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Why Is China's Saving Rate So High? A Comparative Study of Cross-Country Panel Data

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Abstract

This paper uses a large cross-country panel dataset to estimate models of national saving rates and addresses two related issues. First, to what extent can China's saving rate be explained by models of saving rates? Second, what are the factors responsible for China's extraordinarily high saving rates?

We find that our benchmark models explain about 72 to 76 percent of China's national saving rate during 1990-2007, depending on whether China is included in the dataset. China's national saving rate during that period is higher than the predictions of those models by about 10 to 12 percentage points on average. The predominant driver of the explained portion of China's high saving rates is China's relatively low *old dependency* (the ratio of the population ages 65 and older relative to the population ages 15 to 64). China's relatively *low urbanization, strong economic growth,* and *weak social safety net* are also important factors. In comparison, the *high degree of currency undervaluation* is a smaller contributor to China's high saving.

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Juann H. Hung and Rong Qian

1. Introduction

China's extraordinarily high national saving rate has been at the center of much concern and analysis in recent years. In March 2005, Chairman Ben Bernanke of the Board of Governors of the Federal Reserve System proposed that the saving glut (i.e., more saving than needed for domestic investment) in parts of the world – notably China and some oil-exporting countries – has contributed to the large US current account deficit and global imbalance. Since then, concerns about the mounting global imbalance – and more recently, the conviction in some quarters that the large saving glut was a main culprit of the 2008-2009 financial meltdown and the accompanying great recession – have drawn even more attention to China's high saving rate.

China's saving rate is higher than the average of other high-saving countries, such as its East Asian neighbors and OPEC countries (Figure 1). Its national saving rate was 54.4 percent of gross national income in 2007, more than twice of the average saving rate of OECD countries (Table 1). Moreover, high saving, not weak investment is responsible for China's large excess saving. China's investment/GDP ratio averaged 41 percent from 2000 through 2008, more than double that in the United States (20 percent) over the same period. However, China's national saving rate was even higher: It averaged 48 percent from 2000 to 2008, compared to 15 percent in the United States.

Many hypotheses have been advanced to make sense of China's extraordinarily high saving rate, but it remains unclear to what extent each of those hypothetical factors contributed to making China's saving rate higher than most other countries. In particular, whether China's

exchange rate policy has played a significant role in driving its high saving rate has been subject to much debate. Many analysts have argued that China's policy of undervaluing its currency is a major reason for its high saving rate.[1] However, other economists have argued that a revaluation of the yuan would not necessarily eliminate China's surplus saving because that saving is mainly rooted in complicated structural factors.[2]

Indeed, most analysts would agree that saving is driven by various motives, opportunities, incentives, and constraints. As reported in section 2 of this paper, an extensive literature has suggested that there are several structural and economic factors that could have played a part in its high saving for the past two decades: a weak social safety net, an underdeveloped consumer credit market, a low degree of urbanization, a relatively young population, and rapid economic growth.[3] It may be important to take those factors into account in any attempt to assess the effect of exchange rate policy – or other types of policies – on China's saving.

Against this backdrop, this paper investigates two related empirical questions. First, to what extent does China's saving rate exceed the projections of credible models of saving rates? That is, if we include most traditional and newly formed theoretical determinants (or their proxies/instruments) of saving rates in a model, how much of China's saving rate is left unexplained? Second, what are the factors primarily responsible for China's extraordinarily high

[1] For example, see Wolf (2010) and papers cited in that article.

[2] For example, Spence (2010) argues that China's exchange rate is but one facet in the complexity of its transition toward a middle-income economy, and that revaluing the yuan is unlikely to get rid of China's surplus saving because China's high savings are embedded in its overall economic structure – such as the government's extensive control of income (directly and through ownership of the state-owned enterprises. Similarly, Rodrik (2009) maintains that China's exchange rate policy is designed mainly as a second-best solution to reduce the distortions and inefficiencies in its economic and financial infrastructure that tend to retard its economic growth. Thus, pressuring China to revalue its currency may do more harm than good.

[3] For more detailed discussion of structural and economic factors, see Section 3.1.

saving rate? That is, how much of China's high saving rate is attributable to structural factors, as opposed to variables that can be significantly influenced by macroeconomic policies in the short run – such as the exchange rate, the government budget balance, the real interest rate, and inflation?

Our empirical method consists of two stages. In stage one, we estimate models of national saving, using a large panel data set of about 70 countries over the time span from 1980 through 2007. In this stage, we are mainly interested in identifying plausible models of national saving. We consider several explanatory variables, including variables that are traditionally considered as macroeconomic policy instruments (such as the budget balance, interest rates, inflation, and the exchange rate) and those that are not (such as real per capital income, income growth, demography, social safety net, financial development, etc.). Following Loayza, Schmidt-Hebbel, and Serven (2000), we use a dynamic two-step system generalized method of moments (GMM) method of estimation. That method has been used by many researchers to address many issues in the estimation of equations that include lagged dependent variables as well as explanatory variables that are potentially endogenous.[4] On the whole, our coefficient estimates on the traditional list of variables are not too far off from those of Loayza et al. (2000).

In the second stage, we use our estimated models to make in-sample predictions of national saving rates for individual countries and to measure the extent to which a country's national saving deviates from models' predictions for that country. Overall, our estimated models do a very decent job of explaining national saving rates of the 70 countries in the sample. Thus, they provide a useful benchmark to assess the extent to which China's saving behavior

[4] The GMM estimation was proposed by Chamberlain (1984); Holtz-Eakin, Newey, and Rosen (1988); Arellano and Bond (1991); and Arellano and Bover (1995). It has been applied to cross-country studies by, among others, Easterly, Loayza, and Montiel (1997) and Rodrik (2008).

differs from that of the average country and the relative contributions of different explanatory variables to China's high saving rate.

We find that China's lower *old dependency* (the population ages 65 and older relative to the population ages 15 to 64) than that of other countries is the most important factor responsible for China's higher saving. To a lesser extent, China's *stronger economic growth*, *weaker social safety net*, and *lower urbanization* are also important factors responsible for China's higher saving rates. China's *currency undervaluation* turns out to be a relatively modest contributor to China's high saving.[5] Other variables either contribute little or have a negative contribution to China's saving rate. Overall, China's national saving rate is higher than the predictions of our benchmark model by about 10-12 percentage points, depending on whether China is included in the dataset.

By including *the East Asia dummy* in some of our models, we find that factors proxied by that dummy variable also contribute to China's higher saving rate, and that most of those factors are those underlying the high-saving, high-growth strategy of East Asian economies. However, it is beyond the scope of this paper to disentangle the many complex factors that are likely to be proxied by that dummy.

The remainder of the paper is organized as follows. Section 2 presents existing theories of China's high saving rate. Section 3 reports the choice of explanatory variables, empirical strategy, and the regression results. Section 4 chooses the benchmark model and compares

[5] The total effect of China's *currency undervaluation* on its saving rate may be higher, since it is likely to have an indirect effect by spurring economic growth (which in turn has a positive effect on the saving rate); however, available estimates suggest that the indirect effect is quite small as well. The estimates in Rodrik (2008) imply that a 10 percent real depreciation of the yuan will increase China's growth by 0.86 percentage points. This paper's estimate implies that a one-percentage-point increase in China's growth will increase China's saving rate by about 0.2 percentage points, and one percent increase in China's real per capita GDP will increase its saving rate by about 0.03 percentage points. On average, the yuan's undervaluation increased 3 percent per year between 2001 and 2007. Both estimates combined imply that the yuan's undervaluation should increase China's national saving rate by about 0.06 percentage points per year during that time.

China's national saving rate to the long-term forecast of the benchmark model. Section 5 uses our estimated models to account for the gap between saving rates of China and the United States. Section 6 discusses the relationship between China's high saving and the East Asia model of economic growth. Section 7 concludes.

2. Related Literature

This paper is related to three strands of economic literature. One strand is concerned with the causes and consequences of global imbalances – for example, Chinn and Prasad (2003), Eichengreen (2004), Dooley et al. (2003, 2004), Obstfeld and Rogoff (2005), Roubini and Setser (2005), Hung and Kim (2006), Congressional Budget Office (2004, 2005, 2007), and Caballero (2009). Nearly all those papers argue the large global imbalance is not sustainable, though some are more optimistic than others in how the imbalance will be resolved. Another set of papers attempts to explain why countries have vastly different saving rates – for example, Edwards (1996), Masson et al. (1998), Loayza et al (2000), and International Monetary Fund (2005). Those papers generally use a large multiple-country dataset to estimate the marginal effect of various structural and nonstructural determinants on national or private saving rates.

More directly related to this paper is the third set of papers, which focuses on addressing why China's national saving rate is much higher than the saving rate of most countries – for example, Modigliani and Cao (2004), Blanchard and Giavazzi (2006), Kuijs (2005, 2006), Aziz and Cui (2007), Chamon and Prasad (2010), Wei and Zhang (2009), and Wolf (2010). Their explanations can be roughly summarized as follows:

(1) The Chinese have a higher demand for saving in part because of their frayed social safety net and an underdeveloped financial sector (Chamon and Prasad, 2010; Blanchard and

Giavazzi, 2006; and Kuijs, 2006). The declining public provision of education, health, and housing services and the lack of pension programs (or, the breaking of "the iron rice bowl") creates a strong motive for the Chinese to save. An underdeveloped banking/financial sector adds to that precautionary demand for saving, because it is difficult for consumers to borrow from banks to tide them over hard times. China's small firms, which generally do not receive the preferential treatment that large state-owned enterprises do, also tend to retain earnings because they need them to finance their ventures and to provide a cushion for bad times.

(2) China's policies favor industry at the cost of jobs and consumer spending (Kuijs, 2006).[6] This policy bias has led to higher national saving in two ways. First, it has led household disposable income to decline relative to national income. Thus, even if the consumption share of disposable income stays constant, the consumption share of national income will decline, and the national saving rate increase, as the economy grows.[7] Second, those policies not only have helped to keep corporate profits high; they have also allowed or encouraged those profits to be retained in the companies (rather than distributed to shareholders), thereby adding to national saving.[8]

(3) China has a high rate of economic growth (Modigliani and Cao, 2004). According to the life-cycle hypothesis, people save when they are wage earners in order to finance their

[6] This point is particularly emphasized by Kuijs (2006). Several studies have found that the rapid growth in total factor productivity (TFP) is a main pillar of China's real GDP growth in the reform era, second only to capital formation. For example, Kuijs and Wang (2006) found that capital accumulation contributed over 50 percent, and TFP growth about 33 percent, to China's output growth between 1978 and 2004, with employment growth contributing the modest remainder. Bosworth and Collins (2007) also have similar findings.

[7] Partly as a result of China's pro-industry policy, the share of wages and other household income in GDP fell from 72 percent in 1992 to 55 percent in 2007. See Aziz and Cui (2007).

[8] See Kuijs (2006). An article in *the Economist* (October 1st, 2009) with the title "The hamster-wheel" also reports that China's state-owned enterprises now provide a modest pay-out to the government, but until 2008 they paid nothing at all. In 2008, almost 45 percent of listed companies in China did not pay a dividend.

negative saving after they retire. When the economy is growing, workers' saving will increase relative to retirees' dissaving, thereby raising aggregate saving. This channel may even be stronger for countries such as China where the social safety net is weak for retirees.

(4) China has an undervalued currency (Goldstein, 2007; Wolf, 2010).[9] An undervalued currency undercuts the abilities of Chinese consumers to purchase foreign goods and services while it improves the price competitiveness of its exports, thereby keeping China's saving rate high.

(5) China has a one-child policy (Wei and Zhang, 2009). The policy, intended to reduce "the number of mouths to be fed" until the country's capital stock is large enough to employ its large pool of excess labor, has increased the male/female ratio in China because of the tradition of favoring sons over daughters. This in turn has generated a highly competitive marriage market, driving up China's saving rates as households with sons are forced to raise their savings to increase the chance of winning a bride. This theory was proposed mainly to explain the observation that China's saving rate started to shoot up around 2002, just as the gender ratio for the marriage-age cohort began to be seriously out of balance.

This third set of papers suggests that part of the root cause of China's high saving are the poverty and underdevelopment of the country and its haste to grow and catch up. Indeed, China was a destitute country when its pro-market economic reform started in late 1978. Despite its

[9] Whether a country's currency is undervalued depends on the concept used to construct the yardstick (i.e., the fundamental equilibrium exchange rate) used to measure its undervaluation. Those yardsticks include various variations of the Purchasing Power Parity condition, the intertemporal balance of payment equilibrium, and others. Cheung et al. (2007) provides a brief review of some of those concepts and discusses the difficulty in measuring the equilibrium exchange rate and the uncertainty surrounding those measurements. Most analysts have concluded that the Chinese currency has been significantly undervalued.

rapid economic growth over the past three decades, China's real per capital GDP in 2007 was still lower than one half of an average upper-middle income country's level and no higher than an average lower-middle country's level (Table 1 and Figure 2).[10]

However, each of those papers tends to focus on a small set of factors alone, and thus is susceptible to the problems caused by omitted variables. It's difficult to know *a priori* whether each of those factors would still play a significant role in China's high saving when most of them are included in the same model, along with other traditionally important variables such as demography and urbanization. This paper supplements this third strand of literature – by estimating a model of national saving rates that includes variables from a broad range of theories, and by using that estimated model to assess the relative contribution of each included variable on China's saving rate.

3. Estimating Models of National Saving Rates

We estimate models of national saving, not private saving. This is largely because we are primarily interested in shedding light on whether the global imbalance can be largely accounted for by the vast differences in pre-existing economic and institutional conditions among countries. It is also partly because data on household saving are much more limited than data on national saving.

3.1 Explanatory Variables

Following Loayza et al. (2000), our specifications are reduced-form linear equations, drawing upon a broad range of theories for explanatory variables. We include several

[10] For example, China's real GDP per capita was only 38% of that in Mexico (an upper-middle income country) in 2007.

"traditional" variables – those that have been included in previous studies – as well as four "new" variables: *an income-adjusted growth rate, the amount of government social spending, the degree of currency undervaluation,* and *an East Asia dummy*.[11]

Real income per capita. In a standard Keynesian model, saving is a positive function of income because people's ability to save begins to rise after their income exceeds subsistence level of consumption.[12] Lower-income people tend to consume a larger share of their income than higher-income people. The national saving rate is expected to rise as per capita income rises within a country or between countries, because most wage earners in poor countries tend not to have much left to save for retirement after spending on necessities.

Growth of real income per capita. While standard growth models typically posit that an increase in the saving rate leads to higher economic growth, a growing body of empirical studies has concluded that the causality from growth to saving is much more robust than that from saving to growth.[13] Theoretical channels for growth-to-saving causality include the life-cycle hypothesis and the habit-formation hypothesis.[14] The life-cycle hypothesis posits that individuals maximize utility over their lifetime through optimal allocation of their time resources. Thus, people are dissavers when they are young (before they begin to work or when their income is too low to cover their expenses) and when they are old and retired; the working

[11] Some variables, such as measures of income inequality and degree of financial openness, are not included in our study because of the limited availability of good-quality data across countries over the sample period.

[12] This is easily seen if we derive the Keynesian saving equation from a typical Keynesian consumption equation, $C = C_0 + \beta Y$, where C is consumption, C_0 is the subsistence consumption, Y is income, and β is the propensity to consume. The corresponding saving equation would be $S = -C_0 + (1 - \beta)Y$, implying S/Y = $(1-\beta) - C_0/Y$. Thus, $\frac{d(S/Y)}{dY} > 0$: the saving/income ratio is a positive function of income.

[13] For example, see Bosworth (1993), Carroll and Weil (1994), Edwards (1996), Gavin et al. (1997), Loayza et al. (2000), Attanasio et al. (2000), and Sinha and Sinha (2008).

[14] See Modigliani (1970) and Modigliani and Cao (2004) for the life-cycle hypothesis, and Carroll et al (2000) for the habit-formation model.

population (those between the young and the old) are those who save. When the economy is growing, the income and saving of the working population will increase relative to the non-working population's income and dissaving, causing aggregate saving to rise. The habit-formation hypothesis posits that, when the economy is growing, people's habits tend to pull their consumption toward the level compatible with their past habits and away from the steady-state level compatible with the higher level of income. Thus, if an economy receives a shock that boosts its growth rate, its saving will rise during the transition to the new steady state. The more powerful are habits, the larger and longer-lived are these transitional effects.

