



# National savings rate and sectoral income distribution: An empirical look at China

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## ABSTRACT

China's saving rate is found to be higher than predictions of empirical estimations based on conventional models of consumption. This problem has been recently admitted as arising from research attention biased towards household saving, yet savings by the corporate and public sectors (termed the non-household sector) may be more important in China. We find strong evidence that the biased distribution of national income towards the non-household sector is a key determinant of high aggregate saving in China, with this situation reinforced by its huge surplus labor. Such a sectoral perspective, albeit useful for elucidating Chinese savings, was previously used in descriptive discussions. This perspective is formally taken into account in our empirical study generating significant findings. We also show that high Chinese savings have more or less to do with other economic, demographic, and institutional factors as identified in the literature.

## 1. Introduction

A trade war has been recently launched by the U.S. against China as its largest source of trade deficits (BBC-World News, June 15, 2018). However, Trump tariffs will not have much impact on this problem because it is the savings-investment gap that drives the trade balance, not the other way around (Wildau, 2018). Trade deficits of the U.S. are caused by its falling and low savings relative to its level of investment, and its recent deficit-financed tax cuts and spending hikes are likely to worsen its current account (Kehoe & Smith, 2018). The U.S. deficits with China have become more serious even during the trade war, and this situation is due to the savings-investment gap that has long existed in China as well as in the U.S. It is thus worthwhile to address why the U.S. has saved so less and why China has saved so much (e.g., 52.5% of GDP in 2008) (Ma & Yi, 2010). This study will focus only on the Chinese saving issue.

Yet this is a difficult issue called the “Chinese saving puzzle” (Modigliani & Cao, 2004), which was hotly debated not long ago but has not been resolved yet in the literature. China was blamed on its “savings glut” for trade frictions, economic imbalances, and even global financial crises (Greenspan, 2009; Yang, 2012). Various studies have emerged to explain this glut, but there exist certain flaws in those explanations as reviewed in the next section. The issue still remains open to debate as revisited in our paper. A serious flaw in the past studies was the biased attention paid only to household saving. Such saving is most important to aggregate (or national) saving in other economies but may not be so crucial in China, especially for the recent period (after 2000).

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While progress has been made in understanding China's household saving behavior, the literature is void of research on savings by its corporate and public sectors (referred to as the non-household or state sector) (Yang, Zhang, & Zhou, 2011).<sup>1</sup> China's household saving fluctuated around 20% of GDP in 2002 but has since increased only slightly; in contrast, its non-household saving has grown steeply, rising above 32% in 2008 (Ma & Yi, 2010). Thus focusing on household saving portrays an incomplete picture of aggregate saving (He & Cao, 2007). Cross-country studies find China as an outlier, and its national saving rate is one quarter higher than what can be inferred from empirical estimation (Kuijs, 2006; Park & Shin, 2009). To obtain a full picture, enough attention should be paid to the non-household as well as household savings. This paper attaches more importance to the corporate and public savings.

One reason for imprecise estimation of China's national saving is that the empirical work is based on flawed consumption theories which involve no income distribution. China's high rate of aggregate saving is attributable to the unequal distribution of income, through which the corporate, public, and household sectors are interrelated to each other. As more of national income is distributed to the investing non-household sector and as disposable income increases faster in this sector than in the consuming household sector, a natural outcome must be a rising and high rate of aggregate saving. It is therefore necessary to examine, as done in this paper, the effects of income distribution on the saving of each sector. Although the implication of those effects for aggregate saving was discussed in various op-eds and descriptive reports (Chen, Chen, & Tan, 2014; Laffargue & Yu, 2015), no formal empirical study for this implication has been conducted yet in the literature. Our paper will fill such a gap.

