u	z_0^r	ϕ	$\mho$	$\bar{n}$	α	β	γ	σ	θ	R
	0.076	0.038	0.03	0.05	2.68	0.3	0.99	2	1.5	0.5	1.08

Table 1: Parameter Choice of the Model

Path in the Absence of the Government

In light of uninsurable idiosyncratic risk, there is no analytical solution to native urban households' problem. We therefore resort to numerical solutions. Suppose the expected path urban population growth rates is $\{n_t, n_{t+1}, n_{t+2}, \cdots\}$, then the path of wage growth rates for native urban households is $\{w_t^{nu}, w_{t+1}^{nu}, w_{t+2}^{nu}, \cdots\}$ where

$$w_{t+i}^{nu} = z_{t+i}^u - (1-\alpha)n_{t+i}$$

Figure 3 shows that the consumption function of native urban households is concave in wealth in a stationary equilibrium where $n_{t+i} = 0$, a standard result in the consumption literature. Carroll (2011) proves that there exists a target level of wealth under mild assumptions. The consumption function in the transition periods toward the stationary equilibrium have similar qualitative feature.

Given the expected path of urban population growth rates, the path of wage growth rates for rural households is $\{w_t^r, w_{t+1}^r, w_{t+2}^r, \cdots\}$, where

$$\begin{aligned} w_{t+i}^r &= z_{t+i}^r - (1-\alpha)n_{t+i}^r \\ &= \left[1-(1-\phi)^n\right] z^u + (1-\phi)^n z_t^r - (1-\alpha)n_{t+i}^r \end{aligned}$$

The second equality stems from equation (1) by backward substitution. In a stationary equilibrium, $n^r_{t+i} = 0$ and $w^r_{t+i} = z^u$, that is, there is no labor movement from rural to urban areas; rural productivity growth is the same as urban productivity growth after catching up.

The optimization problem faced by migrants is exactly the same as that of native urban households in the absence of government intervention. Thus, when they decide to move from rural to urban areas, they transition from hand-to-mouth households to savers, saving toward their target level of wealth. As will be clear later, this effect on the household saving rate would be phenomenal if migrants account for a large share of the economy.

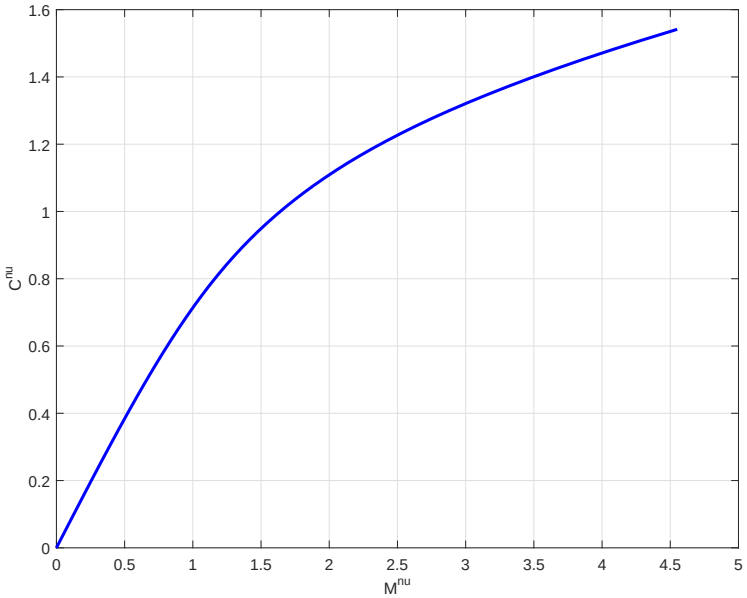

Figure 3: Consumption Function of Native Urban Households

Figure 4 shows that the path of urbanization without government intervention has two features. First, the growth rate of the urban share of labor force is remarkably high at the beginning, close to 15% within the first five years. This is mainly because the initial wage gap far outweighs the unemployment risk in affecting rural households' decision about migration. But the growth rate quickly dampens, as massive labor flow put downward pressure on the wage growth in urban areas. Second, the pattern of the urban share of labor force is concave.