Income-adjusted growth rate. Saving rate may also be a positive function of the growth rate of real GDP because poor countries have an added incentive to save: to reach the Golden-Rule steady state by increasing capital accumulation.[15] Poor countries that have the motivation to grow by saving may not be able to do so if they are mired in a poverty trap. However, given a poor country's desire to grow and move to a higher income and consumption steady state (i.e., the Golden-Rule state), if somehow that country's growth rate picks up due to lucky exogenous shocks, that growth rate's effect on its saving rate may be stronger than that on a richer country's rate because of the poorer country's added incentive to save.[16] Because this "catch-up" or "Golden-Rule" motivation for saving is likely to be positively correlated with the degree of

[15] See Phelps (1961, 1965).

[16] See Easterly et al. (1997) for stylized facts and empirical findings that suggest shocks are important relative to country characteristics in determining long-run growth. Relatedly, in their attempt to interpret the experience of the East Asian countries in the context of the habit-formation model, Caroll et al. (2000) write "The evidence in William Easterly et al. (1997) suggests that the best way to model the growth experiences in the East Asian countries is as a series of positive shocks. Thus we might interpret the East Asian experience as a sequence of exogenous increases in the 'broad capital' embodied in *k* in our model. . . . . One prediction of our model is that saving rates in the East Asian countries should decline once those economies stop their technological convergence with more advanced economies." (p. 351)

poverty of a country, we enter an income-adjusted growth rate (of real GDP per capita) in the regression to capture that additional effect of growth on the saving rate.[17]

Dependency Ratio. The life-cycle hypothesis argues that people are dissavers when they are young, savers when they are wage-earners, and dissavers again after they have retired. Thus, a country's saving declines (rises) when its dependency ratio increases (decreases). We include both the old dependency ratio (*population ages 65 and over/population ages 15 to 64)* and the young dependency ratio *(population younger than age 15/population ages 15 to 64)* in our regressions.

Domestic Credit. A greater availability of credit could lead to a decline in saving. The extent to which individuals can smooth their consumption will depend on their ability to borrow to finance consumption. If the borrowing constraint is binding, households will be unable to increase their present consumption even if their expected lifetime income stream has increased, and they will have to lower consumption in response to negative transitory shocks to income. Moreover, stringent borrowing constraints mean that households need to save a large sum before they can think of buying a house or other big-ticket items, and that firms need to rely more on retained earnings to fund their investment. This paper uses the *domestic credits/GDP ratio* as an indicator for the availability of domestic credit. The higher is this ratio, the less stringent is the borrowing constraint.

Social Safety Net (Government's Social Spending). An important implication of the life-cycle framework of saving is that private saving will be affected by the extent and coverage of the social safety net provided by the government. The more generous the social safety net (such

[17] The relative income-adjusted growth rate of real GDP per capita of country *i* is the product of an income-adjustment factor and the growth rate of real GDP per capita of country *i*. The income-adjustment factor is the moving average of (Y^{us}/Y^{i}) of the past three years, where Y^{us} is the real GDP per capita of the United States. Thus, the adjusted growth is measured by [moving average of $(Y^{us}_{t-1,t-3}/Y^{i}_{t-1,t-3})$] × $[(Y^{i}_{t}/Y^{i}_{t-1}) -1]$.

as unemployment benefits, medical assistance to the poor, etc.), the less individuals are likely to save for precautionary purposes. We use government social spending (as a percentage of GDP) as an indicator of the generosity of the social safety net.

Urbanization (urban population/total population). Rural households, which depend heavily on agricultural income, tend to save a larger proportion of their income than city households because precautionary saving tends to be higher for households subject to higher income volatility. According to this theory, industrial countries that have a higher degree of urbanization than developing countries will also have a lower saving rate than the latter. In our view, another likely reason for the negative effect of urbanization on saving rates is related to the fact that in developing countries dual economy is the norm. Although city dwellers' living standards are not far below those of industrial economies, households in many villages still do not have even most basic services such as running water, electricity, and easy access to buying goods. In a dual economy, income inequality rises as the economy grows because the rural population is trapped in poverty. Thus, a rise in urbanization amounts to a decline in income inequality. Since the saving rate tends to be positively correlated with income inequality – the richest are the ones that save most – it is likely to be negatively correlated with urbanization.

Real Interest Rate. The effect of a higher real interest rate depends on the relative strength of substitution and income effects. The substitution effect is positive: An increase in the real interest rate will increase saving by increasing the rate of return on saving in the current period relative to that in the next period. The income effect is negative: An increase in the real interest rate will lower saving because it increases income (an increase in wealth), and thus consumption, in the current period. In many developing countries, governments are known to have kept their real interest rates low as a means of financial repression to force the national

saving rate to rise – providing cheap credit to industries to promote production while suppressing consumption through lower interest income.

Inflation. In many developing countries, consumer price inflation means the amount of consumer goods that wage earners can afford will fall. Inflation thus may increase saving by redistributing wealth from workers (who tend to have a lower saving rate) toward capital owners (who tend to have a higher saving rate). Many researchers have also included inflation in a saving equation as a proxy for macroeconomic uncertainty, an increase of which is expected to have a positive effect on precautionary saving.[18]

The Government Budget Balance. In the hypothetical world of Ricardian Equivalence (RE), change in the government budget balance has no effect on national saving. In that world, any decrease in the budget balance is completely offset by an increase in private saving because taxpayers view government spending as a substitute of their own spending and an increase in the government deficit as an increase in their future tax liabilities. However, most analysts believe that the taxpayers' offset is smaller than predicted by the RE hypothesis, and that a decrease in the budget balance will decrease the national saving rate to some extent.

The Real Exchange Rate. The mercantilist view that a country can boost its net exports – and thus its national income and national saving – by undervaluing its currency is a long-held one. Its presumption is that a country, to the extent it succeeds in devaluing its currency and keeping it undervalued, can boost and preserve the price competitiveness of its tradables. Of course, that is not a consensus view among economists.[19] Nevertheless, the mercantilist view is

[18] See Loayza, Schmidt-Hebbel, and Serven (2000).

[19] For example, the Harberger-Laursen-Metzler hypothesis postulates that a real devaluation, which causes a decline in real income, will lead to a decrease in savings via the Keynesian channel. See Harberger (1950) and Laursen and Metzler (1950).

popular among contemporary commentators in reaction to China's large trade surplus and high saving rate.

There is also a growing literature that shows that an undervalued currency has a positive effect on saving through non-mercantilist channels. For example, Levy-Yeyati and Sturzzenegger (2007) show that an undervalued currency boosts output growth by increasing savings and capital accumulation. Korinek and Serven (2010) claim that currency undervaluation can raise growth through learning-by-doing externalities in the tradable sector that was otherwise underdeveloped.

We include two exchange-rate variables as explanatory variables: a measure of real currency depreciation and an index of currency undervaluation.[20]

East Asia Dummy. It is well known that countries in East Asia – namely, Japan, South Korea, Taiwan, China, Hong Kong, and Singapore – on average have a higher national saving rate than do other regions (Table 1). Some analysts attribute this to East Asian's cultural factors, while others attribute it to the "East Asian growth model" which includes various policies designed to promote growth through capital accumulation, by making credit cheaper and more accessible to industries than to consumers. Because it is difficult to quantify countries' culture and growth model, we include an *East Asia dummy* to capture any marginal effect that "being an East Asian country" has on the saving rate.

3.2 Data

The main source of data used to estimate the benchmark model is the World Bank's World Development Indicators 2009. We also used data from IMF's International Financial Statistics, and data from the Asian Development Bank and the United Nations. Appendix 1 reports the

[20] The index of currency undervaluation is constructed in the same fashion as that in Rodrik (2008). See Data appendix for the details of its construction.

definition and construction of variables and data sources. Appendix 2 shows the range of variation in the data (Table A1) and the correlation matrix of variables used in our models (Table A2). After the removal of outliers, we ended up with a sample of 70 countries, from 1980 to 2007. (See Appendix 1 for the criteria used for removing outliers.)

3.3 The Estimation Method

A detailed description of the estimation method used in this paper, and its assumptions and advantages, is provided in section III of Loayza, Schmidt-Hebbel, and Serven (2000). It is briefly summarized below.

The empirical analysis is based on generalized method of moments (GMM) estimators applied to a dynamic system of saving rates. More specifically, GMM is used to estimate a system of two equations:

(1) $s_{i,t} = \alpha s_{i,t-1} + \theta' X_{i,t} + \delta_i + \epsilon_{i,t}$

(2) $s_{i,t} - s_{i,t-1} = \alpha\left(s_{i,t-1} - s_{i,t-2}\right) + \theta'(X_{i,t} - X_{i,t-1}) + (\epsilon_{i,t} - \epsilon_{i,t-1})$

where s is the saving rate, X is a set of explanatory variables, δ is the country specific effect and ϵ is the error term. The subscript i represents country and t stands for time period.

This estimation method has several advantages. First, the dynamic specification of equation (1) allows us to use annual data to estimate both the long-run and short-run effects of the explanatory variables; thus it is a better way to deal with the presence of inertia in saving rates than phase-averaging using an arbitrary phase length (such as a five- or ten-year moving average), which has the disadvantage of distorting the available information.[21] Second, equation (2) allows us to study the time-series relationship between the saving rate and its determinants by

[21] Inertia in saving rates can arise from lagged effects of the explanatory variables on saving, or from consumption habits and from consumption smoothing.

eliminating country-specific effects, while equation (1) allows us to study their cross-country relationship. Finally, the GMM system estimates allow us to control for the potential endogeneity of the explanatory variables, the possible presence of unobserved country-specific effects correlated with the regressors, and the problem that the within (fixed-effect) estimates of $\propto$ and θ are inconsistent in a dynamic specification such as in equation (1).[22]

The instruments for each explanatory variable that is potentially endogenous in equation (2) are the lagged levels of that variable, while the instruments in equation (1) are the lagged differences of that variable.[23] These are appropriate instruments under this additional assumption: *there is no correlation between the differences of the right-side variables and the country-specific effect in equation (1), even if there is correlation between the levels of those variables and the country-specific effect.* With this method, we do not need to assume that the explanatory variables are strictly exogenous, even though we still need to assume that the explanatory variables are weakly exogenous – i.e., they can be affected by current and past realizations of the saving rate but not by future saving rates.

The consistency of the GMM-system estimates depends on whether lagged values of the explanatory variables are valid instruments in the saving regression. To address this issue, we perform two specification tests. The first is the Sargan test of overidentifying restrictions first suggested by Arellano and Bond (1991), which tests the joint validity of the instruments. When

[22] When the lagged dependent variable is included as a regressor (to allow the effect of inertia in saving rate), the within estimators of α and θ are inconsistent. This is because in the within model (the model in which the fixed effects are eliminated by using mean-differenced variables in the regression), the first regressor ($s_{i,t-1} - \overline{s_i}$,) will be correlated with the error $\epsilon_{i,t} - \overline{\epsilon_i}$,. Instrumental-variable (IV) estimators using lags as instruments will not solve the problem because any lags of $s_{i,z}$ will also be correlated with $\overline{\epsilon_i}$.

[23] In equation (2) $\left(s_{i,t-1} - s_{i,t-2}\right)$ is correlated with $(\epsilon_{i,t} - \epsilon_{i,t-1})$, yielding inconsistent estimates. To circumvent this problem, Anderson and Hsiao (1981) suggested using $s_{i,t-2}$, which is uncorrelated with $(\epsilon_{i,t} - \epsilon_{i,t-1})$, as an instrument for $\left(s_{i,t-1} - s_{i,t-2}\right)$.

the null hypothesis cannot be rejected, the error term is uncorrelated with the instruments. The second is the test of the hypothesis that the error term $\epsilon_{i,t}$ is not serially correlated or, if it is correlated, that it follows a finite-order moving-average process. First-order serial correlation in $\Delta\,\epsilon_{i,t}$ is expected, even if $\epsilon_{i,t}$ is serially uncorrelated, because Cov($\epsilon_{i,t} - \epsilon_{i,t-1}, \epsilon_{i,t-1} - \epsilon_{i,t-2}$) ≠0. But $\Delta\,\epsilon_{i,t}$ will not be correlated with $\Delta\,\epsilon_{i,t-k}$ for $k \geq 2$, if $\epsilon_{i,t}$ is serially uncorrelated. Thus, if the test fails to reject the null hypothesis that Cov($\Delta\,\epsilon_{i,t}\,, \Delta\,\epsilon_{i,t-k}\,) = 0$ for $k = 2\ and\ 3$, we conclude that the original error term is serially uncorrelated.

3.4 Regression Results

We report the estimation results in two sets of tables. The first set of tables, Tables 2A and 2A′, report results of all six specifications that do not include *the income-adjusted growth rate* as a regressor, with Table 2A reporting results that include China in the dataset and Table 2A′ reporting those that do not include China in the dataset. The second set of tables, Tables 2B and 2B′, reports results of all six specifications that include *the income-adjusted growth* term as a regressor, with Table 2B reporting results that include China in the sample and Table 2B′ reporting those that do not.

The results of the specification tests shown in all tables generally support the use of GMM system panel estimates. In all regressions, the Sargan test of overidentifying restrictions cannot reject the null hypothesis that the instruments are uncorrelated with the error term. Likewise, the tests of serial correlation reject the hypothesis that the error term is either second-order or third-order serially correlated, giving additional support to the use of lagged explanatory variables as instruments in the regression. Thus, in the subsequent discussion, we will interpret our estimates under the assumption that we have succeeded in isolating the effects of the exogenous component of the explanatory variables on the saving rate.

To facilitate discussion – purely for the purpose of convenience and by no means a scientific assertion, we will henceforth refer to variables that are conventionally considered as policy instruments or targets – i.e., *the real interest rate, the budget balance, inflation,* and *the two exchange rate variables (i.e., change in the exchange rate and undervaluation)*– as policy variables. We will refer to all other explanatory variables, except the dummy variables, as fundamental variables.

General observations of results presented in all four tables:

- All explanatory variables, except *inflation,* are statistically significant at the 95% confidence level in at least two tables. They also all have the expected, or theoretically justifiable, sign. Explanatory variables' coefficients in Tables 2B and 2B′ are somewhat more stable across models than those in Tables 2A and 2A′ . In particular, the coefficient estimates on both *urbanization* and *social spending* in Tables 2A and 2A′ are considerably more varied in magnitude and statistical significance across models than those in Tables 2B and 2B′.
- The national saving rate is estimated to be a positive function of (*real) per capita GDP*, the *growth rate of per capita GDP, the income-adjusted growth rate, the budget balance, the real exchange rate change (i.e., real currency depreciation), and undervaluation;* and a negative function of *domestic credit/GDP, old dependency, young dependency, social safety net, and urbanization*.[24] *The real interest rate* has a negative coefficient, suggesting that its income effect outweighs the sum of its substitution and wealth effects. This is not particularly counterintuitive for developing economies in which other motives

[24] The real exchange rate is the price of the U.S. dollar in foreign currency terms, adjusted for relative prices. Thus, a higher level of the real exchange rate means the real purchasing power of a country's currency is lower in dollar terms, and an increase in a country's real exchange rate means a depreciation of its currency.

for saving are likely to outweigh the substitution effect of the real interest rate.[25] One-percentage point increase in *government saving* leads to about 0.3 percentage points increase in national saving, suggesting that there is a partial Ricardian Equivalence effect.

- The coefficient estimates on both exchange-rate variables – *change in real exchange rate (i.e., real currency depreciation)* and *undervaluation* – are statistically significant with similar magnitudes in both Tables 2A and 2A′ and in both Tables 2B and 2B′. This suggests that the marginal impact of the real exchange rate on saving rates in China is not markedly different from that in other countries. In each table, the magnitudes of those exchange-rate coefficients are also stable regardless of whether the *East Asia dummy* is included in the regression, suggesting that the net effect of factors captured by that dummy – be it a culture of thrift, industrial policies, or something else – is largely independent of the exchange rate.
- The coefficient estimates on the lagged dependent variable are around 0.5 in all four tables, indicating that there is a high degree of persistence in national saving. This in turn implies that the long-run effects (on the saving rate) of other explanatory variables are about twice as large as their respective short-run effects, if all changes in these variables were permanent.

Comparing Table 2A to Table 2B:

- The coefficient estimate on *income-adjusted growth rate* is statistically significant, with an expected sign and a reasonable magnitude, in all six regressions reported in Table 2B.

[25] Loayza, et al. (2000) point out that such results should be taken with some caution. In view of the strong negative correlation between inflation and the real interest rate, the real interest rate measure may reflect more the action of nominal interest-rate controls and financial repression than the intertemporal rate of substitution of consumers.

This offers some evidence of the "catch-up effect" hypothesis, which argues that the marginal effect of economic growth on the saving rate tends to be higher for poor countries with high growth rate than for richer countries.

- All six specifications with the *income-adjusted growth rate* appear to be better than the ones without: The coefficient estimates on *urbanization* and on *social spending* in regressions in Table 2B are more statistically significant and lie within a narrower range than their counterparts in Table 2A.