The paper establishes empirical evidence for the sectoral income distribution as a key determinant of China's national saving. This distribution is a common factor for all sectors as more of the given income distributed to one sector implies less of it left to another. These sectors are interrelated via this factor that, however, may have differing impacts on aggregate saving. Following previous studies our regression includes other economic, demographic, and institutional factors as control variables specific to sectors. Each of these covariates plays a special role for sectoral and national savings. A distinction between saving rates and propensities is made to elucidate the different effects on saving behavior of the common factor and specific factors. A two-stage least squares (2SLS) estimator is used to deal with endogenous variables in regressions for propensities and rates of sectoral savings. A seemingly unrelated regressions (SUR) estimator is employed to capture common shocks to interrelated sectors and heterogeneous factors that drive their own saving rates. An autoregressive distributed lag - error correction (ARDL-EC) estimator is invoked to extract the impact of the sectoral income distribution on the national saving rate. We find that a biased distribution of national income towards the non-household and away from the household sector is responsible for high saving in China. This important result was discussed before in a descriptive manner but has not been empirically tested yet in the literature. We also find that rising savings in those sectors are also attributable more or less to the one-child policy, reform-created uncertainty, massive capital investment, economic growth strategy, and monetary interventions in forex markets. Those findings are useful to derive outlook predictions and policy recommendations for saving and investment decisions in China.

The paper proceeds as follows. Section 2 provides a brief literature review. Section 3 proposes a concise theoretical formulation. Section 4 documents stylized facts observed in China. Section 5 presents empirical evidence found from Chinese data. Section 6 concludes.

## 2. Literature review

Since the high Chinese saving rate became a central issue for global imbalances, various studies have emerged to address its root causes and effects. However, almost all of them are devoted to studying Chinese household saving while ignoring the corporate and public savings that were equally important previously and have recently become more crucial to aggregate saving. This research bias arises because existing theories for backing up empirical studies are centered on household behavior and because previous studies for other economies that are used as China study references concentrated on household saving that dominates national saving in those economies. Such biased research for China along with the neglect of distributional factors creates a great deal of problems even in the household saving study itself, as noted in the literature (Chen et al., 2014).

These problems are listed below, showing why the Chinese saving puzzle is difficult to resolve. First, the life cycle theory is adopted to discuss income growth, population dependency, gender ratio, and life expectancy as Chinese saving determinants (Banerjee, Meng, & Qian, 2010; Chao, Laffargue, & Yu, 2011; Choukhmane, Coeurdacier, & Jin, 2013; Modigliani & Cao, 2004; Song & Yang, 2010). Yet the saving rate is higher among elderly and young people than the working class in China; this is not the case in the U.S. or the U.K. (Chamon & Prasad, 2010). Additionally, the demographic structure that is usually slow to vary cannot be used to account for the rapid rise in household saving observed in China (Kraay, 2000; Wei & Zhang, 2011).

Second, the liquidity constraint theory is used to explain high saving rates in China (Aziz & Cui, 2007). Since consumer credit and mortgage lending were previously unavailable in China, households could not borrow to consume but had to save for large purchases. China's financial system is much better developed today than before, but the saving rate is still increasing under lessened liquidity

<sup>1</sup> As a substantial portion of China's corporate sector, state owned enterprises (SOEs) are either owned by the central government (called “央企”) or by provincial and municipal governments (called “地方国企”). These enterprises, while receiving “capital transfers” (called “资金划拨”) for production and investment from their government owners, also return taxes and (part or all of) profits to those owners (called “利税上缴”) (Gu, Tam, Li, & Zhao, 2018). Thus there is no clear-cut boundary between the corporate and public sectors in China. Given the fact that both governmental departments and SOEs play an increasing role in the Chinese economy (Li, Liu, & Wang, 2015), it is more sensible to put the two sectors together as a state sector (termed the non-household sector) for more precise analysis on some occasions. On others, however, we just follow the literature to use the distinction between the corporate and public sectors when needed to do so.

constraints (Wei & Zhang, 2011). Young earners can now borrow against future wealth to smooth consumption over lifetime so that higher income growth, if anticipated, leads to lower saving (Carroll, Overland, & Weil, 2000). Nonetheless, high saving is coupled with fast growth in China.

Third, the precautionary motive theory is invoked to pinpoint reform-induced income uncertainty as a unique motive for Chinese saving (Blanchard & Giavazzi, 2006; Chamon, Liu, & Prasad, 2010; Meng, 2003). The anomaly is that the saving rate fell as life was less secure in the late 1990s with dramatic reforms leading to massive urban layoffs and state subsidy removals (Bonham & Wiemer, 2013). Yet the saving rate increased when life became more secure after 2000 that saw both the near completion of corporate reform and the significant progress in social welfare (Bai, Li, & Wu, 2012). The weak, mixed, or even negative links of saving with uncertainty are found in previous studies (Chamon & Prasad, 2010; Kraay, 2000; Wei & Zhang, 2011).