Path Desired by the Government

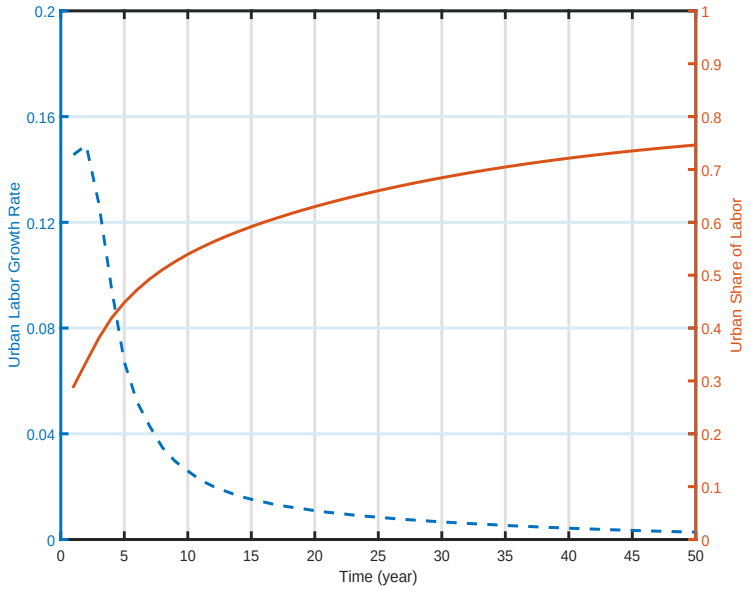

Figure 4: Simulated Path of Urban Labor Force Growth
without Government Intervention

Notice that we have, implicitly, made a simplifying assumption that there is no aggregate uncertainty. This assumption makes the government desired path tractable. Taking the first order condition with respect to n_{t+i} and let λ be the Lagrange multiplier of the population growth constraint and λ_i be that of the non-negativity constraint in equation (3), we have

$$\beta^i \frac{\partial u^G}{\partial n_{t+i}} = \lambda \exp\left\{\sum_{i=0}^{\infty} n_{t+i}\right\} - \lambda_i \tag{4}$$

Then the optimal path of $\{n^*_{t+i}\}_{i=0}^{\infty}$ is the solution to the following sysmtem of equations:

$$\exp\left\{\sum_{i=0}^{\infty} n_{t+i}\right\} = 1 + \bar{n}$$

$$\alpha(z^u + \alpha n_{t+i})^{-\gamma} - \theta(1-\alpha)(z^u - (1-\alpha)n_{t+i})^{-\sigma} - \frac{\lambda \exp\left\{\sum_{i=0}^{\infty} n_{t+i}\right\} - \lambda_i}{\beta^i} = 0 \qquad \forall i$$

While the nonnegativity constraint is not binding, $\lambda_i = 0$, and n^*_{t+i} is the solution to

$$\frac{\partial u^G}{\partial n_{t+i}} = \frac{\lambda(1+\bar{n})}{\beta^i}$$

Thus n^*_{t+i} is a function of $\frac{\lambda}{\beta^i}$, i.e., $n^*_{t+i} = g(\frac{\lambda}{\beta^i})$ where $g(\cdot)$ is a decreasing function. Note that as i increases, $\frac{\lambda}{\beta^i}$ would increase, resulting in an ever decreasing n^*_{t+i}. At some point i, n^*_{t+i} would reach the non-negativity constraint, in which case λ_i varies accordingly such that equation (4) holds. To sum up, the desired path of urban population growth in the eyes of the government would be one that decreases over time and vanishes at zero at some point. Of course, the desired path depends on the government's preference and the urbanization target $\bar{n}$.

Figure 5 shows one possible desired path of urban population growth from the perspective of the government. We set the initial ratio of urban over total labor force to 25%, roughly the number that China had in 1980, and target the eventual ratio at 75% ($\bar{n} = 2$). We then simulate the path of urban labor force growth over the next 50 years under the parameter choice $\{\alpha, \beta, \gamma, \sigma, \theta\} = \{0.3, 0.99, 2, 1.5, 0.1\}$. The first 30 years displays remarkably qualitatively similar feature as in the data (See Figure 1). The urban share of labor force rises at a low speed over a span of roughly 50 years until it reaches the government target.

How does the government achieve its desired path of urbanization? Figure 6 shows the implied wedge on migrants' wage under the government's optimal urbanization path. A big wedge at the beginning effectively slows down labor movement. As rural productivity catches up with urban productivity, the gap between expected growth rates in urban and rural areas shrinks. As a result, migration to urban areas becomes less attractive and smaller wedges are needed to achieve the desired urban labor force growth over time.