Comparing Table 2B to Table 2B′*:*

- On average, the coefficient estimates on *income-adjusted growth* are somewhat larger in Table 2B than in Table 2B′. This suggests that the catch-up effect is more powerfully at work in China than in other countries.
- The coefficient on the *East Asia dummy* in Table 2B′ (Model B6) is statistically insignificant and quantitatively much smaller than that in Table 2B (Model B6). Because the former is estimated without China in the dataset, this result suggests that there are other factors proxied by the *East Asia dummy* that are at work in China more powerfully than in other East Asian economies.

Comparing our results to the literature:

To our knowledge, IMF (2005) is the only study of national saving rate using a large cross-country panel dataset since Loayza et al. (2000).[26] A comparison between coefficient estimates in Table 2A (the regression closest to those two papers in regression specification and the construction of explanatory variables) and coefficient estimates in those two previous papers

[26] IMF (2005) applies the same methodology as in Loayza, et al. (2000) to a smaller set of explanatory variables.

are presented in Table 3. Given that there are considerable differences between our paper and those papers, it comes as no surprise that there are some differences in the size of the estimates in the three studies.[27] Nevertheless, it is reassuring that our long-term coefficient estimates on the *old dependency ratio, the young dependency ratio, urbanization*, *the real interest rate,* and *the real exchange rate change*, are all reasonably close to those in Loayza et al. (2000), and that those on the *growth of real GDP per capita*, *real GDP per capita*, and *domestic credit/GDP* are qualitatively comparable to (though noticeably smaller in absolute terms) than those in Loayza et al. (2000). Our coefficient estimate on *the budget balance* (0.283) is also close to that in IMF (2005).

4. Choosing the Benchmark Model to Assess China's Unexplained Saving

Which of our estimated models is most appropriate as the benchmark model for our purpose? Since we have already established that models with *the income-adjusted growth rate* perform better than those without, let us narrow our comparison to the six models presented in Tables 2B and 2B′. Unsurprisingly, the extent of each country's unexplained saving – the difference between the national saving rate and the long-term forecast of a regression equation – varies across the six models and depends on whether China is included in the dataset (Table 4).[28] By the standard of the average rate of unexplained saving of all OECD countries and that of China, the best choice is Model B6 – the model that includes *the East Asia dummy* and *the two*

[27] The differences include those in model specification, measurement of independent and explanatory variables, number of countries and sample period. For example, this paper uses data from 1980 to 2007, and measures national saving as gross national income (GNI) minus consumption. In comparison, Loayza et al. (2000) uses data from 1965 to 1994, and measures national saving as gross national disposable income (which equals to GNI plus all net unrequited transfers from abroad) minus consumption .

[28] The long-term model forecasts are obtained by ignoring fixed effects of each country, summing up only the long-term marginal effects of all explanatory variables in each model, where the marginal effect of variable $\boldsymbol{X}$ = (level of variable $\boldsymbol{X}$)× [coefficient of variable $\boldsymbol{X}$/(1-coefficient of lagged saving)].

exchange rate variables. However, Model B6 should be ruled out because our preceding analysis found that the *East Asia dummy* largely reflects China-specific factors – its unique industrial policy mix, its government's ability to command those policies through the state-owned enterprises and other means, or something else. Having ruled out Model B6, the unambiguous winner is Model B5 as it has the best fit to China's saving rate and OECD countries' average saving rate. Moreover, its ability to fit national saving rates remains relatively unchanged regardless of whether it is estimated with or without China in the dataset (Figures 3.1 to 3.11). This is another advantage of choosing Model B5 over Model B6: The ability of Model B6 to fit national saving rates depends on, to a greater degree, whether China is included in the dataset (Figures 4.1 to 4.6).

Using Model B5 as the benchmark model, China's average unexplained saving from 1990 to 2007 was about 10.3 percentage points (or, 24% of its national saving rate) if China is included in the dataset of estimation, and 12.2 percentage points (or 28% of its national saving rate) if China is excluded from the dataset. China had a higher level of unexplained saving rate over its sample period than almost all other countries included in the sample, even though its average saving rate was actually exceeded by that of three countries – Bhutan, Singapore, and Brunei (Tables 4.1 and 4.2).

5. What Factors are Responsible for China's High National Saving Rate?

The preceding analysis suggests that about three-quarters of China's high saving rate is attributable to explanatory variables included in the benchmark model (Model B5 in Table 2B). This section assesses the relative importance of each model variable's contribution to China's high saving rate by estimating its contribution to the saving-rate gap between China and OECD

countries. It then discusses the factors outside the model that may have been responsible for the rise in the unexplained portion of China's saving rate after 2001.

The contribution of each variable to the China-OECD saving gap depends on the difference in the magnitude of that variable as well as the elasticity of the saving rate with respect to that variable. Table 5 shows that the magnitudes of most variables in China are quite different from those in the OECD economies. The levels of *old dependency, social spending,* and *urbanization* in China are much lower than their average levels in OECD, while *the growth rate* (including *the income-adjusted growth rate*) and the degree of *currency undervaluation* are much higher in China than that in OECD. To provide some degree of sensitivity analysis, Table 6.1 presents the contribution of each explanatory variable using coefficient estimates in the benchmark model as well as those in other models reported in Table 2B.

Table 6.1 shows that, regardless of which model's coefficient estimates are used, China's much *lower level of old dependency* stands out as the explanatory variable most responsible for China's much higher saving rate. The rankings of other factors are somewhat model-dependent. Based on our benchmark model, the other important factors are China's *higher growth rate of real GDP per capita* (including *the adjusted growth*), *weaker social safety net,* and *lower urbanization ratio.* The preeminence of *old dependency* in accounting for the China-OECD saving gap remains unchanged when we use coefficient estimates without China in the dataset (Table 6.2). That preeminence stemmed from both the large elasticity of saving in response to *the old dependency ratio* and the fact that the ratio is much higher in OECD than in China (by 12 percentage points). The relative modest contribution of China's *currency undervaluation*, on the other hand, mainly reflected the small elasticity of saving in response to currency undervaluation. The other variables – *domestic credit/GDP, the young dependency ratio*, and

real GDP per capita– made either little or negative contributions to the China-OECD saving gap. In particular, everything else being equal, the higher income level of the OECD countries meant China's saving rate should have been lower than OECD's rate by 15 percentage points during 2000-2006. From this perspective, those positive factors together contributed over 27 percentage points to the China-OECD saving rate gap during that period.

All those positive factors' contributions to the saving gap declined somewhat in recent years, however. The contribution of China's *lower old dependency ratio* declined from 77% in 1990-2000 to 59% in 2001-2006; that of China's *higher growth rate* fell from 29% to 19%, that of its *weaker social safety net* fell from 27% to 19%; and that of its *lower urbanization* fell from 26% to 17%. China's real exchange rate, including both effects of *real currency depreciation* and *currency undervaluation*, turns out to be a more modest contributor to its higher saving rate than those four factors in both periods: Its contribution was 14% in 1990-2000 and 12% in 2001-2006.[29] Indeed, the benchmark model as a whole has become less able to account for China's saving rate in recent years (Figure 3.1). Even Model B6, which includes *the East Asia dummy* and tracks China's saving rate remarkably well before 2001, becomes less able to explain China's saving after 2001 (Figure 4.1)

Clearly, some factors not included in our models have become increasingly important in driving China's saving rate in recent years. The literature suggests three possibilities.

The first is the possible effect of the 1997-98 Asian crisis on boosting both private and government precautionary saving. In one of his speeches in 2009, Zhou Xiaochuan, the governor of the People's Bank of China, claimed that one factor behind East Asian countries' high saving rates and large foreign reserves is "defensive reactions against predatory

[29] The contribution of China's *lower old dependency ratio* is calculated as equal to 14.1/18.4 in 1990-2000, and 13.9/23.6 in 2001-2006. Those of other variables are calculated in the same fashion.

speculation" that had led to the Asian financial crisis.[30] Park and Shin (2009) also argue that the Asian crisis has had a positive effect on precautionary saving in East Asian economies, boosting their current account surpluses. When we added *an Asian Crisis dummy* to our regressions, we find that *the Asian Crisis dummy* indeed has a positive effect on national saving in several specifications (Tables 2C and 2C′). However, that dummy is not significant in all the specifications that include the exchange rate variables, suggesting that the exchange rate may be one important tool used to reach the higher level of precautionary saving in response to the Asian crisis.

The second possibility is the widening gender imbalance hypothesized by Wei and Zhang (2009). According to the authors, China's one-child policy has resulted in a surplus of men. This in turn has generated a highly competitive marriage market, driving up China's saving rates as households with sons were forced to raise their saving to increase the chance of winning a bride. The authors presented evidence to show that the saving rate started to shoot up around 2002 largely because that was when the gender ratio for the marriage-age cohort began to be seriously out of balance, enhancing incentives of households with sons to increase saving for the sake of winning a bride.

The third possible factor is the increase in the transfer of income away from the household sector to banks and businesses as a result of policymakers' efforts to resolve the crisis posed by the surge in non-performing loans (NPLs) that began in the late 1990s. The government began to implement a variety of measures to reduce the NPLs in 1998; those efforts began to speed up in earnest in 2001 as the government stepped up the country's transition from a centrally planned economy to a market-oriented one.[31] According to Pettis (2010), the

[30] See Zhou (2009).
[31] See Xu (2005).

government's measures to resolve the bad-loan crisis all resulted in passing the bail-out costs on to bank depositors.[32] Thus, he argues, household income share, already a low share of domestic income by international standards, declined further. It is undeniable that China's household income share did begin to decline significantly in 2002, regardless of whether the NPL bailout was the main cause (Figure 5). That decline, combined with a rising personal saving rate during the same period (Figure 6), no doubt contributed to the rise in China's national saving rate unexplained by our models in recent years.[33]

6. China's High Saving and the East Asian Economic Growth Model

The finding that Model B6, which includes the *East Asia dummy*, explained nearly 92 percent of China's saving rate from 1990 to 2006 begs this question: How much of China's high saving rate is attributable to factors that are shared by East Asian economies but different from the rest of the world? This section discusses this issue by drawing from empirical findings of this paper, stylized facts, and the literature.

The fact that the coefficient estimate on *the East Asia dummy* becomes statistically insignificant when Model B6 is re-estimated without China in the dataset would seem to suggest that the dummy mainly captures China-specific factors. However, that the dummy remains statistically significant in Model A6 – the model that excludes *the income-adjusted growth rate* –

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[32] According to Pettis (2010), the government used three tools to reduce non-performing loans. First, the central bank slowed the accumulation of those loans by keeping lending rates low, making it easier for struggling businesses to roll over the debt while the growth of the economy reduced the real value of debt payments. Second, policymakers infused the banks with additional equity, partly directly and partly by purchasing bad loans at above their liquidation value. They financed these capital infusions by borrowing at artificially low rates, thereby passing the repayment burden on to lenders. Finally, the central bank mandated a wide spread between the bank lending and the deposit rate, which helped to recapitalize banks by increasing their profitability. All three tools required that bank depositors subsidize the bail-out of the banking industry.

[33] For example, see Aziz and Cui (2007) for discussion of the role of household income in China's low consumption.

whether it is estimated with or without China in the dataset suggests one cannot easily dismiss the East Asia dummy as merely a proxy for China-specific fixed effects. More plausible is the interpretation that there is a significant overlap of the factors captured by *the East Asia dummy* and those proxied by the *income-adjusted growth rate*. Thus, when China is excluded from the dataset, the *East Asia dummy* becomes insignificant in a model that already includes *the adjusted growth rate*, but remains significant in the model that does not. The question is: What are those common factors captured by both *the East Asia dummy* and *the income-adjusted growth rate*?

Volumes have been written about why the East Asian economies have managed to grow much more rapidly than other developing economies. In that literature, the so-called East Asian growth model can be loosely described as a "high saving-high investment-high growth" strategy modeled on Japan's model of economic growth and development.[34] Although the specific policy mix varies across East Asian economies, that growth model basically relies on heavy government interventions that favor capital formation (i.e., industrialization) at the expense of consumer spending, through various means that effectively force savings from consumers to keep the cost of financing low for investment.[35] For example, several East Asian economies – including Japan, South Korea, and Taiwan – provided affordable credit to business by allowing inflation to effectively curtail consumer spending in some periods during their years of industrialization. Until recent years, consumers generally had more difficulty obtaining credit than did business entities in those countries. Even in Japan, which grew to become a rich and industrialized

[34] For example, see Hirono (1988) and other articles collected in Hughes (1988). A study by the World Bank (1993) also emphasizes that a "virtuous circle" – going from higher growth, to higher savings, to even higher growth – has played a central role in successful development experiences in East Asia.

[35] Foreign credit tended to be too expensive or too scant during the early stage of industrialization in those countries after WWII. For more discussion of the similarities and differences between China's development model and those of the East Asian model, see Baek (2005) and Boltho and Weber (2009).

country more than three decades ago, policies that favor business investment at the expense of consumer demand have only begun to fade or be reversed in recent years.[36] Haggard (1988) argues that a key element underlying those East Asian governments' ability to implement those policies with success is their political systems "in which economic policymaking process was relatively *insulated* from direct political pressures and compromises" and "legislatures are historically weak or non-existent and other channels of political access and representation tightly controlled, even under nominally democratic regimes."

There is plenty of evidence that China has adopted its neighbors' successful strategies of achieving rapid growth through high saving and investment. For example, China's policies are known to favor capital-intensive investment, which arguably is less effective in creating jobs to absorb its large pool of excess labor than labor-intensive investment is. Growth has been capital-intensive and profits have outpaced wage income, a situation that has which depressed household consumption relative to national income (Figure 5). Capital-intensive production has been encouraged by low interest rates and by the fact that most state-owned firms do not pay any dividends, allowing them to reinvest all their profits. Furthermore, the government has also favored manufacturing over services by policies such as holding down the yuan exchange rate and suppressing the prices of inputs such as land and energy. Most economists now agree that a main reason underlying the rise in China's national saving rate is that households' disposable income had grown more slowly relative to GDP, depressing their consumption share of GDP. Indeed, some authors – for example, Kuijs (2005, 2006) and Ma and Yi (2010) – have pointed out that a major driver of the sharp rise in China's national saving rate is the significant rise in

[36] Japan's national saving rate stayed over 30 percent throughout its fast-growing decades. It fell below 30 percent only after 1997 as its government deficit continued to rise during its prolonged economic slump of the previous two decades. Still, despite its large government deficit, Japan's average national saving rate during 2000-2006 (26.4%) was still higher than that of OECD (23.8%).

China's corporate saving (the sum of retained earnings and depreciation) and government saving (Figure 7).

Ma and Yi attribute the rise in corporate saving to the combination of two related factors: (1) a very tough corporate restructuring during 1995-2005 that consequently boosted corporate efficiency and profitability; and (2) a government policy that state companies were not required to pay dividends to the government.[37] Those two factors, together with the fact that smaller private firms probably need to fund investment with retained earnings because they tend not to have easy access bank loans, imply that corporate retained earnings in China rose in tandem with net corporate profits, which rose from about 4 percent of GNI in 2001 to 10 percent in 2007 (Figure 8).[38] The rise in government saving from 2001 to 2007 was even larger than that in corporate saving (Figure 7). That rise mainly stemmed from the fact that much of the increase in government revenue went to government investment (which is considered government saving) as opposed to consumption (such as unemployment benefit, medical care for the poor, etc. Chinese central government actually ran a small budget deficit during that period, because its total spending (the sum of investment and consumption) exceeded its total revenue.[39] The household

[37] The dividend policy allowed the bulk of the dividend payouts by listed Chinese state companies to go to their non-listed parent holding companies (direct majority shareholders) instead of the government (the ultimate owner) and thus is still retained within the corporate sector.

[38] Ma and Yi (2010) also argue that depreciation as a share of GDP has probably risen over time because (1) depreciation is positively linked to the higher capital stock and newer vintages of capital, and (2) the capital stock per worker in the industrial sector has at least doubled in the past decade as a result of rapid industrialization. Since there are no official data of depreciation, the authors cite Bai et al (2006), which claimed China's capital stock as a ratio to GDP rose from 130% to 170% between the early 1990s and the mid-2000s, to support their argument.