Fourth, the post-Keynesian and neoclassical theories are employed to explore whether rising income inequality has any bearing on higher Chinese saving (Jin, Li, & Wu, 2011). While the econometric estimation of national saving lacks micro foundation for aggregate analysis (Gu & Tam, 2013), the empirical studies for household saving have no macro implication for rising national saving (Chen, Kong, Wang, & Hu, 2017). Although (Gini-indexed) interpersonal income inequality has recently deteriorated, household saving has increased to a much lesser extent compared with its non-household counterpart, contributing relatively less to the rise in aggregate saving (Li & Yin, 2007). Thus greater importance should have been attached to the sectoral rather than interpersonal distribution of national income (Bai & Qian, 2009).

Fifth, Chinese saving behavior is also connected with other potential factors such as habit formation, cultural traditions, and family preferences (Cheng & Zhang, 2011; Horioka & Wan, 2007). The tradition and habit may account for the high level of Chinese saving, but cannot well explain its rapid hike in the recent period, let alone an observed structural shift around 2000. More factors are discussed as possible drivers for high saving, which include the low level of urbanization, the underdeveloped sector of service, the imbalanced ratio of gender, the exchange rate of undervalued currency, and the large set of policy-created structural distortions (Aziz & Cui, 2007; Guo & N'Diaye, 2010; Kuijs, 2006). Unfortunately, those studies for China are problematic in one way or another. For example, the imbalanced sex ratio causing competition for brides via saving (Wei & Zhang, 2011) takes place only in rural areas, but the rise in overall household saving has much to do with the saving behavior of urban families (Chen & Yang, 2013).

Despite expansive research, the Chinese saving puzzle has not been well addressed due to an over-emphasis on household saving. This problem is revealed in the form of various inconsistencies between observed realities and available theories surveyed above. The missing points from existing studies are the structural variation of sectoral savings and the sectoral distribution of national income. A new study resorting to a sectoral perspective may lead to an acceptable solution to the “puzzle”, as attempted in this paper. Although this perspective has been used recently in opinion editorials and descriptive discussions (Bai & Qian, 2009; Li & Yin, 2007), there are no formal studies as yet that incorporate such a perspective into regression specifications. Two factors are now perceived to be responsible for the rising and high rate of Chinese aggregate saving in the recent period (after 2000). One is that more of national income has been distributed to the non-household sector, and the other is that its higher saving contributes more to aggregate saving. Previous discussions did not tell why these two factors had arisen, and our work will explore in this direction.

### 3. Theoretical discussion

As claimed by some authors (Chen et al., 2014), existing theories have limited applicability to the case of Chinese saving so that the related empirical studies turn out to be imprecise or unrealistic. It is thus necessary to develop a theoretical model suitable for China saving study. We will do so by proposing an aggregate analysis model without resort to complicated formulations of inter-temporal choices or rational expectations. This model is not intended for general purposes but only utilized to identify the main determinants of China's national saving rate in a concise and informative manner.

We distinguish between the saving rate  $s_i = S_i/Y$  and saving propensity  $s_i^p = S_i/Y_i$  of sector  $i$  for  $i = \{H$  for households,  $NH$  for non-households}, where  $Y (= \sum Y_i)$  is the national income,  $Y_i$  is the disposable income of sector  $i$ ,  $S_i$  is the saving amount of sector  $i$ , and  $NH$  includes  $\{F$  for firms,  $G$  for governments}. The expression of

$$s = S/Y = \sum S_i/Y = \sum (S_i/Y_i)(Y_i/Y) = \sum \alpha_i s_i^p \quad (1)$$

characterizes all sectoral contributions to the national saving rate  $s$ , where  $S (= \sum S_i)$  is the amount of aggregate saving and  $\alpha_i$  is sector  $i$ 's share in national income.

In Eq. (1) decomposing national saving into sectoral components sheds light on driving forces behind the rising and high rate of Chinese saving. Clearly, the sectoral saving rates  $s_i$  and hence the aggregate saving rate  $s (= \sum s_i)$  hinge positively on both sectoral income shares  $\alpha_i$  and sectoral saving propensities  $s_i^p$ . While such sectoral income shares are determined by income distribution between sectors as a common factor that directly affects aggregate saving, each sectoral saving propensity is influenced by sector-specific heterogeneous factors that have indirect effects on national saving.