A Comparison

We are now ready to compare the paths of two economies with and without government intervention. Figure 7 displays such results.

The top two graphs show the stark contrast between the pace of urbanization with and without government intervention. The growth rate of urban share of labor is much more smooth under government intervention, and its contribution to the share of urban labor force in the economy is spread out over time. The smooth labor growth in urban areas is essential to sustained urban wage growth and production growth, as is seen in the bottom two graphs.

Without government intervention, massive flow of labor from rural to urban areas drives down wage growth in urban areas. In fact, as the blue line in the bottom left graph shows, the flow of labor would have been so large that it makes the wage growth

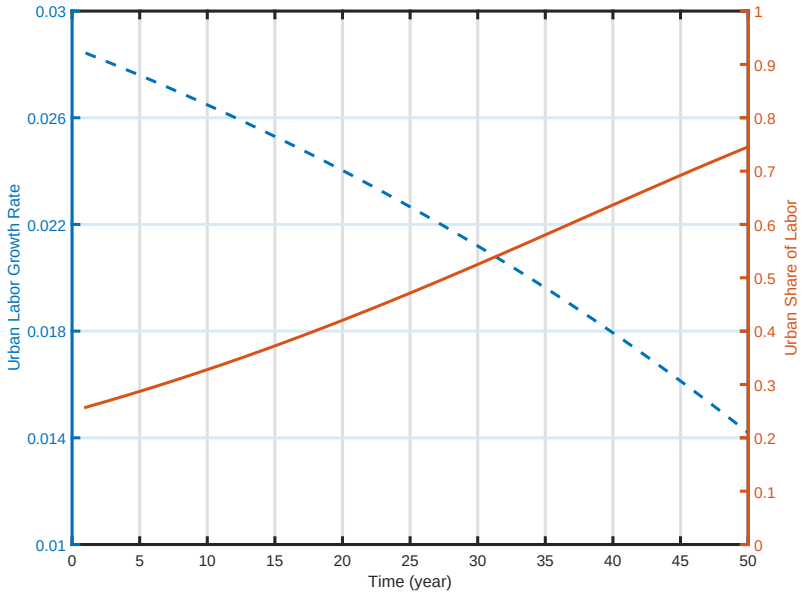

Figure 5: Simulated Path of Urban Labor Force Growth Desired by the Government

rate for native urban households negative in the first few years. From the standpoint of a government whose political support mainly comes from relatively well organized and wealthy urban households, such a devastating effect of the economic reform would be intolerable. Thus it would be optimal for the government not to relax its household registration system at the beginning. However, labor flow to urban areas does contribute to production growth. To maintain a high level of production growth, the government has to gradually remove the frictions in the labor market, notably relaxing the enforcement of the household registration system.

4.3 The Saving Puzzle

Figure 8 shows the main result of the paper. The blue line is the path of the saving rate of the economy without frictions in the labor market while the red line is with frictions induced by the government. A comparison of the two lines reveals that the continuous flow of labor from rural to urban areas under government intervention produces a dramatic rise in saving rate. Such a big increase would not have been possible without frictions in the labor market.

The key of this mechanism is the interaction between growth differential and controlled urbanization. Consider a migrant who moves to a city and begins to