[39] Ma and Yi (2010) suggest three reasons behind the Chinese government's decision to invest rather than consume most of its rising income. First, the anticipation of rapid population aging and the 1997 pension reform prompted increased pension contributions by the corporate and household sectors. These contributions are parked under various pension funds administered by the government. These funds have been invested, directly or indirectly, in financial and physical assets at home or abroad. Thus, the rise in government saving may be partly due to the build-up of pension assets. Second, local Chinese government officials have incentives to start new investment projects, as promotions have been mainly based on economic growth in their jurisdictions. Hence they have an innate tendency to invest more rather than to provide additional public services for a given rise of government revenues,

saving/GDP ratio, despite the decline in the share of national income going to households, has again surpassed enterprises saving/GDP after 2004 (Figure 7). In part, this is due to the continuing rise in household saving rate since the early 1990s, which reached nearly 30 percent by 2008 (Figure 6).[40]

Clearly, all three players – the household sector, the corporate sector (both private-owned and state-owned enterprises), and the government – have been responsible for China's high saving rate. This is consistent with what one would expect from a country that has adopted the East Asian growth model, especially if the first two groups' high savings are in part induced by government policies.

The evolution of national saving and economic growth in Japan, the grandfather of the East Asian growth model, suggests that we are likely to see a slow normalization of China's saving rate once the Chinese economy is better developed and ranked among rich countries (in terms of real GDP per capita). Given that China's real GDP per capita in 2007 was still slightly below that of Japan in the early 1960s, however, it is unlikely that China's saving will decline to a more "normal" level within the next decade.[41] Nevertheless, there are signs that that process of "normalization" has begun. For example, the government allowed its currency to fall against the US dollar by over 17 percent from June 2005 to July 2008 (the beginning of the 2008-2009 global financial turmoil). That trend is likely to continue once the global economy begins to

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thereby boosting government saving. Third, while a rising share of fiscal revenue is appropriated by the central government, the the social expenditure burden primarily remains on the less well-funded local governments.

[40] This may stem from the fact that, due to the rapid growth in national income, households' disposable income has continued to rise even though their share in national income declines, which in turn increases their saving rate through the mechanism proposed by the habit-formation hypothesis.

[41] Japan's real GDP per capita, in purchasing-power-parity (PPP)-adjusted 2005 dollars, was $5698 in 1960. In comparison, China's real GDP per capital was $5084 (in PPP-adjusted 2005 dollars) in 2007. (China's data are taken from 2009 World Economic Indicators, published by the World Bank; Japan's data are from Bureau of Labor Statistics of the United States.)

recover on a more solid footing. The government has also begun to strengthen the social safety net in recent years, especially after 2005 (Figure 9).[42]

7. Conclusions

In this paper, we estimate models of national saving rates to gauge the extent to which China's high saving rate can be accounted for by models that explain other countries' saving rates reasonably well on average. We find that our benchmark models explain about 72 to 76 percent of China's national saving rate during 1990-2007, depending on whether China is included in the dataset. On average, China's national saving rate exceeded the predictions of those models by about 10 to 12 percentage points.

Many traditional determinants of saving indeed have a statistically and quantitatively significant effect on national saving rates. The predominant drivers of China's higher saving rates are its relatively *low old dependency ratio,* and, to a lesser extent, its *strong growth rate, weak social safety net,* and *low urbanization.* The contribution of China's *currency undervaluation* to its saving rate is relatively more modest. Our results also suggest that some factors shared by East Asian economies have contributed to China's higher saving rate, and that those factors are mainly those underlying the high-savings-high-growth strategy of East Asian economies. However, it is beyond the scope of this paper to disentangle the many complex factors that are likely to be proxied by that dummy.

Our results imply that, as the Chinese population becomes older and China's national income reaches its potential, its saving rate will also begin to decline.

[42] For example, the Chinese government has promised to spend 850 billion yuan ($125 billion) from 2009 to 2011 to widen health-insurance coverage and to improve public clinics and hospitals. It is also reforming the pension system, which now leaves out over half of urban workers and 90% of their rural counterparts.

Appendix 1. Definition of Variables and Sources of Data

Data are obtained from the World Bank's *World Development Indicators 2009*, except otherwise indicated. Outliers removed from the sample include (1) Domestic Credit/GDP greater than 1000; (2) Real interest rates greater than 50 or less than -50; (3) Inflation rates greater than 500.

Asian-Crisis Dummy equals zero in the years before 1999 and one in the years beginning in 1999.

Adjusted growth rate of real GDP per capita of country *i* is the product of an income-adjustment factor and the growth rate of real GDP per capita of country *i*. The income-adjustment factor is the moving average of (Y^{us}/Y^{i}) of the past three years, where Y^{us} is the real GDP per capita of the United States. That is, the adjusted growth is measured by [moving average of $(Y^{us}_{t-1,t-3}/Y^{i}_{t-1,t-3})$] x $[(Y^{i}_{t}/Y^{i}_{t-1}) -1]$.

Currency undervaluation is an index constructed for all countries in the sample by following the three-step method used in Rodrik (2008). In step 1, we use data on exchange rates (XRAT) and PPP conversion factors (PPP) from Penn World Table 6.3 to calculate a real exchange rate (RER) with equation (1) $\ln(RER_{it}) = \ln(XRAT_{it}/PPP_{it})$, for country *i* in year *t*. (When RER is greater than one it means the currency is undervalued by the standard of the purchasing power parity.) In step 2, we adjust RER for the Balassa-Samuelson effect – a country's real exchange rate appreciates along with productivity growth – by regressing RER on real GDP per capita (RGDPCH). That is, we estimate equation (2) $\ln(RER_{it})=\alpha +\beta \ln(RGDPCH_{it}) + f_t + \varepsilon_{it}$, where f_t counts for time fixed effect. We then use the fitted value of RER as the real exchange rate adjusted for productivity growth. Finally, we measure the index of currency undervaluation (*UNDERVAL*) by taking the log difference between RER and the fitted value. That is, $UNDERVAL_{it} = \ln(RER_{it}) - \ln(RER^{*}_{it})$, where $\ln(RER^{*}_{it})$ is the fitted value from equation (2).

Domestic credit is the percent share of domestic credit of GDP. Domestic credit includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other banking institutions are savings and mortgage loan institutions and building and loan associations.

East Asia dummy is set to equal 1 for China, Japan, South Korea, Singapore, and Hong Kong; it is set to zero for all other countries. (Taiwan is not included in the dataset because *World Economic Indicators* does not include data for Taiwan.)

Government budget balance is the central government budget balance as a percent share of GDP. Data are obtained from OECD, the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), and the Asian Development Bank.

Growth rate of real GDP per capita of country *i* is measured by $100*((Y^{i}_{t}/Y^{i}_{t-1}) -1)$, where Y^{i}_{t} is real GDP per capita of country *i* in year *t*.

Inflation is the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.

National Saving Rate is gross national saving (gross national income minus consumption) as a percent share of Gross National Income.

Old dependency is the ratio of the old-age population (ages 65 and older) relative to the working-age population (ages 15 to 64), in percent terms.

Real interest rate is the bank lending rate adjusted for the annualized inflation rate (measured by the GDP deflator) in percent terms.

Real exchange rate (2000 = 100) is the index of the bilateral real exchange rate of a country's currency relative to the dollar. For the U.S., the real exchange rate is the Federal Reserve Board's broad index of its trade-weighted real exchange rate relative to its major trading partners.

Real GDP per capita is a country's real gross domestic product per capita converted to be expressed in terms of international dollars using purchasing power parity rates. An international dollar has the same purchasing power as the U.S. dollar has in the United States. Data are in constant 2005 international dollars.

Social spending is government social spending as a percentage of GDP. Social spending includes expenditure on unemployment benefit, social security, healthcare, and education. Data are obtained from OECD, the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), and the Asian Development Bank.

Urbanization is measured by urban population as percent of total population. Urban population is population of areas defined as urban in each country and reported to the United Nations.

Young dependency is the ratio of the youth population (ages 14 and younger) relative to the working-age population (ages 15 to 64), in percent terms.

Appendix 2. Descriptive Analysis of Data

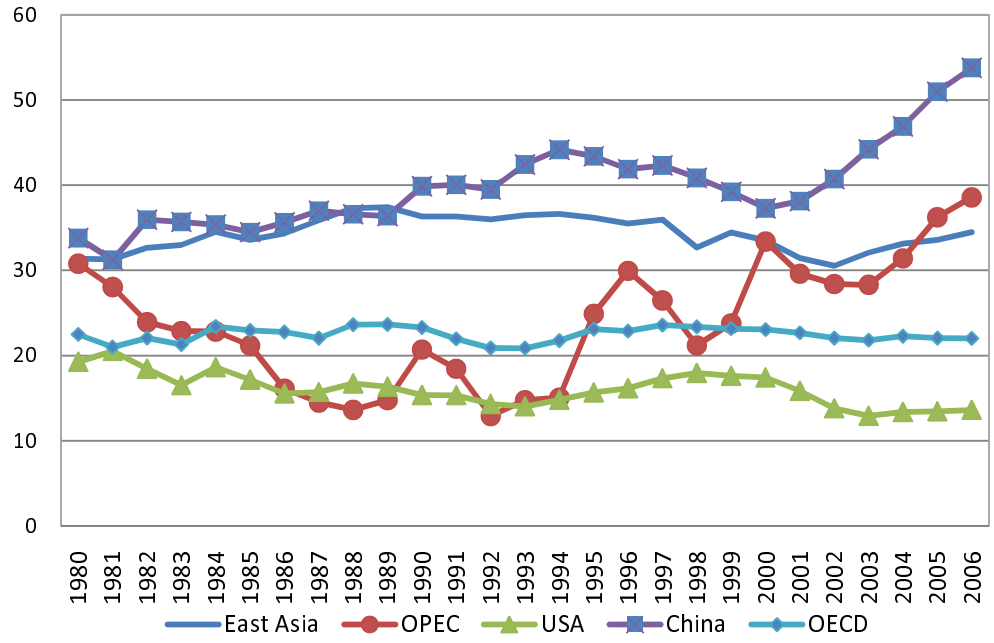
Table A1. Summary Statistics				
	Mean	Std. Dev.	Min	Max
National Saving Rate	19.1	10.5	-59.0	70.0
Urbanization	51.4	23.4	4.7	100.0
Young Dependency	57.7	24.1	19.4	110.7
Old Dependency	11.3	6.5	3.7	30.7
Growth of Real GDP/Capita	2.2	4.6	-31.3	58.5
Ln(Real GDP Per Capita)	850.6	123.6	549.3	1093.4
Domestic Credit/GDP	58.9	46.0	0.1	313.5
Inflation	15.3	35.3	-13.1	492.4
Real Interest Rate	7.0	10.0	-49.8	48.4
Adj. Growth of Real GDP/Capita	34.2	65.3	-4.6	484.4
Government Budget Balance	14.6	9.9	-10.5	83.5
Gov't Social Spending	14.3	7.7	0.0	35.8
Change in Real Exchange Rate	0.0	0.2	-0.9	2.8
Currency Undervaluation	0.0	0.5	-2.1	1.5

Table A2. Correlation Matrix of Variables in the Regression Equations of National Saving Rates

	Saving Rate	Urbani-zation	Young Depen-dency	Old Depen-dency	Growth of Real GDP/Capita	Ln(Real GDP per Capita)	Domestic Credit/GDP	Inflation	Real Interest Rate	Adjusted Growth Rate	Gov't Budget Balance	Social Spending	Change in Real Exchange Rate	Currency Under-valuation
Saving Rate	1.00													
Urbanization	0.31	1.00												
Young Dependency	-0.41	-0.67	1.00											
Old Dependency	0.17	0.59	-0.82	1.00										
Growth of Real GDP/Capita	0.28	0.08	-0.24	0.13	1.00									
Ln(Real GDP Per Capita)	0.45	0.79	-0.81	0.72	0.14	1.00								
Domestic Credit/GDP	0.27	0.42	-0.53	0.48	0.01	0.60	1.00							
Inflation	-0.18	-0.01	0.09	-0.08	-0.20	-0.12	-0.11	1.00						
Real Interest Rate	-0.10	0.02	0.07	-0.06	0.03	-0.06	-0.11	-0.39	1.00					
Adjusted Growth Rate	-0.08	-0.35	0.23	-0.24	0.46	-0.44	-0.27	-0.03	0.07	1.00				
Gov't Budget Balance	0.29	0.30	-0.29	0.29	0.06	0.41	0.10	-0.07	-0.08	-0.27	1.00			
Social Spending	-0.15	0.59	-0.65	0.81	-0.16	0.67	0.33	-0.16	0.01	-0.42	0.55	1.00		
Change in Real Exchange Rate	-0.05	-0.06	0.12	-0.08	-0.12	-0.07	0.00	0.04	-0.03	-0.04	0.00	0.02	1.00	
Currency Undervaluation	-0.10	-0.43	0.30	-0.44	0.08	-0.54	-0.43	0.18	0.03	0.33	-0.32	-0.68	0.09	1.00

Figure 1. National Saving Rate by Region

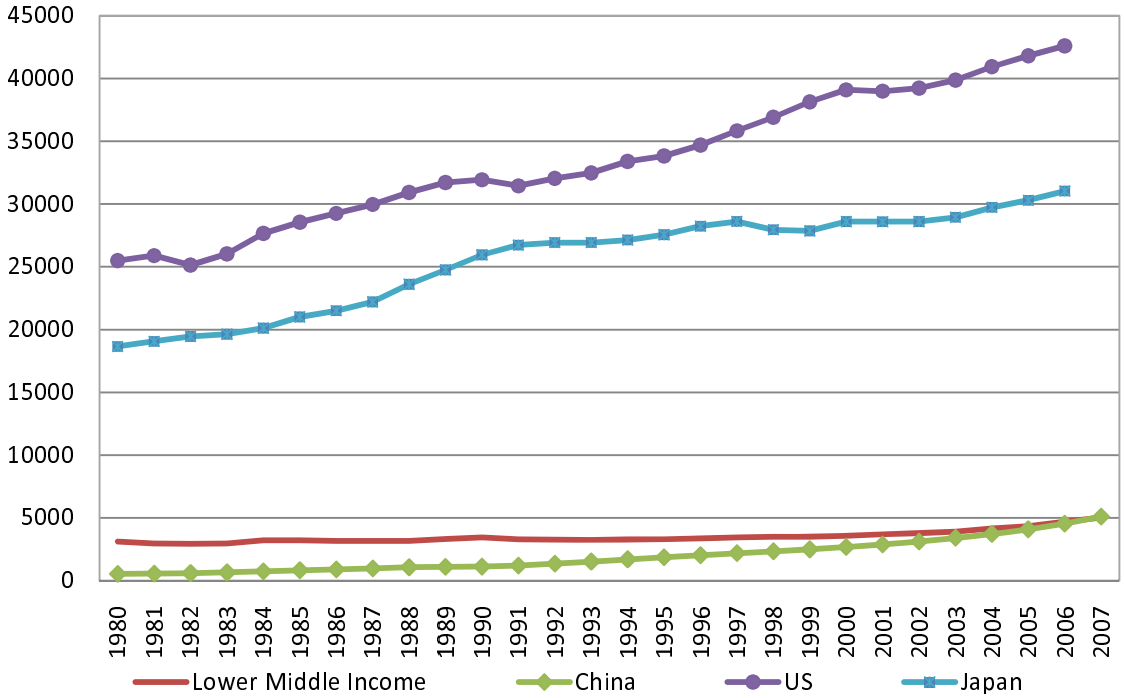
(Percent)



Sources: World Bank National Accounts and OECD National Accounts.

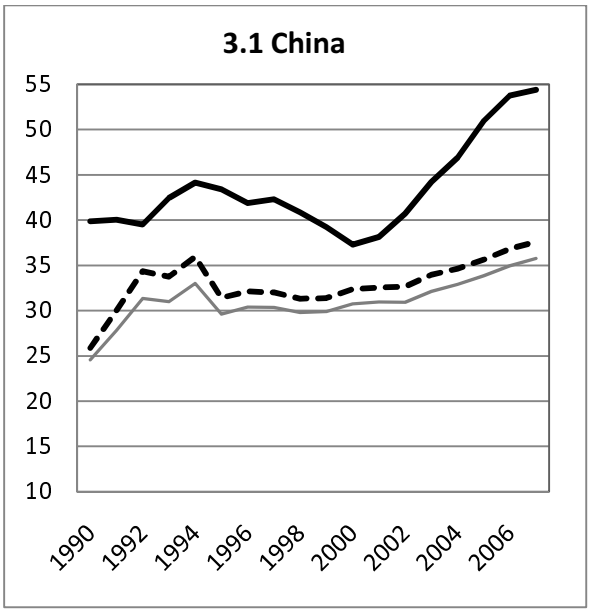
Figure 2. Real GDP Per Capita

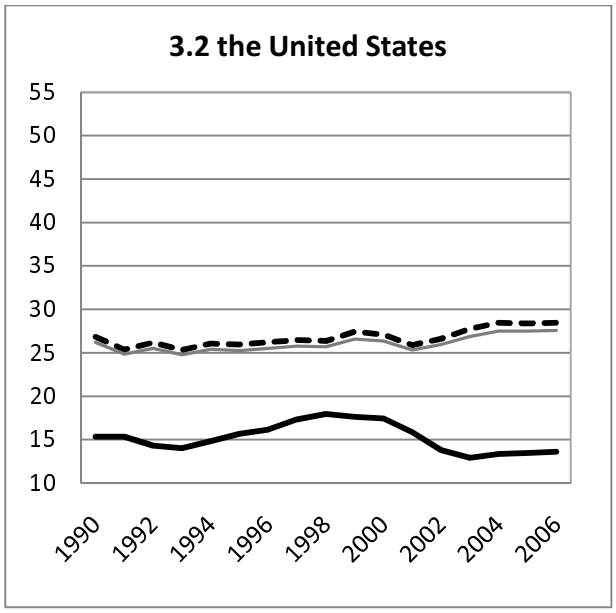
(Constant 2005 Int'l Dollars Based on PPP Rates)



Source: World Development Indicators 2008.