Specifically, let  $\alpha$  refer to the share of national income distributed to the non-household sector (i.e.,  $\alpha = Y_{NH}/Y$ ) and  $\beta$  to this sector's share in aggregate saving (i.e.,  $\beta = S_{NH}/S$ ). Introduce  $g_x = \Delta x/x$  as the rate of growth or percentage change in any variable  $x$ . Differencing Eq. (1), dividing it by  $s$  on its left-hand side and by  $S/Y$  on its right-hand side, and rearranging or collecting terms, we obtain a neat expression of

$$g_s = \frac{\beta - \alpha}{1 - \alpha} g_\alpha + \beta g_{s_{NH}^p} + (1 - \beta) g_{s_H^p} \quad (2)$$

for key determinants of Chinese aggregate saving. Obviously, the evolution  $g_s$  of the national saving rate is influenced by variations ( $g_\alpha, g_{s_i^p}$ ) in the sectoral income distribution and sectoral saving propensities, with the sectoral shares ( $\alpha, \beta$ ) of income and saving also playing some roles for such evolution.

More concrete results can be obtained from Eq. (2). First, the rise in aggregate saving rate will be quickened if the distribution of national income is increasingly biased towards the non-household sector. This is the case for China with  $(1 >) \beta > \alpha$  (as can be confirmed by data). Since there is no consumption in the corporate sector and since (social) consumption is much lower than (public) investment in the government sector, the saving share must be far higher than the income share within the non-household sector. Second, the national saving rate will increase more quickly if the non-household saving propensity goes up faster. Such co-movements will be reinforced by a higher saving share for the non-household sector. All these results hold true in China, especially for the recent period (since 2000), as will be shown as stylized facts documented in the next section.

#### 4. Stylized facts

It is useful to take a quick look at history first. Starting from a high rate around 35% of GDP in the early 1980s, China's national saving has been surging up to around 50% of GDP (CSY, 2018). This saving rate is much higher than what was experienced by other fast growing economies in their transition phases (e.g., 40% in Korea in 1983–2000 and 38% in India in 2008) (Ma & Yi, 2010). China's GDP per capita was only US\$7400 in 2010 when its saving rate rose above 50%; whereas, per capita incomes associated with their highest saving rates (below 50%) were US\$15,700 in Japan in 1974 and US\$15,500 in Korea in 1998 (Laffargue & Yu, 2015). History may help explain high saving in China; it used to adopt a national policy of developing its economy with neither internal nor external debt. This policy goal was largely achieved through high aggregate saving at about 30% of GDP in 1952–1980. Such three-decade long policy must have had certain impacts on subsequent saving decisions of policy makers and private agents. Yet the question is why China's national saving rate has kept on escalating for another three decades up to now.

Since its reform and opening-up policy was launched in 1978, China has been perceived to rely heavily on investment and trade for economic growth by sacrificing consumption. High savings are required to finance such growth strategy, and China's enormous savings indeed have led to rapid growth in industry and trade via massive capital formation (that expanded at 18.6% in 2011 and reached a level of 45.6% relative to GDP) (CSY, 2018). In the meanwhile, a substantial substitution of labor with capital has taken place in production, as reflected by a quick rise in the capital-to-labor ratio that was more than doubled in the 2000s (Ma & Yi, 2010). Under these circumstances, a huge labor supply in China exacerbates workers' bargaining power for pay raise despite their rising productivity (Knight, Deng, & Li, 2011). Surplus labor depresses aggregate consumption and domestic demand, aggravating the economy's reliance on trade for growth and pushing up the national saving rate further. Stylized facts documented below provide important insights into Chinese saving determinants.