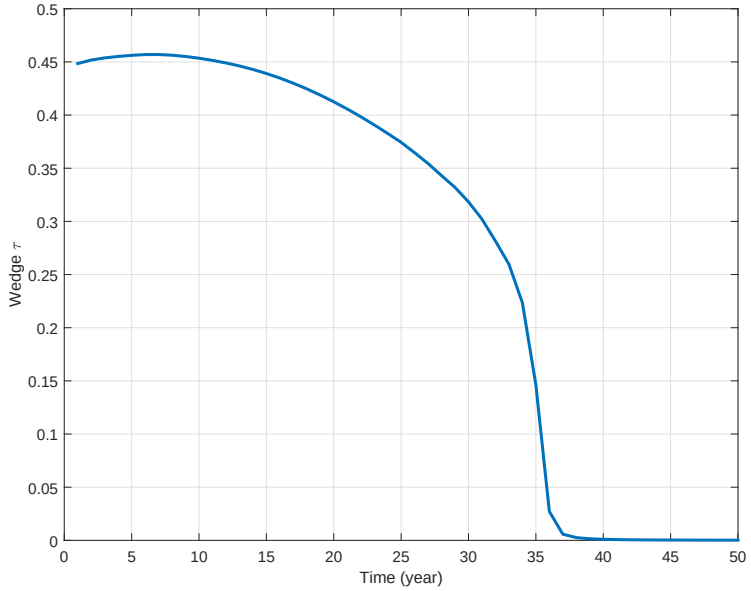

Figure 6: Wedges under the Government Optimal Path

save[11]. While on the way to his wealth target, the migrant's saving in each year is contributing to the overall saving rate. Collectively, labor flow drives up the saving rate. Without frictions in the labor market, labor market would balance quickly between rural and urban areas, wage gap would shrink, and there is only a temporary rise in the saving rate of the economy. On the other hand, if there are large frictions in the labor market, labor flow is subdued at the beginning and wage gap would widen for a long period of time before it shrinks. A migrant who moves later contributes more to the saving rate than a migrant who moves earlier, because at the time he moves, urban wage is higher and frictions are lower, and thus his weight in the economy is higher. Frictions in the labor market effectively causes those who would have moved early to move late, not only changing the timing of their contribution to the saving rate of the economy but altering its magnitude. In other words, controlled urbanization brings the persistent rise in saving rate, and the rise is of bigger magnitude than it would otherwise be without frictions in the labor market.

There is one caveat here. Our model abstracts from saving for life cycle reasons. In the stationary equilibrium, rural households have a saving rate of zero as they are

[11]In the model, rural households who decide to move to cities start to save a period before they move, as they need to build up a wealth buffer to insure against unemployment risk in urban areas.

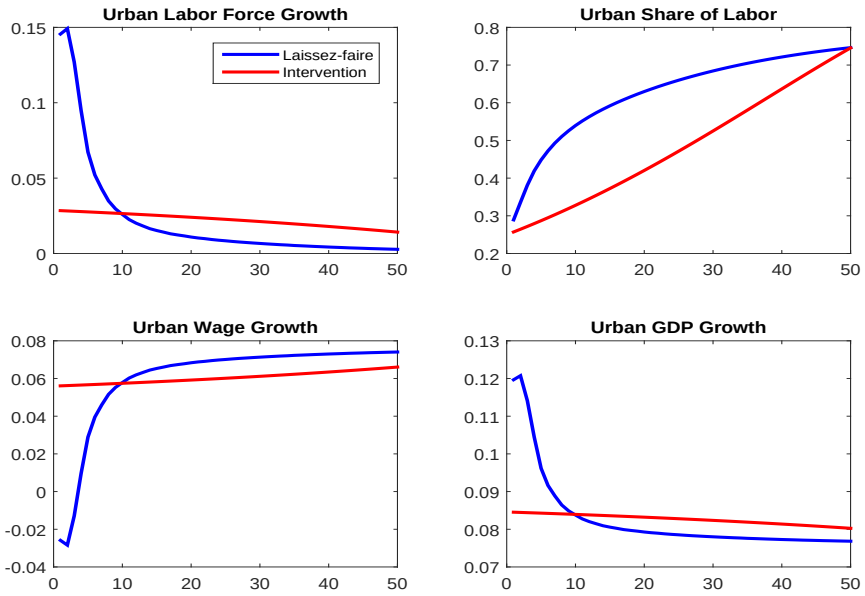

Figure 7: A Comparison of Urban Growth Path
with and without Government Intervention

hand-to-mouth; native urban households' saving rate is also close to zero as they are at their wealth target. Thus the rise in saving rate can be attributed almost entirely to migrants or new households in urban areas. While there are numerous reasons why native urban households could have high saving rate by themselves, we leave it for future research how migrants affect household saving for life cycle reasons.

5 International Evidence and Policy Implications

In appendix C, we provide some international evidence that the rise in saving rate tends to happen at the same time with the rise in urban population. While we do not have data on household saving rate in these countries, the pattern is still revealing. Japan provides the earliest and the most complete picture of the relation between saving rate and the path of urbanization. After World War II, the rapid rise in urban population was coupled with the rise in saving rate. When urbanization slowed down, saving rate was on the decline. Interestingly, Japan's path of urbanization is concave, indicating that it might perhaps has less frictions in the labor market at the beginning than China in the 1980s. Korea has a similar patten, and India's urban population as well as its saving rate are still on their way up. Frictions in the labor market,