Figures 3.1-3.4. National Saving Rate: Actual vs. Long-Term Forecast of the Benchmark Model (Percent)

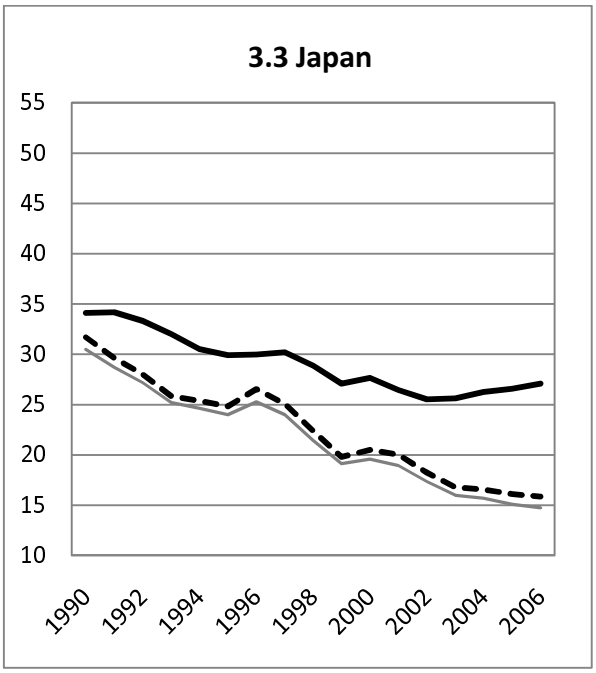


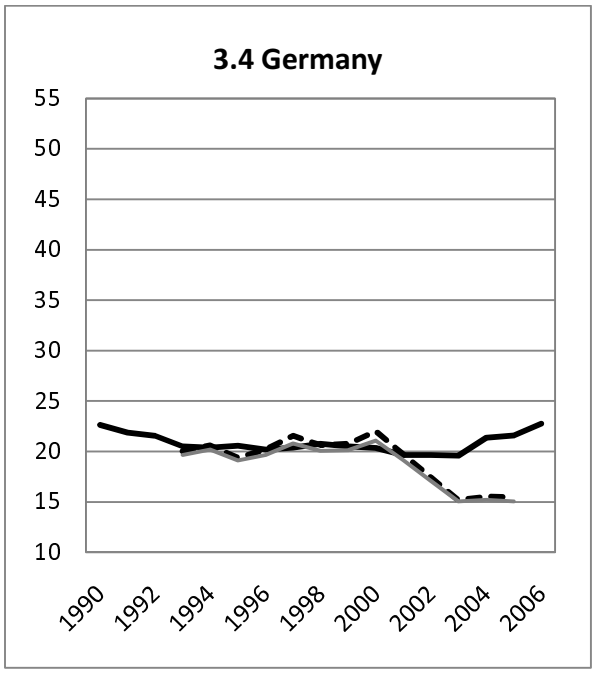


Actual

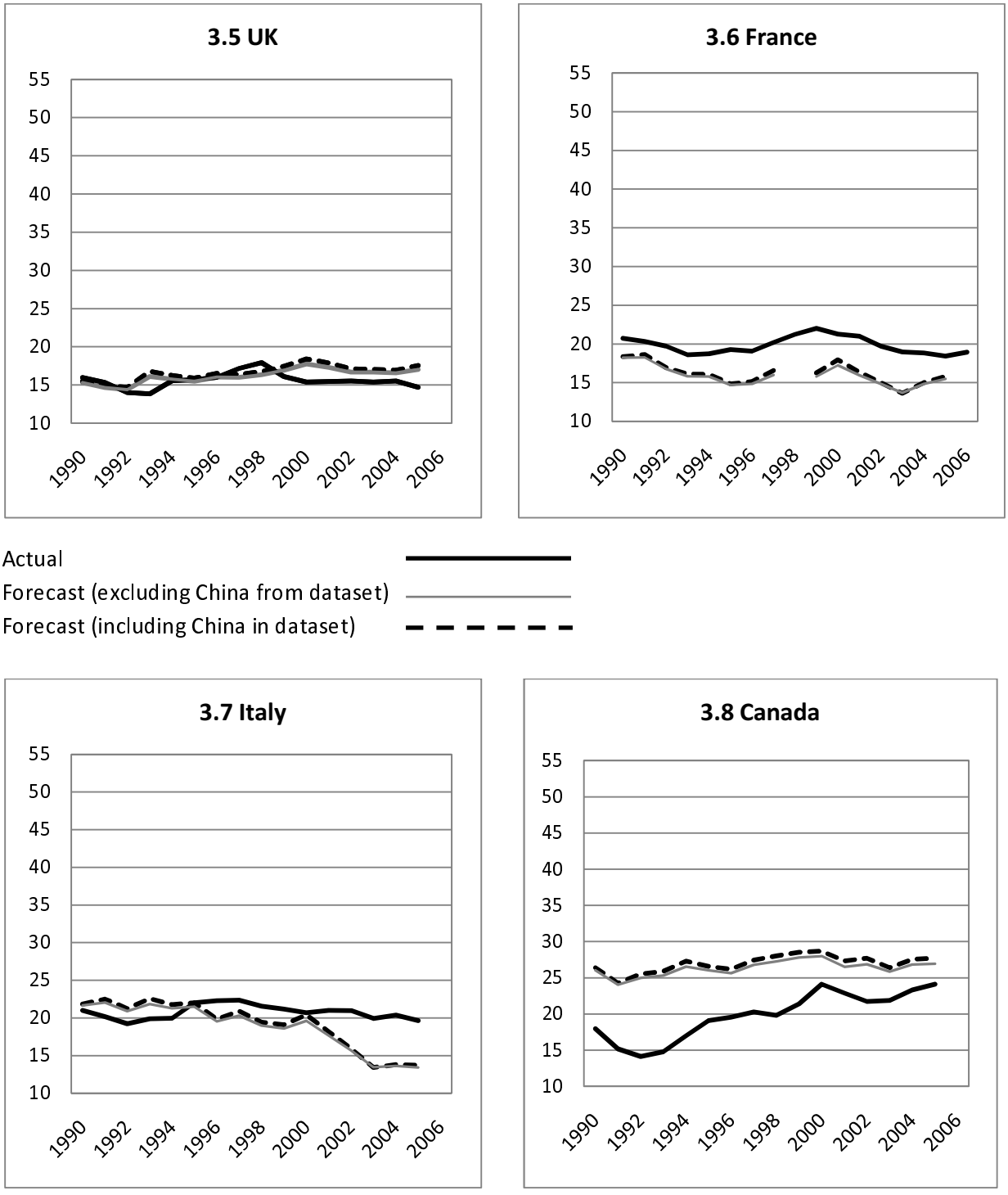
Forecast (excluding China from dataset)

Forecast (including China in dataset)

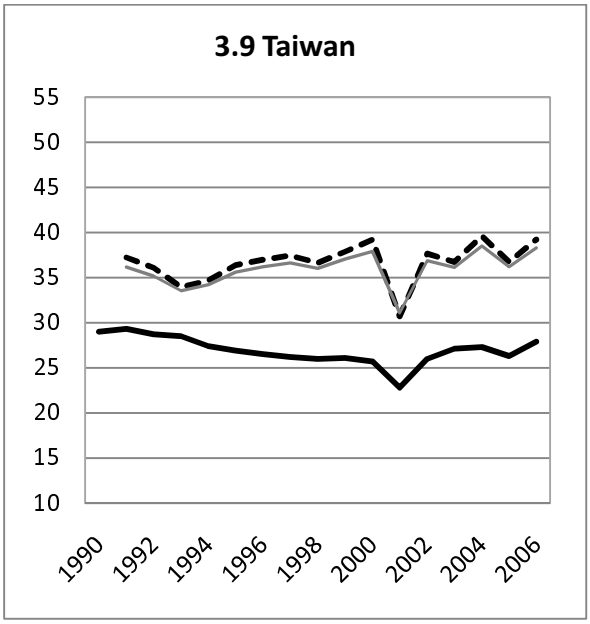


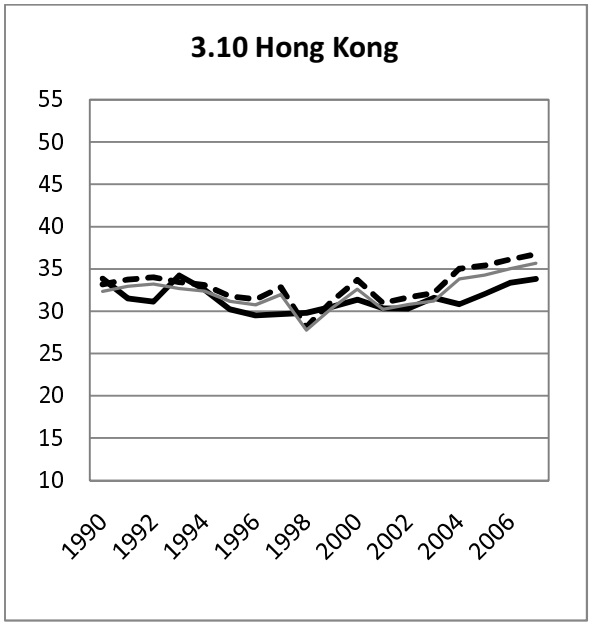


Figures 3.5-3.8. National Saving Rate: Actual vs. Long-Term Forecast of the Benchmark Model (Percent)

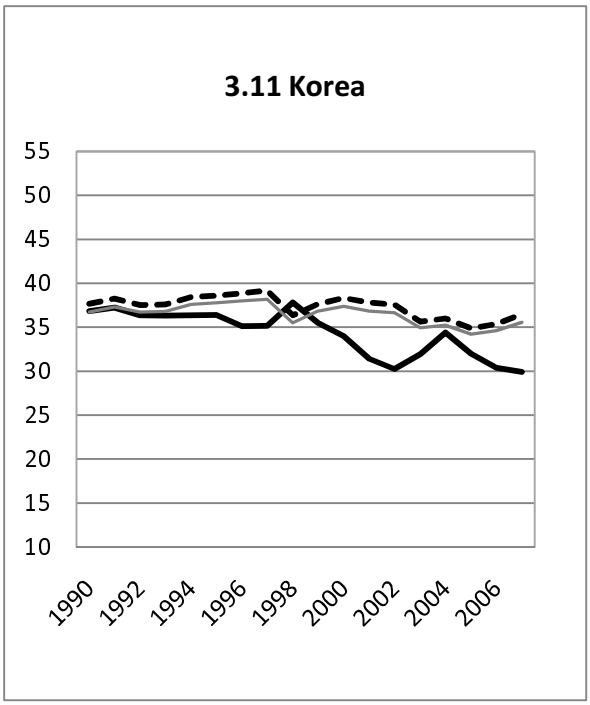


Figures 3.9-3.11. National Saving Rate: Actual vs. Long-Term Forecast of the Benchmark Model (Percent)

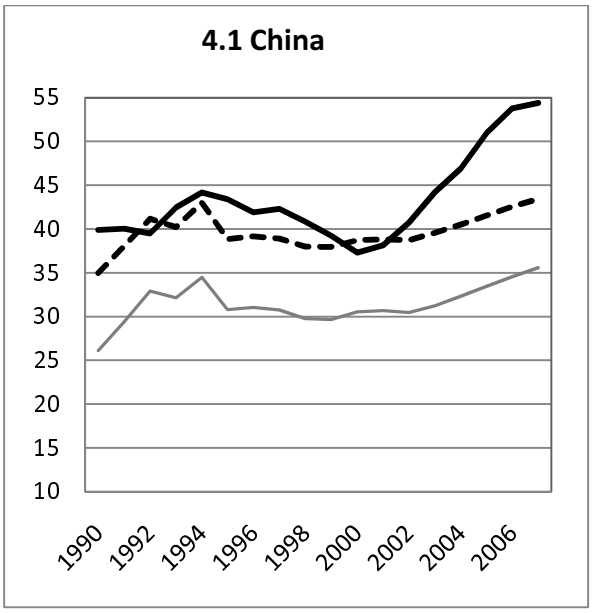


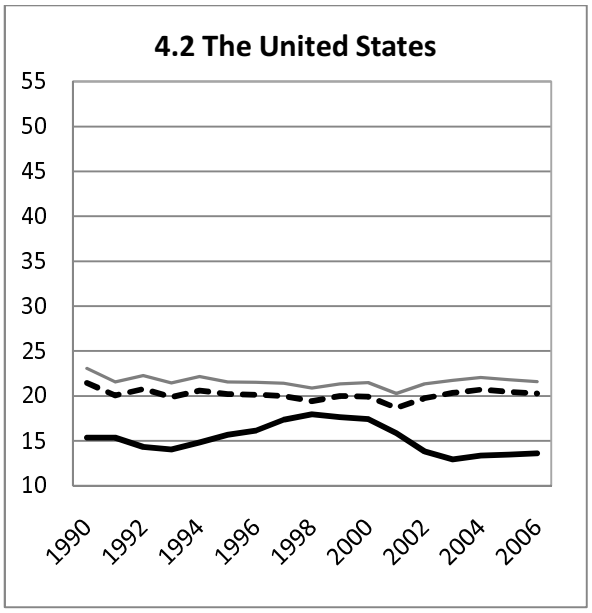


Actual
Forecast (excluding China from dataset)
Forecast (including China in dataset)



Figures 4.1- 4.4. National Saving Rate: Actual vs. Long-Term Forecast of the Benchmark Model plus East Asia Dummy (Percent)