Fig. 1 (left panel) exhibits the time path of China's income distribution between different sectors ( $Y_H, Y_F, Y_G$ ). Overall, disposable income increases in all three sectors yet with differing paces of changes in their share in national income. First, the relative stagnation in household income is attributable to a declining share of labor income for the working class, a low distribution of investment income by firms and banks, and a diminishing amount of net transfers from governments. The decline in wage is engendered by the 1995–2005 tough corporate restructuring (that resulted in massive layoffs) and underdeveloped service sectors and small firms (that

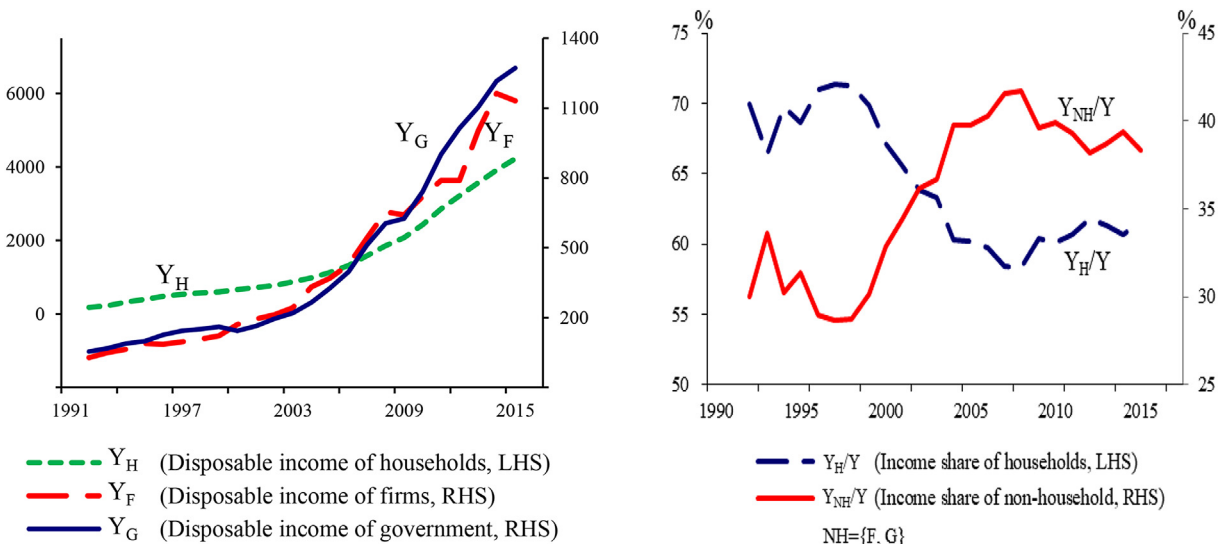


Fig. 1. Sectoral income distribution biased towards non-households.

Note: Data of  $Y$  and  $Y_i$  for  $i = \{H, F, G\}$  are collected from the CEIC Database and China's National Bureau of Statistics (NBS). Definitions of the two types of variables are also given in these data sources. The state sector (defined in footnote 1) is composed of the corporate and public sectors by following the literature (Chen et al., 2014).  $Y$  and  $Y_i$  are measured in terms of the Chinese currency (10 billion RMB).

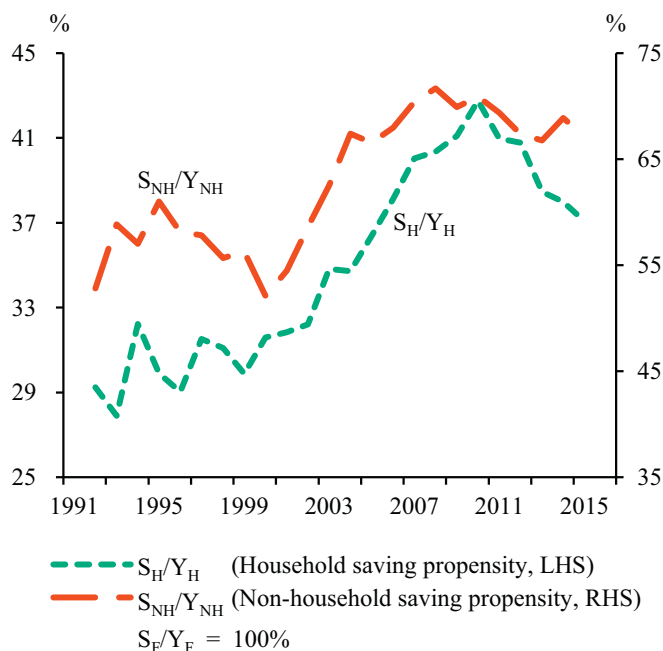


Fig. 2. Sectoral saving propensities.