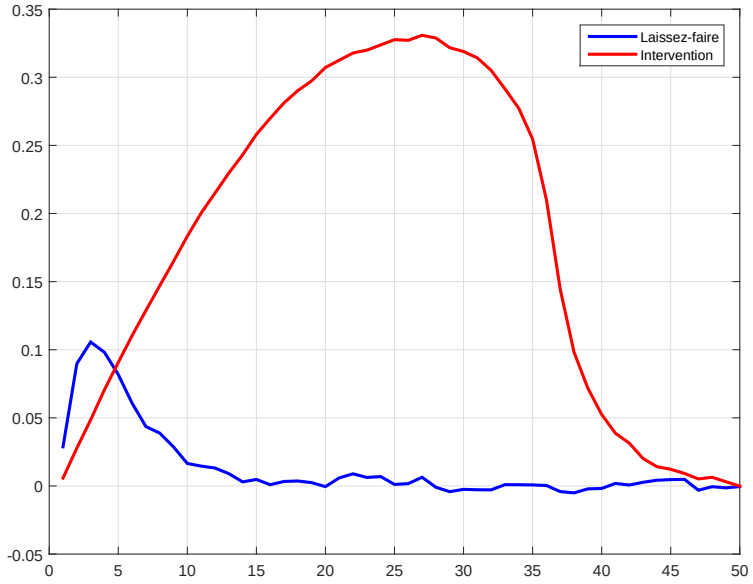

Figure 8: Saving Rate of the Economy
with and without Government Intervention

notably the rural-urban divide, all existed in these countries to some extent. The details of their labor markets and the effects on saving and urbanization would be interesting areas of research that we pursue in the future.

The policy implications of our analysis is twofold. First, our model shows that frictions in the labor market may well affect the path of urbanization and hence saving rate. Governments' policies that increase or decrease the frictions are therefore quite relevant for production growth, wage growth and saving rate of the economy. This is in contrast to conventional arguments that financial underdevelopment and capital controls are the main cause of China's high saving rate. Second, China's current labor market reform, in particular the relaxation of its household registration system is likely to reduce frictions in the labor market and facilitate further urbanization. As our model implies, before the wedge is fully removed, the rise in saving rate will still continue along with urbanization.

6 Conclusion

In this paper, we develop a general equilibrium model that accounts for the controlled urbanization and rising wage gap in China's labor market. Frictions in the

labor market is key to understanding these two trends. We show that a government focusing on urban development, in light of the trade-off between production growth and wage growth, has an incentive to enact policies that generate these frictions. Using such a model, we show that the combination of rural-urban growth differential and controlled urbanization is able to generate a high and rising saving rate qualitatively similar to what we observed in the data. There is some international evidence that urbanization and the rise in saving rate is correlated. Frictions in the labor market might be underlying the trend in saving rate, suggesting that one should look at the details of labor market when considering questions such as global imbalances.

The analysis in this paper can be extended in several directions. A natural extension is to add life cycle considerations of households in the model to fully account for the level of saving rate. Another extension is to introduce capital in the model so that we have scope for discussion of China's huge external balance. One could also add rural and urban relative prices to the model for the purpose of explaining China's exchange rate pattern. The suppressed labor flow from rural to urban areas is likely to have maintained a level of nontradable goods production that would otherwise be lower, which effectively drove down the relative price of nontradable goods and hence caused a seemingly undervalued currency. It would be interesting to pursue these research directions in the future.

References

Attanasio, O. P., L. Picci, and A. E. Scorcu (2000): "Saving, growth, and investment: a macroeconomic analysis using a panel of countries," *Review of Economics and Statistics*, 82(2), 182–211. Cited on page 6.

Carroll, C. D. (2011): "Theoretical foundations of buffer stock saving," Discussion paper, CFS Working Paper. Cited on page 15.

Carroll, C. D., J. Overland, and D. N. Weil (2000): "Saving and growth with habit formation," *American Economic Review*, pp. 341–355. Cited on page 6.

Carroll, C. D., and D. N. Weil (1994): "Saving and growth: a reinterpretation," in *Carnegie-Rochester Conference Series on Public Policy*, vol. 40, pp. 133–192. Elsevier. Cited on page 6.

Chamon, M. D., and E. S. Prasad (2010): "Why are saving rates of urban households in China rising?," *American Economic Journal: Macroeconomics*, pp. 93–130. Cited on page 6.

Coeurdacier, N., S. Guibaud, and K. Jin (2015): "Credit constraints and growth in a global economy," *American Economic Review*. Cited on page 6.