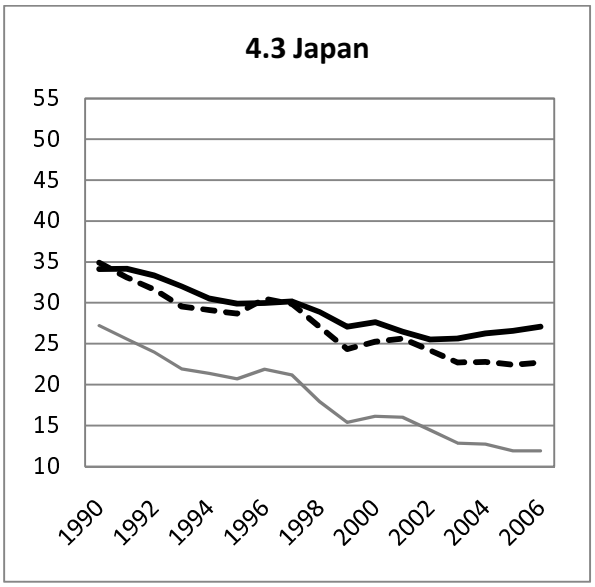


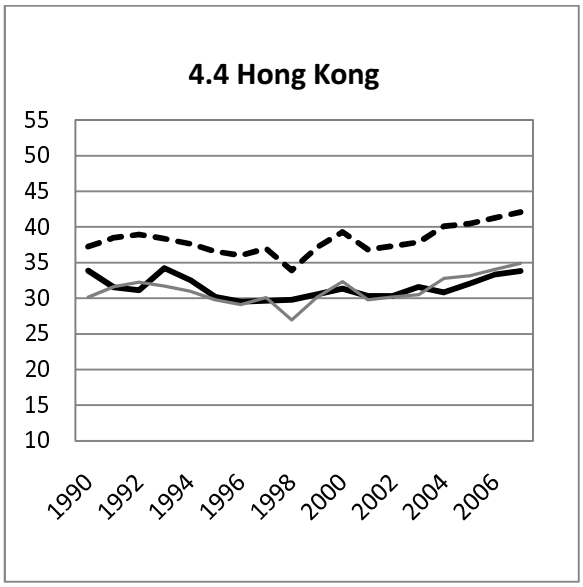


Actual

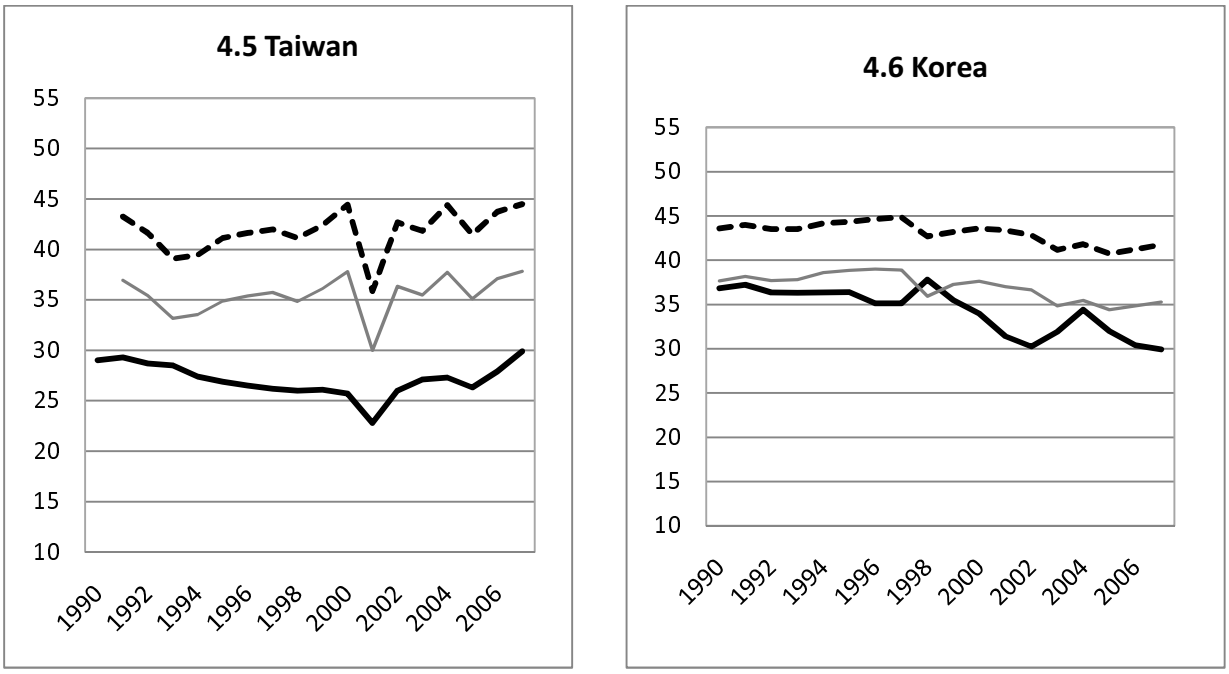
Forecast (excluding China from dataset)

Forecast (including China in dataset)





Figures 4.5-4.6. National Saving Rate: Actual vs. Long-Term Forecast of the Benchmark Model plus East Asia Dummy (Percent)



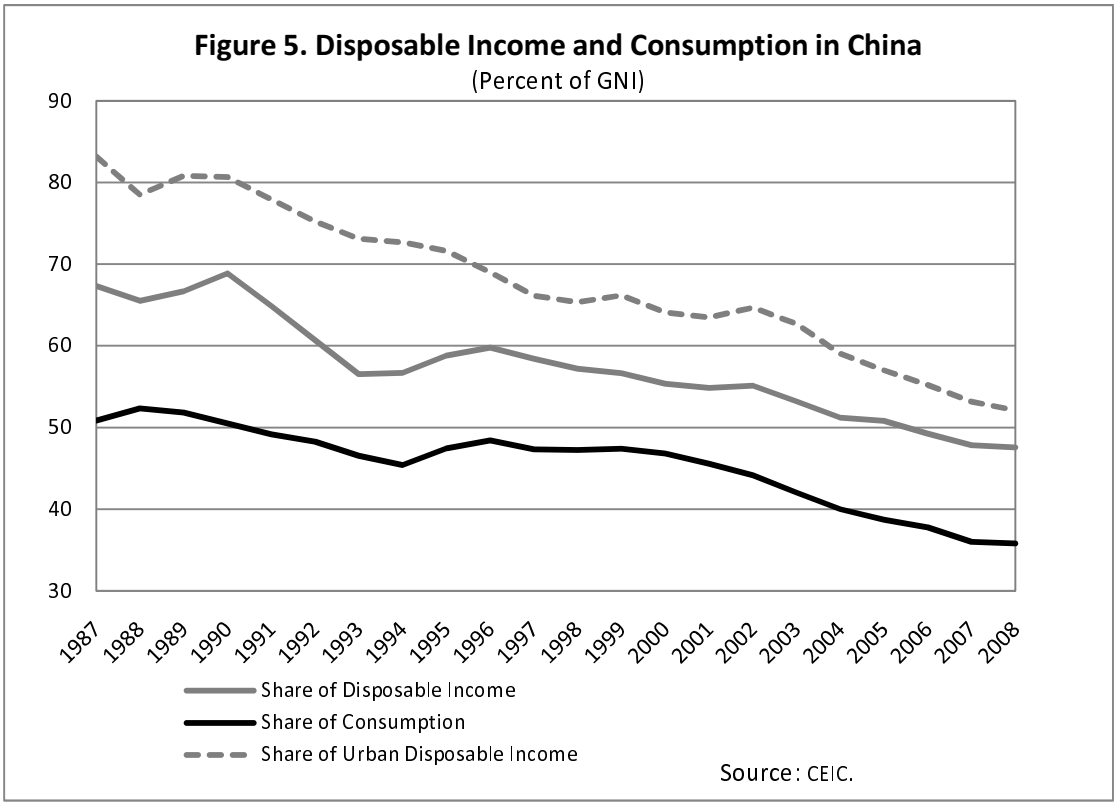


Figure 5. Disposable Income and Consumption in China
(Percent of GNI)
90
80
70
60
50
40
30
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Share of Disposable Income
Share of Consumption
Share of Urban Disposable Income
Source: CEIC.

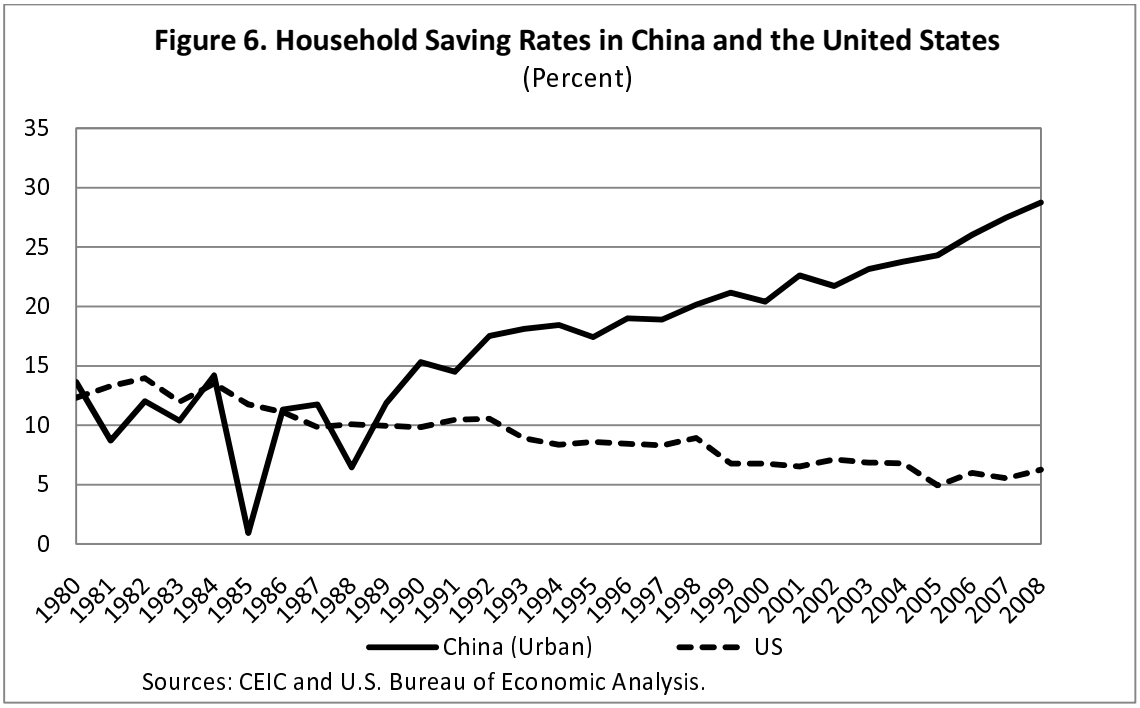
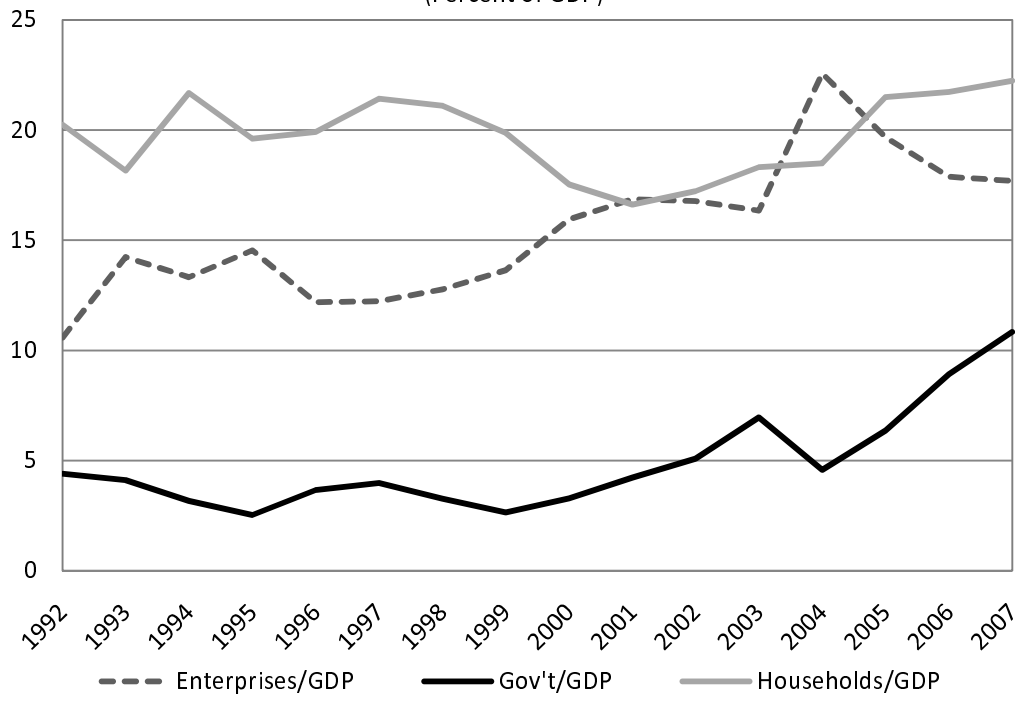


Figure 6. Household Saving Rates in China and the United States
(Percent)
35
30
25
20
15
10
5
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
China (Urban)
US
Sources: CEIC and U.S. Bureau of Economic Analysis.

Figure 7. Composition of Gross Saving in China

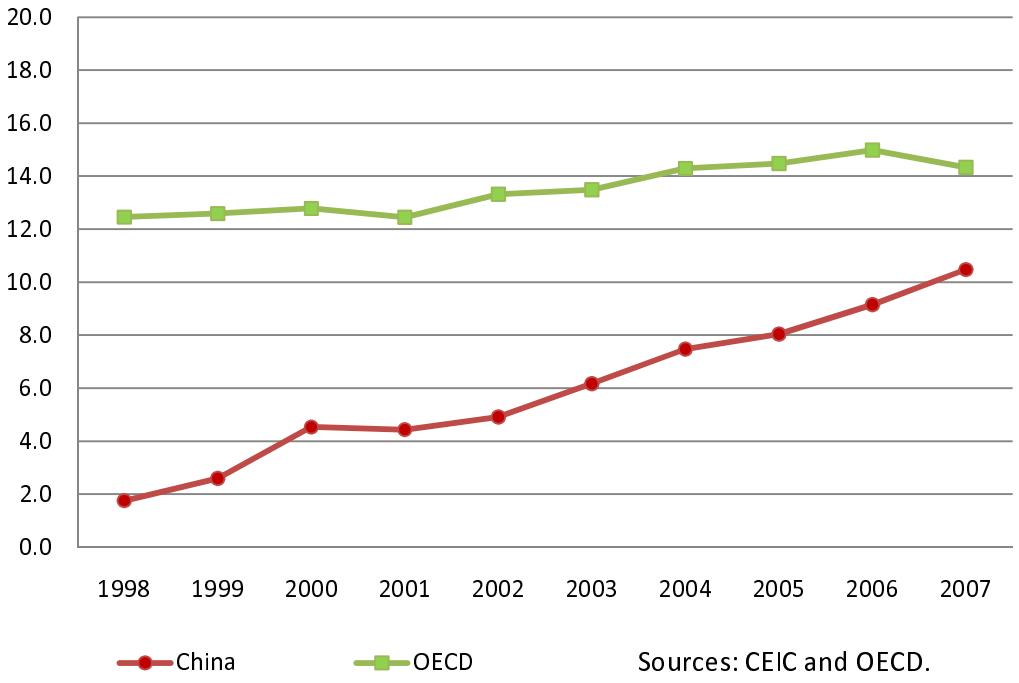
(Percent of GDP)



Source: CEIC.

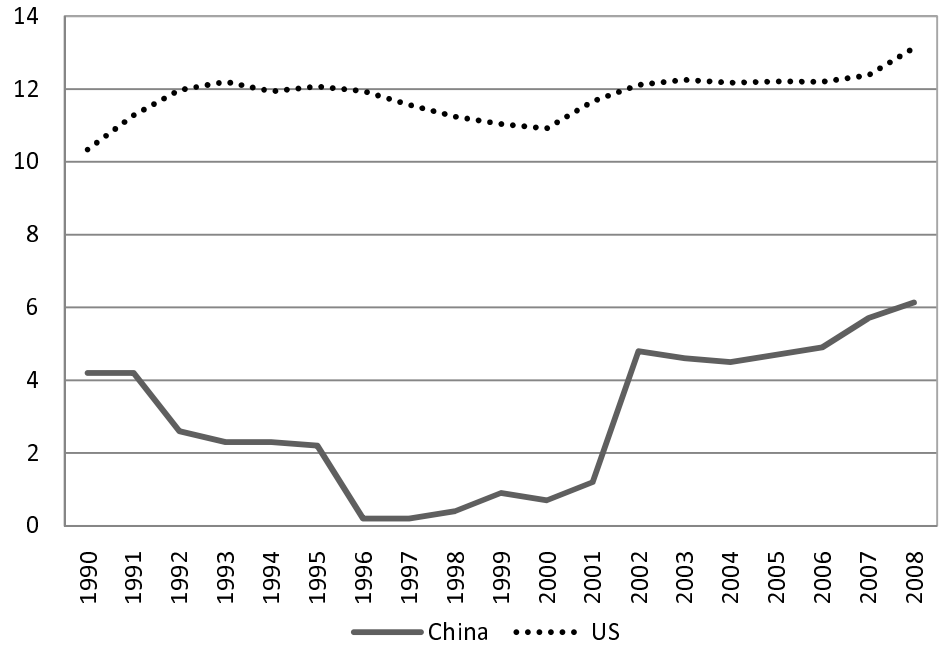
Figure 8. Net Corporate Profits in China and OECD

(Percent of GNI)



Sources: CEIC and OECD.

Figure 9. Government Social Spending in China and the United States (Percent of GDP)



Sources: Asian Development Bank and U.S. Bureau of Economic Analysis.

Table 1. Real GDP per Capita and National Saving Rate

(Annual Average)

	High Income	Upper Middle Income	Lower Middle Income	Low Income	OECD	USA	China
Real GDP per capita (constant 2005 int'l dollar based on PPP rates)							
1980-1990	13280	6158	3156	1049	20875	28420	807
1991-2000	18313	7686	3367	1037	25123	34796	1920
2001-2006	21501	9125	4070	1140	29343	40588	3613
2007	25990	11665	5019	1368	30533	43102	5084
National Saving Rate (%)							
1980-1990	20.5	20.7	19.8	9.0	22.6	17.8	35.6
1991-2000	23.8	18.8	18.0	11.0	22.5	16.7	41.1
2001-2006	30.3	18.8	23.1	14.9	22.1	15.0	45.8
2007	29.5	20.0	26.7	19.8	23.0	14.3	54.4

Note: Countries' income-level classifications are based on World Bank classification.