Note: Data sources of  $Y_i$  and  $S_i$  for  $i = \{H, NH\}$  are the CEIC Database and China's NBS. The measurement of the two variables is also given in these sources, with saving variables defined as the differences between disposable incomes and consumption as in China's Flow of Funds Accounts.  $Y_i$  and  $S_i$  are measured in terms of 10 billion RMB (the Chinese yuan).

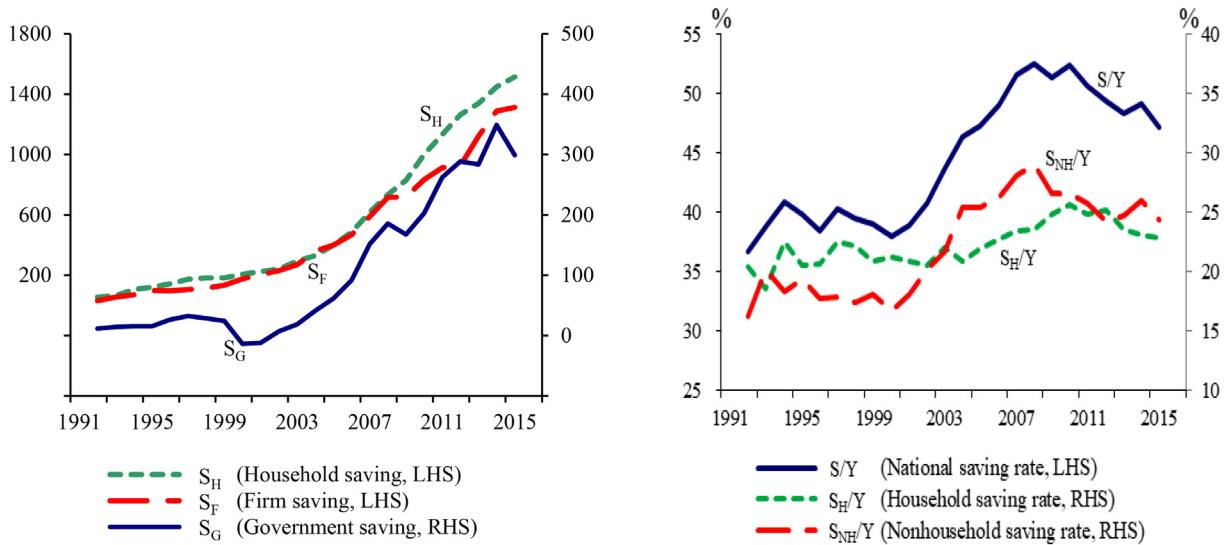
are labor-intensive businesses but constrained by limited access to financing) (Bai & Qian, 2009; Guo & N'Diaye, 2010). Second, rising corporate profits are due to huge cheap labor (with migrant workers reducing wage costs), low interest rates (with net interest payments more than halved in 1992–2007) (Ma & Yi, 2010), and various distortions or subsidies (e.g., market power and low-priced resources, created by governments in favor of state owned enterprises (SOEs) for promoting trade and growth) (Jha, Prasad, & Terada-Hagiwra, 2009). Third, fiscal revenue rose much faster than GDP in most years since the mid-1990s as a result of strong output growth, the 1994 tax and forex reforms, land sales for real estate development, and the contribution of companies and households to social welfare funds (Wong & Bird, 2008).

Fig. 1 (right panel) displays a direct comparison of income shares between the non-household and household sectors in China:  $Y_{NH}/Y$  versus  $Y_H/Y$ . Clearly, a trend rise of the non-household income share as of the 1990s has been accompanied by a corresponding trend fall of the household share. This is a natural outcome because GDP grew at about 10% a year on average in 1992–2011, but firms' disposable income swelled by 19.6% per year and governments' tax revenue rose by 16.6% per year (CSY, 2018). In contrast, the household income share suffered a substantial slide from both stagnant real wages under huge surplus labor and significant job losses under capital-labor substitution; this share is lower in China (60.5% in 2009) than in other countries (79.2% in the U.S., 69.2% in France, and 65.1% in Japan) (Laffargue & Yu, 2015). Much of tax revenue was used as investment in infrastructure construction or capital transfers to SOEs, leading to a decline in social consumption and hence a surge in public saving. Firms have no consumption at all so that their handsome profits went directly to corporate saving for capital formation and factor substitution.