Deaton, A. S., and C. Paxson (1994): "Saving, growth, and aging in Taiwan," in *Studies in the Economics of Aging*, pp. 331–362. University of Chicago Press. Cited on page 6.

Gourinchas, P.-O., and O. Jeanne (2013): "Capital flows to developing countries: The allocation puzzle," *The Review of Economic Studies*, p. rdt004. Cited on page 6.

Hausmann, R., L. Pritchett, and D. Rodrik (2005): "Growth accelerations," *Journal of Economic Growth*, 10(4), 303–329. Cited on page 6.

Horioka, C. Y., and J. Wan (2007): "The determinants of household saving in China: a dynamic panel analysis of provincial data," *Journal of Money, Credit and Banking*, 39(8), 2077–2096. Cited on page 6.

Houthakker, H. S. (1961): "An international comparison of personal saving," *Bulletin of the International Statistical Institute*, 38, 55–70. Cited on page 6.

Lipton, M. (1977): "Why poor people stay poor: urban bias in world development.," . Cited on pages 7 and 9.

——— (1984): "Urban bias revisited," *The Journal of Development Studies*, 20(3), 139–166. Cited on page 7.

Loayza, N., K. Schmidt-Hebbel, and L. Servén (2000): "What drives private saving across the world?," *Review of Economics and Statistics*, 82(2), 165–181. Cited on page 6.

Modigliani, F. (1970): "The life cycle hypothesis of saving and intercountry differences in the saving ratio," *Induction, growth and trade*, pp. 197–225. Cited on page 6.

Oi, J. C. (1993): "Reform and urban bias in China," *The Journal of Development Studies*, 29(4), 129–148. Cited on pages 7 and 9.

Wang, F.-L. (2010): "Renovating the great flood gate: The reform of China?s hukou system," . Cited on page 3.

Wei, S.-J., and X. Zhang (2009): "The competitive saving motive: Evidence from rising sex ratios and savings rates in China," Discussion paper, National Bureau of Economic Research. Cited on page 6.

Yang, D. T. (1999): "Urban-biased policies and rising income inequality in China," *American Economic Review*, pp. 306–310. Cited on page 7.

A Details of Rural Households' Problem

In this section, we describe the details and the solution to rural households' problem. We normalize state variables by income. In particular, we normalize rural households' consumption and market resources by rural income and migrants' consumption and market resources by urban income. Using lowercase letters to denote normalized variables, we have the value function of rural households conditional on staying at rural place

$$v_t^{rr}(m_t^r) = u(c_t^{rr}) + \beta \left(e^{w_{t+1}^r}\right)^{1-\rho} E_t \left(v_{t+1}^r(m_{t+1}^r)\right)$$

subject to the budget constraint

$$\begin{aligned} a_t^{rr} &= m_t^r - c_t^{rr} \\ m_{t+1}^r &= \frac{R}{\exp(w_{t+1}^r)} a_t^{rr} + 1 \end{aligned}$$

the value function of rural households conditional on migrating to urban areas

$$v_t^{rm}(m_t^r) = u(c_t^{rm}) + \beta \left(\frac{W_{t+1}^{nu}}{W_{t+1}^r} e^{w_{t+1}^r}\right)^{1-\rho} E_t \left(v_{t+1}^m(m_{t+1}^m)\right)$$

subject to

$$\begin{aligned} a_t^{rm} &= m_t^r - c_t^{rm} \\ m_{t+1}^m &= \frac{R}{\exp(w_{t+1}^r)} \frac{W_{t+1}^r}{W_{t+1}^{nu}} a_t^{rm} + \frac{1-\tau_t}{1-\mho} \qquad \text{migrate, employed} \\ m_{t+1}^m &= \frac{R}{\exp(w_{t+1}^r)} \frac{W_{t+1}^r}{W_{t+1}^{nu}} a_t^{rm} \qquad \text{migrate, unemployed} \end{aligned}$$

and the value function of rural households

$$v_t^r(m_t^r) = \max\left\{v_t^{rr}(m_t^r), v_t^{rm}(m_t^r)\right\}$$

The migrants' value function is

$$v_t^m(m_t^m) = u(c_t^m) + \beta \left(e^{w_{t+1}^m}\right)^{1-\rho} E_t \left(v_{t+1}^m(m_{t+1}^m)\right)$$

subject to

$$\begin{aligned} a_t^m &= m_t^m - c_t^m \\ m_{t+1}^m &= \frac{R}{\exp(w_{t+1}^m)} a_t^m + \frac{1-\tau_t}{1-\mho} \qquad \text{employed} \\ m_{t+1}^m &= \frac{R}{\exp(w_{t+1}^m)} a_t^m \qquad \text{unemployed} \end{aligned}$$

Native urban households' value function is the same as the migrants' one except that $\tau_t = 0$ for them.