Sources: World Development Indicators and Survey of Current Business.

Table 2A. Dynamic Panel Regressions of National Saving Rates, Including China in Dataset						
(Estimation method: Two-step system GMM; P-values are below coefficient estimates.)						
Variable	**Model A1**	**Model A2**	**Model A3**	**Model A4**	**Model A5**	**Model A6**
Lagged Saving	**0.51**	**0.499**	**0.535**	**0.5**	**0.564**	**0.532**
	0	0	0	0	0	0
Ln(Real GDP Per Capita)	**0.036**	**0.038**	**0.032**	**0.035**	**0.03**	**0.027**
	0	0	0	0	0	0
Growth of Real GDP Per Capita	**0.11**	**0.129**	**0.153**	**0.1**	**0.213**	**0.183**
	0	0	0	0	0	0
Domestic Credit/GDP	**-0.038**	**-0.024**	**-0.04**	**-0.033**	**-0.013**	**-0.025**
	0	0	0	0	0.037	0
Old Dependency	**-0.522**	**-0.579**	**-0.44**	**-0.477**	**-0.47**	**-0.464**
	0	0	0	0	0	0
Young Dependency	**-0.161**	**-0.154**	**-0.118**	**-0.107**	**-0.148**	**-0.141**
	0	0	0	0	0	0
Urbanization	**-0.04**	**-0.077**	**-0.001**	**-0.084**	**-0.049**	**-0.002**
	0.115	0.001	0.947	0	0.197	0.966
Social Spending	**-0.194**	**-0.144**	**-0.209**	**-0.047**	**-0.051**	**-0.03**
	0	0.02	0	0.242	0.438	0.623
Inflation		**0.001**				
		0.885				
Real Interest Rate			**-0.146**			
			0			
Gov't Budget Balance				**0.283**		
				0		
Change in Real Exchange Rate					**0.038**	**0.031**
					0	0
Undervaluation					**0.014**	**0.013**
					0	0
East Asia Dummy						**6.761**
						0
P-values of Wald test of joint significance and other tests for consistency of estimators:						
Wald test	0.00	0.00	0.00	0.00	0.00	0.00
Sargan test	1.00	1.00	1.00	1.00	1.00	1.00
1st-order serial correlation	0.01	0.01	0.02	0.02	0.01	0.01
2nd-order serial correlation	0.19	0.19	0.24	0.30	0.17	0.17
3rd-order serial correlation	0.15	0.15	0.19	0.23	0.14	0.14
Number of Observations	1188	1188	1092	1110	1170	1170
Number of Countries	70	70	69	67	69	69

Table 2A'. Dynamic Panel Regressions of National Saving, Excluding China from Dataset						
(Estimation method: Two-step system GMM; P-values are below coefficient estimates.)						
Variable	**Model A1**	**Model A2**	**Model A3**	**Model A4**	**Model A5**	**Model A6**
Lagged Saving	**0.487**	**0.471**	**0.546**	**0.488**	**0.535**	**0.511**
	0.000	0.000	0.000	0.000	0.000	0.000
Ln(Real GDP Per Capita)	**0.035**	**0.036**	**0.029**	**0.034**	**0.031**	**0.029**
	0.000	0.000	0.000	0.000	0.000	0.000
Growth of Real GDP Per Capita	**0.089**	**0.095**	**0.140**	**0.065**	**0.174**	**0.170**
	0.000	0.000	0.000	0.001	0.000	0.000
Domestic Credit/GDP	**-0.034**	**-0.027**	**-0.038**	**-0.034**	**-0.012**	**-0.026**
	0.000	0.000	0.000	0.000	0.033	0.000
Old Dependency	**-0.492**	**-0.568**	**-0.411**	**-0.428**	**-0.518**	**-0.447**
	0.000	0.000	0.000	0.000	0.000	0.000
Young Dependency	**-0.149**	**-0.160**	**-0.113**	**-0.104**	**-0.154**	**-0.154**
	0.000	0.000	0.000	0.000	0.000	0.000
Urbanization	**-0.024**	**-0.038**	**0.010**	**-0.092**	**-0.051**	**-0.016**
	0.483	0.053	0.663	0.002	0.271	0.740
Social Spending	**-0.218**	**-0.149**	**-0.177**	**-0.023**	**-0.040**	**-0.057**
	0.000	0.007	0.000	0.611	0.539	0.147
Inflation		**0.002**				
		0.839				
Real Interest Rate			**-0.156**			
			0.000			
Gov't Budget Balance				**0.289**		
				0.000		
Change in Real Exchange Rate					**0.036**	**0.033**
					0.000	0.000
Undervaluation					**0.012**	**0.010**
					0.000	0.000
East Asia Dummy						**4.248**
						0.014
P-values of Wald test of joint significance and other tests for consistency of estimators:						
Wald test	0.00	0.00	0.00	0.00	0.00	0.00
Sargan test	1.00	1.00	1.00	1.00	1.00	1.00
1st-order serial correlation	0.01	0.01	0.02	0.02	0.01	0.01
2nd-order serial correlation	0.19	0.19	0.24	0.31	0.17	0.18
3rd-order serial correlation	0.15	0.15	0.19	0.23	0.14	0.14
Number of Observations	1170	1170	1074	1096	1152	1152
Number of Countries	69	69	68	66	68	68

Table 2B. Dynamic Panel Regressions of National Saving, Including China in Dataset						
(Estimation method: Two-step system GMM; P-values are below coefficient estimates.)						
Variable	**Model B1**	**Model B2**	**Model B3**	**Model B4**	**Model B5**	**Model B6**
Lagged Saving Rate	**0.555**	**0.536**	**0.567**	**0.532**	**0.545**	**0.491**
	0	0	0	0	0	0
Ln(Real GDP Per Capita)	**0.032**	**0.035**	**0.03**	**0.031**	**0.033**	**0.032**
	0	0	0	0	0	0
Growth of Real GDP Per Capita	**0.089**	**0.069**	**0.103**	**0.065**	**0.144**	**0.138**
	0	0	0	0	0	0
Adjusted Growth Rate	**0.01**	**0.012**	**0.005**	**0.008**	**0.008**	**0.007**
	0	0	0	0	0	0
Domestic Credit/GDP	**-0.033**	**-0.022**	**-0.034**	**-0.032**	**-0.002**	**-0.019**
	0	0	0	0	0.733	0
Old Dependency	**-0.492**	**-0.549**	**-0.459**	**-0.48**	**-0.547**	**-0.458**
	0	0	0	0	0	0
Young Dependency	**-0.157**	**-0.171**	**-0.1**	**-0.117**	**-0.164**	**-0.154**
	0	0	0	0	0	0
Urbanization	**-0.029**	**-0.057**	**-0.027**	**-0.047**	**-0.05**	**-0.07**
	0.009	0	0.079	0	0.024	0
Social Spending	**-0.126**	**-0.115**	**-0.111**	**-0.003**	**-0.122**	**-0.042**
	0.001	0.005	0.005	0.942	0.003	0.328
Inflation		**0.013**				
		0.162				
Real Interest Rate			**-0.144**			
			0			
Gov't Budget Balance				**0.287**		
				0		
Change in Real Exchange Rate					**0.035**	**0.041**
					0	0
Undervaluation					**0.011**	**0.013**
					0	0
East Asia Dummy						**6.648**
						0
P-values of Wald test of joint significance and other tests for consistency of estimators:						
Wald test	0.00	0.00	0.00	0.00	0.00	0.00
Sargan test	1.00	1.00	1.00	1.00	1.00	1.00
1st-order serial correlation	0.01	0.01	0.02	0.02	0.01	0.01
2nd-order serial correlation	0.18	0.18	0.25	0.29	0.18	0.18
3rd-order serial correlation	0.17	0.17	0.20	0.24	0.15	0.14
Number of Observations	1188	1188	1092	1110	1170	1170
Number of Countries	70	70	69	67	69	69

Table 2B'. Dynamic Panel Regressions of National Saving, Excluding China from Dataset						
(Estimation method: Two-step system GMM; P-values are below coefficient estimates.)						
Variable	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**
Lagged Saving	**0.502**	**0.493**	**0.530**	**0.484**	**0.506**	**0.520**
	0.000	0.000	0.000	0.000	0.000	0.000
Ln(Real GDP Per Capita)	**0.037**	**0.034**	**0.030**	**0.035**	**0.035**	**0.034**
	0.000	0.000	0.000	0.000	0.000	0.000
Growth of Real GDP Per Capita	**0.072**	**0.069**	**0.085**	**0.042**	**0.137**	**0.133**
	0.000	0.000	0.000	0.055	0.000	0.000
Domestic Credit/GDP	**-0.033**	**-0.016**	**-0.038**	**-0.035**	**-0.004**	**-0.021**
	0.000	0.004	0.000	0.000	0.542	0.000
Adjusted Growth	**0.006**	**0.007**	**0.003**	**0.003**	**0.006**	**0.007**
	0.000	0.002	0.160	0.053	0.000	0.000
Old Dependency	**-0.525**	**-0.519**	**-0.320**	**-0.519**	**-0.586**	**-0.532**
	0.000	0.000	0.000	0.000	0.000	0.000
Young Dependency	**-0.176**	**-0.152**	**-0.103**	**-0.128**	**-0.171**	**-0.165**
	0.000	0.000	0.000	0.000	0.000	0.000
Urbanization	**-0.050**	**-0.062**	**-0.043**	**-0.059**	**-0.054**	**-0.072**
	0.006	0.000	0.007	0.009	0.001	0.000
Social Spending	**-0.149**	**-0.084**	**-0.116**	**-0.021**	**-0.129**	**-0.050**
	0.006	0.046	0.000	0.586	0.046	0.281
Inflation		**0.014**				
		0.192				
Real Interest Rate			**-0.130**			
			0.000			
Gov't Budget Balance				**0.304**		
				0.000		
Change in Real Exchange Rate					**0.030**	**0.032**
					0.000	0.000
Undervaluation					**0.011**	**0.007**
					0.000	0.049
East Asia Dummy						**1.756**
						0.598
P-values of Wald test of joint significance and other tests for consistency of estimators:						
Wald test	0.00	0.00	0.00	0.00	0.00	0.00
Sargan test	1.00	1.00	1.00	1.00	1.00	1.00
1st-order serial correlation	0.01	0.01	0.02	0.02	0.01	0.01
2nd-order serial correlation	0.19	0.19	0.26	0.31	0.18	0.18
3rd-order serial correlation	0.16	0.16	0.20	0.23	0.15	0.14
Number of Observations	1170	1170	1074	1096	1152	1152
Number of Countries	69	69	68	66	68	68

Table 2C. Dynamic Panel Regressions of National Saving, Including China in Dataset						
(Estimation method: Two-step system GMM; P-values are below coefficient estimates.)						
Variable	**Model C1**	**Model C2**	**Model C3**	**Model C4**	**Model C5**	**Model C6**
Lagged Saving Rate	**0.535**	**0.524**	**0.567**	**0.5**	**0.545**	**0.507**
	0	0	0	0	0	0
Ln(Real GDP Per Capita)	**0.034**	**0.035**	**0.03**	**0.033**	**0.032**	**0.03**
	0	0	0	0	0	0
Growth of Real GDP Per Capita	**0.075**	**0.084**	**0.105**	**0.068**	**0.142**	**0.127**
	0.01	0.003	0	0.01	0	0
Adjusted Growth Rate	**0.009**	**0.01**	**0.005**	**0.005**	**0.011**	**0.008**
	0	0	0.001	0.046	0.006	0.005
Domestic Credit/GDP	**-0.036**	**-0.021**	**-0.034**	**-0.036**	**-0.011**	**-0.009**
	0	0	0	0	0.073	0.233
Old Dependency	**-0.488**	**-0.549**	**-0.441**	**-0.485**	**-0.592**	**-0.607**
	0	0	0	0	0	0
Young Dependency	**-0.173**	**-0.165**	**-0.098**	**-0.129**	**-0.169**	**-0.147**
	0	0	0	0	0	0
Urbanization	**-0.036**	**-0.065**	**-0.027**	**-0.049**	**-0.035**	**-0.033**
	0.038	0	0.094	0.001	0.086	0.089
Social Spending	**-0.148**	**-0.093**	**-0.115**	**-0.023**	**-0.07**	**0.01**
	0.003	0.055	0.005	0.562	0.241	0.812
Asian Crisis Dummy	**0.348**	**0.507**	**0.155**	**0.243**	**0.053**	**0.231**
	0.002	0	0.074	0	0.632	0.014
Inflation		**0.019**				
		0.031				
Real Interest Rate			**-0.143**			
			0			
Gov't Budget Balance				**0.274**		
				0		
Change in Real Exchange Rate					**0.039**	**0.027**
					0	0
Undervaluation					**0.013**	**0.013**
					0	0
East Asia Dummy						**7.023**
						0.054
Number of Observations	1188	1188	1092	1110	1170	1170
Number of Countries	70	70	69	67	69	69

Table 2C'. Dynamic Panel Regressions of National Saving, Excluding China from Dataset						
(Estimation method: Two-step system GMM; P-values are below coefficient estimates.)						
Variable	**Model C1**	**Model C2**	**Model C3**	**Model C4**	**Model C5**	**Model C6**
Lagged Saving Rate	**0.513**	**0.467**	**0.53**	**0.515**	**0.546**	**0.497**
	0	0	0	0	0	0
Ln(Real GDP Per Capita)	**0.035**	**0.038**	**0.03**	**0.032**	**0.029**	**0.031**
	0	0	0	0	0	0
Growth of Real GDP Per Capita	**0.077**	**0.094**	**0.09**	**0.055**	**0.137**	**0.085**
	0	0	0.001	0.003	0	0.04
Adjusted Growth Rate	**0.004**	**0.002**	**0.001**	**0.004**	**0.009**	**0.01**
	0.014	0.504	0.76	0.044	0.004	0.005
Domestic Credit/GDP	**-0.035**	**-0.022**	**-0.038**	**-0.035**	**-0.011**	**-0.01**
	0	0	0	0	0.059	0.125
Old Dependency	**-0.508**	**-0.531**	**-0.329**	**-0.494**	**-0.474**	**-0.577**
	0	0	0	0	0	0
Young Dependency	**-0.161**	**-0.164**	**-0.1**	**-0.115**	**-0.147**	**-0.16**
	0	0	0	0	0	0
Urbanization	**-0.043**	**-0.091**	**-0.042**	**-0.046**	**-0.027**	**-0.039**
	0.007	0.001	0.013	0	0.144	0.01
Social Spending	**-0.13**	**-0.09**	**-0.117**	**0**	**-0.076**	**0**
	0	0.195	0.001	0.991	0.141	0.997
Asian Crisis Dummy	**0.369**	**0.559**	**0.137**	**0.147**	**0.081**	**0.159**
	0.001	0	0.254	0.046	0.433	0.172
Inflation		**0.012**				
		0.117				
Real Interest Rate			**-0.132**			
			0			
Gov't Budget Balance				**0.286**		
				0		
Change in Real Exchange Rate					**0.036**	**0.029**
					0	0
Undervaluation					**0.012**	**0.014**
					0	0.001
East Asia Dummy						**6.383**
						0.196
Number of Observations	1170	1170	1074	1096	1152	1152
Number of Countries	69	69	68	66	68	68

Table 3. Comparisons of Short-term and Long-term coefficient Estimates						
				Implied Long-Term Estimates		
Dependent variable: Saving rate	This Paper	IMF	LHS	This Paper	IMF	LHS
Lagged saving rate	0.510	0.62	0.38			
Growth rate of per capita GDP (GNDI in LHS)	0.110	0.17	0.45	0.224	0.45	0.73
Real per capita GDP (GNDI in LHS)	0.036		0.102	0.073		0.16
Domestic credit/GDP (GNDI in LHS)	-0.038	-3.47	-0.36	-0.078	-9.13	-0.58
Old dependency	-0.522	-0.44	-0.77	-1.065	-1.16	-1.24
Young dependency	-0.161		-0.16	-0.329		-0.26
Urbanization	-0.040		-0.5	-0.082		-0.81
Real interest rate	-0.146		-0.136	-0.298		-0.22
Government saving	0.283	0.27		0.578	0.71	
Real exchange rate change	0.038	0.08	0.057	0.078	0.21	0.09
Inflation	0.001		0.18	0.002		0.29
Note: The comparison needs to be taken in perspective mainly for the following reasons:						
1. LHS refers to Loayza et al. (2000). Both LHS and IMF (2005) include terms of trade growth, not real exchange rate change.						
2. LHS data were from 1965 to 1994, the IMF data were from1972 to 2004 , and this paper's data were from 1980 to 2007.						
3. This paper's coefficient estimates are taken from Table 2A. Estimates of inflation, real interest rate, and government saving are taken from models A2, A3, and A4 respectively. Other coefficients are from Model A5.						
4. The dependent variable is somewhat different in the three papers: it is private saving/gross national disposable income (GNDI) in LHS; national saving/gross national income(GNI) in this paper, and national saving/GDP in IMF.						