Fig. 2 depicts China's sectoral saving propensities ( $S_{NH}/Y_{NH}$ ,  $S_H/Y_H$ ) (but called the saving rates by other authors). The non-household propensity  $S_{NH}/Y_{NH}$  is defined as  $(S_F + S_G)/(Y_F + Y_G)$  ( $< 1$ ) rather than  $S_F/Y_F + S_G/Y_G$  ( $> 1$ ). Note that the corporate saving propensity  $S_F/Y_F$  is 100% by definition since there is no consumption by firms. Clearly, the saving propensity increases faster in the non-household than in the household sector for a long period of time (note that the two axes in Fig. 2 have differing scales). Since  $S_F/Y_F = 1$ , we focus on  $S_G/Y_G$  and  $S_H/Y_H$  for concrete interpretation of propensity. First, rising government revenue led to higher public saving given stagnant social consumption, especially after 2001.<sup>2</sup> The government's marginal saving propensity was more than doubled in 1990s–2000s, and its average saving propensity reached 27% in 2009 (Ma & Yi, 2010). Such changes were made under the policy orientation for infrastructure project investment, pension asset establishment, and social program development. Second, the modest contribution of households to rising national saving in 1992–2009 was the outcome of two opposing impacts: a 10% fall in their income share and a 10% rise in their already-high saving propensity (Ma & Yi, 2010). Both impacts jointly

<sup>2</sup> There was a drastic drop in the government's saving propensity in 1997–2001 due to a greater increase in its spending than its revenue rise. The government substantially increased its spending to support both exporting firms that had experienced trade difficulties due to the Asian financial crisis and laid-off workers who had been affected by massive corporate restructuring.





**Fig. 3.** Amounts and rates of sectoral and national savings.

Note: Data on  $Y$ ,  $S$ ,  $Y_b$ , and  $S_i$  for  $i = \{H, F, G\}$  are taken from the CEIC Database and China's NBS. The definition of all variables is also given in these data sources.  $Y$ ,  $S$ ,  $Y_b$ , and  $S_i$  are measured in terms of 10 billion RMB (the Chinese yuan).

brought about an 11% drop in private consumption from 47% to 36% of GDP in the past decade (Baker & Orsmond, 2010). Despite the fall in households' income share, their saving propensity rose to 40.4% in 2009 which was much higher than in other countries (9.8% in the U.S., 16.1% in France, and 9% in Japan and Korea) (Laffargue & Yu, 2015).

Fig. 3 (left panel) plots the evolution of sectoral savings ( $S_F$ ,  $S_G$ ,  $S_H$ ) observed in China. First, firms' saving stems from capital depreciation and retained earnings. Depreciation has become increasingly large due to preceding massive investment (with capital stock reaching 170% of GDP in the mid-2000s) (Bai, Hsieh, & Qian, 2006). High retained earnings are due to low dividend payouts (e.g., SOEs were allowed to delay dividend payments until 2008), which are used by firms to self-finance their activities when faced with an underdeveloped capital market (IMF, 2009). Large depreciation and detention constitute the very reason for the high and rising rate of corporate saving (that was doubled in 1992–2004). Second, the public saving rate seems to have synchronized with the corporate rate in their variations since 2000. The Chinese government's policy has been observed to favor capital investment over social consumption. Such unusual policy must lead to a decline in public service and a surge in government saving (that more than doubled over 1992–2008 and accounted for half of the fast rise in national saving during the 2000s). Third, ordinary families, albeit suffering from stagnant growth in real income, still have to increase their precautionary savings due to weak social security, greater job uncertainty, and the fast dropping affordability of education and healthcare. In fact, part of increased household saving originates from the wealthy with high capital income and low spending propensity. Many of them are public or SOE officials who can substitute their private consumption with “public” consumption while facing little uncertainty owing to their privileged access to “social” security. The general public with low wage and without access to these benefits cannot possibly save over 40% of their disposable income, for at least 150 million rural Chinese are underemployed and remain desperately poor (Fan, 2013).