Rural households are hand-to-mouth if they continue to live in rural areas, thus

$$a_t^{rr} = 0$$

and

$$m_{t+1}^{rr} = 1$$

In each period, rural households are indifferent to staying and migrating in equilibrium. The equilibrium condition is

$$v_t^{rr}(1) = v_t^{rm}(1)$$

Let T be the last period of labor movement, beyond which it would be optimal for all rural households to stay. Denote the urban population growth rates in the T periods $\{n_t\}_{t=1}^T$. In the Tth period,

$$\begin{aligned} v_T^{rr}(1) &= u(1) + \beta (e^{w_{T+1}^r})^{1-\rho} v_{T+1}^{rr}(1) \\ v_T^{rm}(1) &= \max_{c_T^{rm}} u(c_T^{rm}) + \beta \left(\frac{W_{T+1}^{nu}}{W_{T+1}^r} e^{w_{T+1}^r}\right)^{1-\rho} E_T(v_T^m(m_{T+1}^m)) \end{aligned}$$

Note that

$$\begin{aligned} \frac{W_{T+1}^{nu}}{W_{T+1}^r} e^{w_{T+1}^r} &= \frac{W_T^{nu}}{W_T^r} e^{w_{T+1}^{nu}} \\ &= \frac{W_0^{nu}}{W_0^r} \exp\left(\sum_{t=1}^{T} (w_t^{nu} - w_t^r)\right) \exp(w_{T+1}^{nu}) \\ &= \frac{W_0^{nu}}{W_0^r} \exp\left(\sum_{t=1}^{T} (z_t^u - z_t^r) - (1-\alpha) \sum_{t=1}^{T} (n_t - n_t^r)\right) \exp(w_{T+1}^{nu}) \end{aligned}$$

depends on the path of urbanization. Our solution method is as follows. First, we make a guess about the path of urbanization $\{n_t\}_{t=1}^T$. Under that path, we calculate the value of staying in rural areas for rural households, $\{v_t^{rr}(1)\}_{t=1}^T$, and the value of migrating to urban areas, $\{v_t^{rm}(1)\}_{t=1}^T$. In equilibrium, rural households are indifferent between staying and migrating in each period. Thus we search for $\{n_t\}_{t=1}^T$ such that the two conditional values are equal in every period.

B Household Saving Rate in China

The distinction between rural and urban households is important in our model. Table 2 shows that the increase in China's household saving rate in the past two decades is mainly due to the increase of household savings in urban areas. In the past two decades, rural household saving rate has been hovering around 25% whereas urban household saving rate has risen up steadily to 32% in 2012. During the same period, the urban share of population almost doubled. As a result, urban saving rate had an increasing contribution to the total household saving rate in China during this period.

C International Evidence: Figures

Year	Total	Urban	Rural
1995	0.171	0.174	0.169
1996	0.186	0.190	0.184
1997	0.215	0.189	0.226
1998	0.245	0.202	0.264
1999	0.263	0.211	0.286
2000	0.241	0.204	0.259
2001	0.252	0.226	0.264
2002	0.245	0.217	0.259
2003	0.249	0.231	0.259
2004	0.249	0.238	0.256
2005	0.226	0.243	0.215
2006	0.231	0.260	0.211
2007	0.243	0.275	0.221
2008	0.255	0.288	0.231
2009	0.252	0.286	0.225
2010	0.276	0.295	0.260
2011	0.277	0.305	0.252
2012	0.286	0.321	0.254

Table 2: Urban and Rural Household Saving Rate in China
Source: Authors' calculation based on data from the National Bureau of Statistics of China.