Table 4. Unexplained Saving Rates by Model (percent; average of sample period)						
(unexplained saving = national saving - long-term forecast)						
(% forecast error = long-term forecast/national saving -1)						
	China		OECD		All Countries	
Regression	Unexplained Saving	% Forecast Error	Unexplained Saving	% Forecast Error	Unexplained Saving	% Forecast Error
Models Estimated with the Full Dataset (Table 2B)						
B1	16.1	0%	-0.1	0%	-1.1	0%
B2	13.7	0%	-0.3	0%	-1.1	0%
B3	15.8	0%	-0.3	0%	-1.4	0%
B4	19.8	0%	-0.3	0%	-1.3	0%
B5	10.3	0%	-0.1	0%	-0.8	0%
B6	3.7	0%	1.1	0%	0.5	0%
Models Estimated Excluding China from Dataset (Table 2B')						
B1	17.6	0%	0.1	0%	-0.5	0%
B2	16.5	0%	-0.3	0%	-0.6	0%
B3	19.1	0%	-0.3	0%	-0.3	0%
B4	21.3	0%	0.3	0%	-0.6	0%
B5	12.2	0%	0.4	0%	-0.3	0%
B6	11.9	0%	0.5	0%	-0.1	0%

Table 4.1 Actual and Model Forecasts of National Saving Rates (percent)							
(unexplained saving = national saving - long-term forecast)							
(% deviation = national saving rate/long-term forecast -1)							
Model = Model B5 of Table 2B , estimated with China in dataset							
Country	**Saving Rate**	**Unexplained Saving**	**% deviation**	**Country**	**Saving Rate**	**Unexplained Saving**	**% deviation**
Bhutan	49.07	21.16	76%	Guatemala	12.86	-1.16	-8%
Honduras	24.31	10.63	78%	Ireland	23.31	-1.30	-5%
China	43.34	10.31	31%	Portugal	21.97	-1.48	-6%
Mongolia	29.86	10.13	51%	Hong Kong, China	31.48	-1.55	-5%
Sweden	20.74	9.98	93%	Peru	21.87	-1.56	-7%
Norway	28.04	8.40	43%	Tonga	15.32	-1.61	-9%
Singapore	46.57	6.49	16%	Chile	23.84	-1.92	-7%
Belgium	22.23	6.07	38%	Hungary	19.68	-2.21	-10%
Papua New Guinea	26.47	6.04	30%	Paraguay	15.92	-2.46	-13%
Luxembourg	34.15	5.95	21%	Thailand	32.47	-2.49	-7%
Nepal	22.25	5.14	30%	Nicaragua	12.37	-2.55	-17%
India	30.50	5.00	20%	Georgia	18.27	-2.73	-13%
Switzerland	30.18	4.98	20%	New Zealand	18.88	-2.93	-13%
Philippines	24.78	4.98	25%	South Korea	34.30	-3.04	-8%
Japan	30.08	4.78	19%	Fiji	21.62	-3.75	-15%
Brunei	49.87	4.44	10%	Australia	21.40	-3.92	-15%
Venezuela	28.69	4.07	17%	Poland	18.61	-4.15	-18%
Jamaica	23.72	3.96	20%	Mexico	20.74	-4.79	-19%
Bangladesh	23.61	3.52	18%	Greece	17.22	-4.89	-22%
Denmark	21.06	3.05	17%	Slovak Republic	23.30	-4.94	-17%
Uruguay	13.56	2.37	21%	Iceland	16.62	-6.63	-29%
Panama	24.88	1.89	8%	El Salvador	13.92	-6.67	-32%
France	19.42	1.73	10%	Vanuatu	11.91	-7.40	-38%
Finland	23.90	1.70	8%	Canada	20.17	-7.61	-27%
Argentina	17.81	1.41	9%	Brazil	15.34	-7.68	-33%
Germany	20.42	1.31	7%	Colombia	16.86	-7.87	-32%
Spain	21.94	0.98	5%	Sri Lanka	21.15	-9.07	-30%
Austria	22.46	0.84	4%	Taiwan	26.98	-9.90	-27%
Bolivia	14.92	0.74	5%	Turkey	16.08	-10.12	-39%
Netherlands	25.28	0.43	2%	Cambodia	12.84	-10.40	-45%
Italy	21.25	0.38	2%	Kyrgyz Republic	10.61	-10.43	-50%
Czech Republic	25.19	0.28	1%	Costa Rica	15.01	-10.46	-41%
Indonesia	27.17	-0.61	-2%	Tajikistan	11.77	-11.10	-49%
United Kingdom	16.15	-0.77	-5%	United States	15.95	-11.13	-41%
Dominican Republic	21.63	-0.87	-4%	Trinidad and Tobago	26.56	-11.38	-30%
OECD					22.31	-0.10	0%
All 70 Countries in Sample					22.25	-0.77	-3%
Note: Each country's saving rate is the average over the years for which data are available for that country.							
The sample period is from 1980 to 2007, but some countries do not have data for the entire sample period.							

Table 4.2 Actual and Model Forecasts of National Saving Rates (percent)							
(unexplained saving = national saving - long-term forecast)							
(% deviation = national saving rate/long-term forecast -1)							
Model = Model B5 of Table 2B', estimated without China in dataset							
Country	**Saving Rate**	**Unexplained Saving**	**% Deviation**	**Country**	**Saving Rate**	**Unexplained Saving**	**% Deviation**
Bhutan	49.07	22.01	81%	Hong Kong, China	31.48	-0.69	-2%
China	43.34	12.22	39%	Ireland	23.31	-0.85	-4%
Honduras	24.31	10.65	78%	Portugal	21.97	-0.96	-4%
Mongolia	29.86	10.64	55%	Peru	21.87	-1.22	-5%
Sweden	20.74	10.27	98%	Guatemala	12.86	-1.26	-9%
Norway	28.04	8.75	45%	Chile	23.84	-1.31	-5%
Singapore	46.57	7.33	19%	Georgia	18.27	-1.42	-7%
Luxembourg	34.15	6.68	24%	Tonga	15.32	-1.46	-9%
Belgium	22.23	6.47	41%	Thailand	32.47	-1.47	-4%
Papua New Guinea	26.47	6.27	31%	Hungary	19.68	-1.71	-8%
India	30.50	6.10	25%	South Korea	34.30	-2.19	-6%
Nepal	22.25	5.73	35%	Nicaragua	12.37	-2.25	-15%
Japan	30.08	5.70	23%	Paraguay	15.92	-2.41	-13%
Switzerland	30.18	5.59	23%	New Zealand	18.88	-2.59	-12%
Philippines	24.78	5.31	27%	Fiji	21.62	-3.44	-14%
Brunei	49.87	5.00	11%	Australia	21.40	-3.48	-14%
Bangladesh	23.61	4.48	23%	Poland	18.61	-3.71	-17%
Venezuela	28.69	4.26	17%	Slovak Republic	23.30	-4.36	-16%
Jamaica	23.72	4.24	22%	Greece	17.22	-4.44	-20%
Denmark	21.06	3.36	19%	Mexico	20.74	-4.61	-18%
Uruguay	13.56	2.62	24%	Iceland	16.62	-6.27	-27%
Panama	24.88	2.24	10%	El Salvador	13.92	-6.51	-32%
France	19.42	2.09	12%	Canada	20.17	-7.03	-26%
Finland	23.90	2.04	9%	Brazil	15.34	-7.31	-32%
Germany	20.42	1.79	10%	Vanuatu	11.91	-7.33	-38%
Argentina	17.81	1.73	11%	Colombia	16.86	-7.56	-31%
Spain	21.94	1.50	7%	Sri Lanka	21.15	-8.23	-28%
Austria	22.46	1.32	6%	Cambodia	12.84	-8.82	-41%
Netherlands	25.28	0.99	4%	Taiwan	26.98	-9.16	-25%
Bolivia	14.92	0.87	6%	Tajikistan	11.77	-9.35	-44%
Italy	21.25	0.82	4%	Kyrgyz Republic	10.61	-9.56	-47%
Czech Republic	25.19	0.78	3%	Turkey	16.08	-9.87	-38%
Indonesia	27.17	0.20	1%	Costa Rica	15.01	-10.14	-40%
United Kingdom	16.15	-0.34	-2%	United States	15.95	-10.44	-40%
Dominican Republic	21.63	-0.46	-2%	Trinidad and Tobago	26.56	-10.80	-29%
OECD					22.31	0.39	2%
All 70 Countries in Sample					22.25	-0.26	-1%
Note: Each country's saving rate is the average over the years for which data are available for that country.							
The sample period is from 1980 to 2007, but some countries do not have data for the entire sample period.							

Table 5 Determinants of National Saving in China and OECD			
(Annual average over 2001-2006; in percentage terms)			
Explanatory Variable	China	OECD Average	China-OECD Gap
Ln(Real GDP Per Capita)	8.2	10.3	-2.1
Growth of Real GDP Per Capita	9.2	2.2	7.1
Adjusted Growth Rate	120.0	3.8	116.2
Domestic Credit/GDP	138.4	132.2	6.2
Old Dependency	10.6	22.1	-11.6
Young Dependency	32.4	26.3	6.1
Urbanization	39.0	75.1	-36.1
Social Spending	4.1	20.8	-16.7
Inflation	1.3	2.6	-1.2
Real Interest Rate	2.3	3.9	-1.6
Government Budget Balance	-1.8	-0.8	-1.0
Real Exchange Rate Depreciation	0.7	-1.0	1.7
Undervaluation	47.4	-55.7	103.1
East Asia Dummy	1.0	0.1	0.9
(Annual average over 1990-2000; in percentage terms)			
Explanatory Variable	China	OECD Average	China-OECD Gap
Ln(Real GDP Per Capita)	7.5	10.1	-2.6
Growth of Real GDP Per Capita	8.6	2.2	6.4
Adjusted Growth Rate	197.1	4.2	192.8
Domestic Credit/GDP	99.7	106.3	-6.6
Old Dependency	9.0	20.7	-11.7
Young Dependency	39.3	28.7	10.6
Urbanization	31.5	74.1	-42.6
Social Spending	1.8	20.3	-18.5
Inflation	7.1	4.2	2.9
Real Interest Rate	1.9	6.3	-4.3
Government Budget Balance	-2.5	-2.8	0.2
Real Exchange Rate Depreciation	3.6	0.7	2.9
Undervaluation	47.1	-55.0	102.1
East Asia Dummy	1.0	0.1	0.9
Notes: (1) OECD comprises 27 countries, including two East Asian countries (Japan and S. Korea);			
(2) Unlike other varaibles, Ln(Real GDP Per Capita) is not reported in percentage terms.			

Table 6.1 Contributions of Explanatory Variables to the China-OECD Saving Gaps (percent)						
Based on coefficients estimated with China in dataset; 2001-2006						
Explanatory Variable	**Model B1**	**Model B2**	**Model B3**	**Model B4**	**Model B5**	**Model B6**
Ln(Real GDP per Capita)	-14.9	-15.6	-14.4	-13.7	-15.0	-13.0
Growth of Real GDP per Capita	1.4	1.1	1.7	1.0	2.2	1.9
Adjusted Growth	2.6	3.0	1.3	2.0	2.0	1.6
Domestic Credit/GDP	-0.5	-0.3	-0.5	-0.4	0.0	-0.2
Old Dependency	12.8	13.7	12.2	11.8	13.9	10.4
Young Dependency	-2.2	-2.3	-1.4	-1.5	-2.2	-1.9
Urbanization	2.4	4.4	2.3	3.6	4.0	5.0
Social Spending	4.7	4.1	4.3	0.1	4.5	1.4
Inflation		0.0				
Real Interest Rate			0.5			
Gov't Budget Balance				-0.6		
Change in Real Exchange Rate					0.4	0.4
Undervaluation					2.5	2.6
East Asia Dummy						12.0
Total contribution to saving gap	6.3	8.1	6.1	2.3	12.3	20.2
China-OECD saving rate gap	23.6	23.6	23.6	23.6	23.6	23.6
Based on coefficients estimated with China in dataset; 1990-2000						
Explanatory Variable	**Model B1**	**Model B2**	**Model B3**	**Model B4**	**Model B5**	**Model B6**
Ln(Real GDP per Capita)	-18.7	-19.6	-18.0	-17.2	-18.8	-16.3
Growth of Real GDP per Capita	1.3	1.0	1.5	0.9	2.0	1.7
Adjusted Growth	4.3	5.0	2.2	3.3	3.4	2.7
Domestic Credit/GDP	0.5	0.3	0.5	0.4	0.0	0.2
Old Dependency	13.0	13.9	12.5	12.0	14.1	10.6
Young Dependency	-3.7	-3.9	-2.4	-2.6	-3.8	-3.2
Urbanization	2.8	5.2	2.7	4.3	4.7	5.9
Social Spending	5.2	4.6	4.7	0.1	5.0	1.5
Inflation		0.1				
Real Interest Rate			1.4			
Gov't Budget Balance				0.2		
Change in Real Exchange Rate					0.1	0.1
Undervaluation					2.5	2.6
East Asia Dummy						12.1
Total contribution to saving gap	4.7	6.6	5.1	1.4	9.2	17.9
China-OECD saving rate gap	18.4	18.4	18.4	18.4	18.4	18.4

Note: Marginal contribution of ***X*** = (***X*** in China - ***X*** in OECD)/(1-coefficient of lag saving); the coefficients used are taken from regressions presented in Table 2B, which includes China in the dataset.

Table 6.2 Marginal Contributions of Explanatory Variables to the China-OECD Saving Gaps (percent)						
Based on coefficients estimated without China in dataset; 2001-2006						
Explanatory Variable	**Model B1**	**Model B2**	**Model B3**	**Model B4**	**Model B5**	**Model B6**
Ln(Real GDP per Capita)	-15.4	-13.9	-13.2	-14.1	-14.7	-14.7
Growth of Real GDP per Capita	1.0	1.0	1.3	0.6	2.0	2.0
Adjusted Growth	1.4	1.6	0.7	0.7	1.4	1.7
Domestic Credit/GDP	-0.4	-0.2	-0.5	-0.4	-0.1	-0.3
Old Dependency	12.2	11.8	7.9	11.6	13.7	12.8
Young Dependency	-2.2	-1.8	-1.3	-1.5	-2.1	-2.1
Urbanization	3.6	4.4	3.3	4.1	3.9	5.4
Social Spending	5.0	2.8	4.1	0.7	4.4	1.7
Inflation		0.0				
Real Interest Rate			0.4			
Gov't Budget Balance				-0.6		
Change in Real Exchange Rate					0.3	0.3
Undervaluation					2.3	1.4
East Asia Dummy						3.4
Total contribution to saving gap	5.2	5.6	2.7	1.1	11.2	11.7
China-OECD saving rate gap	23.6	23.6	23.6	23.6	23.6	23.6
Based on coefficients estimated without China in dataset; 1990-2000						
Explanatory Variable	**Model B1**	**Model B2**	**Model B3**	**Model B4**	**Model B5**	**Model B6**
Ln(Real GDP per Capita)	-19.3	-17.4	-16.6	-17.6	-18.4	-18.4
Growth of Real GDP per Capita	0.9	0.9	1.2	0.5	1.8	1.8
Adjusted Growth	2.3	2.7	1.2	1.1	2.3	2.8
Domestic Credit/GDP	0.4	0.2	0.5	0.4	0.1	0.3
Old Dependency	12.4	12.0	8.0	11.8	13.9	13.0
Young Dependency	-3.7	-3.2	-2.3	-2.6	-3.7	-3.6
Urbanization	4.3	5.2	3.9	4.9	4.7	6.4
Social Spending	5.5	3.1	4.6	0.8	4.8	1.9
Inflation		0.1				
Real Interest Rate			1.2			
Gov't Budget Balance				0.1		
Change in Real Exchange Rate					0.1	0.1
Undervaluation					2.3	1.4
East Asia Dummy						3.4
Total contribution to saving gap	2.8	3.5	1.7	-0.6	7.9	9.1
China-OECD saving rate gap	18.4	18.4	18.4	18.4	18.4	18.4

Note: Marginal contribution of ***X*** = (***X*** in China - ***X*** in OECD)/(1-coefficient of lag saving); the coefficients used are taken from regressions presented in Table 2B, which includes China in the dataset.

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