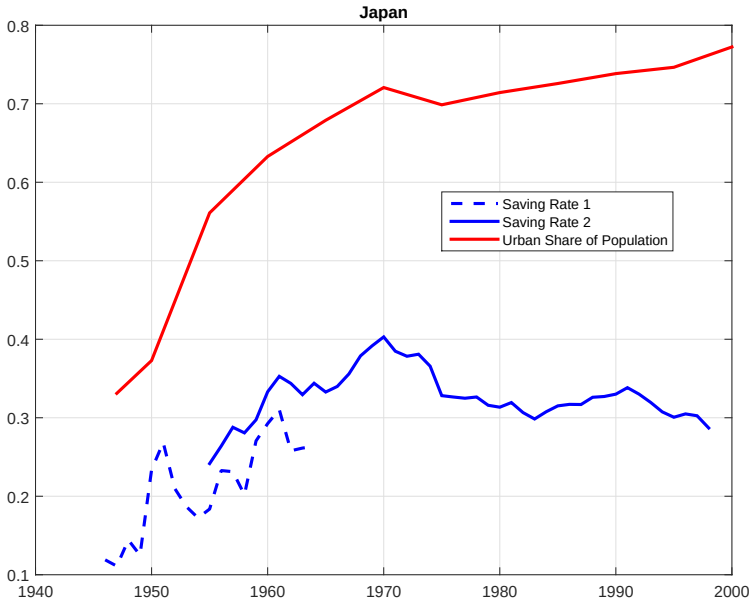

Figure 9: Saving Rate of the Economy: Japan
Saving rate 1 uses data from Cabinet Office of the Government of Japan. Saving rate 2 uses data from Statistics Japan.

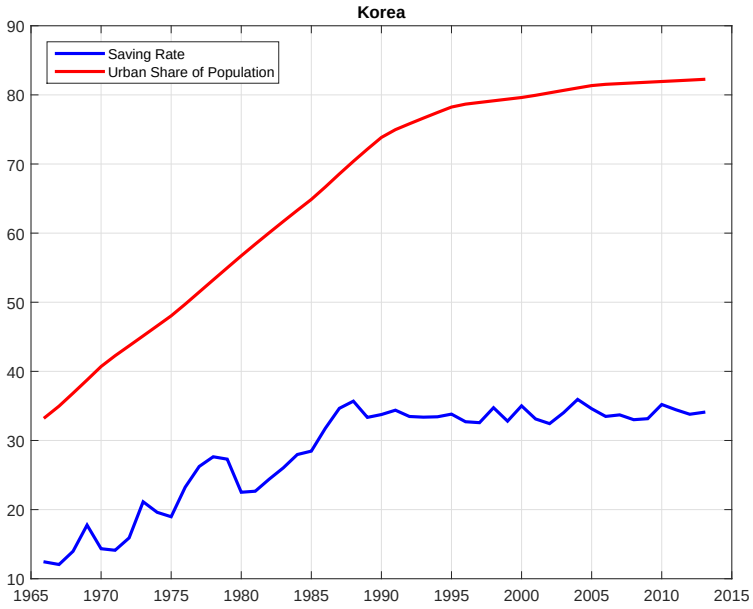

Figure 10: Saving Rate of the Economy: Korea
Source: World Bank

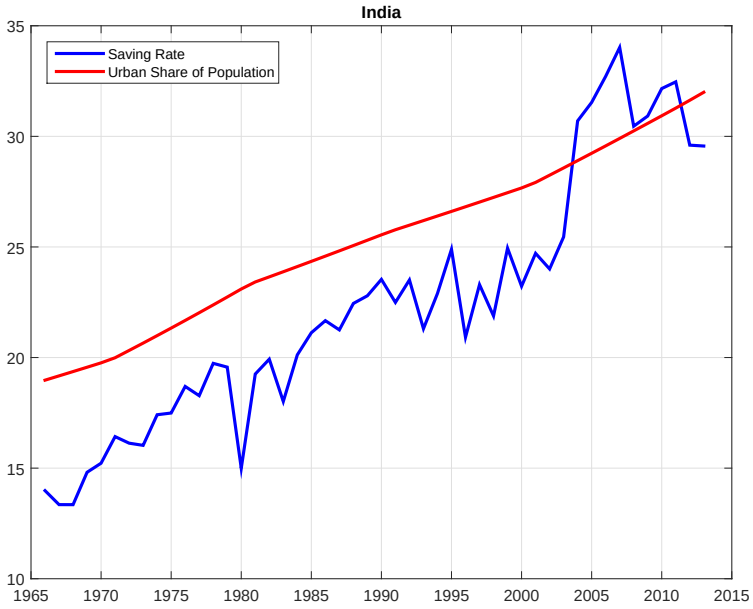

Figure 11: Saving Rate of the Economy: India
Source: World Bank