Fig. 3 (right panel) contrasts the non-household with household saving rates ( $S_{NH}/Y$  versus  $S_H/Y$ ), with the national saving rate  $S/Y$  taken as a benchmark. First, the non-household rate moves in line with the national rate over the entire sample period. The household rate, albeit varying with the national rate before 2000, has deviated greatly from it afterwards. The national and non-household rates rose more steeply than did the household rate in 2000–2008. Second, the household rate may rival the non-household rate occasionally but made only a small contribution to the recent spurt in national saving; in contrast, the non-household sector was the primary driver for such a spurt. A structural shift occurred in 2000, with the household rate exceeding the non-household rate before this threshold; yet the situation was reversed afterwards. Third, China's non-household saving rate (26.1% in 2009) is the highest in the world, higher than in any other countries (3.1% in the U.S., 6.1% in France, 11.5% in India, 15.7% in Japan, and 24.9% in Korea) (Laffargue & Yu, 2015). Fourth, with  $Y_{NH}/Y$  in Fig. 1 (right) and  $S_{NH}/Y$  or  $S/Y$  in Fig. 3 (right) put together for comparison, one sees that the time paths are quite similar between those rates. China's high national saving dominated by its non-household saving mirrors a biased income distribution towards the non-household sector at the expense of households. It is then no wonder that aggregate saving increased (or decreased) in China as more (or less) of its national income was distributed to the investing non-household sector than to the consuming household sector.

## 5. Empirical analysis

The sectoral perspective was previously involved in descriptive discussions on Chinese saving and is now used again in our work but for formal empirical analysis. While the three sectors ( $H$ ,  $F$ ,  $G$ ) that drive aggregate saving interact with each other through the distribution of national income (as the common factor), their respective saving behavior may also be influenced by other variables

**Table 1**  
List of variables with data sources.

| Variables  | Sources                                     |
|--|---|
| Sectoral savings (of households, firms, & governments)<br>Used to calculate saving propensities and saving rates | CEIC Database                               |
| Sectoral income distribution   | National Bureau of Statistics (NBS)         |
| Household: Labor income and capital income   | CEIC Database                               |
| Firm: Retained earnings and capital appreciation   |   |
| Government: Tax revenue and profits from SOEs  |   |
| Demographic factors: Size of the population  | World Development Indicators                |
| Size of the labor force  |   |
| Total and young dependency ratios  |   |
| Surplus labor (in urban areas and from rural areas)  | China Yearbook on Population and Employment |
| Institutional factors  | CEIC Database                               |
| Household: Share of education, healthcare, & housing expenses in total private consumption                       | National Bureau of Statistics               |
| Government: Fraction of government spending on social programs (education & healthcare)                          | Ministry of Health                          |
| Sex ratio (males to females)   | National Bureau of Statistics               |
| Uncertainty: Share of employment in state- and collective- owned firms in total urban employment                 | National Bureau of Statistics               |
| Capital / labor: Capital stock data calculated by using the method from Wang and Yao (2003)                      | National Bureau of Statistics               |
|  | Authors' calculation                        |
| Housing price index  | China Statistical Yearbook                  |
| Real interest rate   | World Development Indicators                |
| Aggregate production: GDP in real terms  | National Bureau of Statistics               |
| Gross fixed capital formation  |   |
| Industry value added   |   |
| Foreign exchange reserves  | National Bureau of Statistics               |

that differ between sectors (termed the sector-specific factors). We choose among regression methods for the most suitable one to address the effects on national saving of both the common and sector-specific factors.

### 5.1. Regression specifications

Table 1 provides definitions of variables and sources of data used in our analysis, with the sample spanning a recent period of 1992–2015 that saw Chinese saving reach the highest rate in history. The sector-specific variables include the number of working people, the size of population dependency, gender ratio, housing prices, uncertainty that arises from market reform, infrastructure construction, forex reserves, and institutional factors (including both social programs funded by the government and compositional shifts in private spending). These sector-specific factors underlie heterogeneous changes in sectoral saving propensities. The common factors to all sectors are China's surplus labor, GDP growth, and sectoral income distribution. These common factors exert pervasive yet perhaps differing impacts on sectoral savings and hence have consequential implications for national saving. Unlike other empirical studies, this study places emphasis on the sectoral income distribution shifts and their contributions to sectoral and national saving rates.

It is necessary to clarify how the determinants of the distributive factor are properly used in regression. First, the household income share  $Y_H/Y$  is often highly correlated with the wage share in GDP,  $W/Y$ , so the two shares should be used separately to avoid multicollinearity. Second, since the fall in  $W/Y$  has to do with the rise in the capital-to-labor ratio  $K/L$ , both variables cannot appear in the same regression. Third, the rise in  $K/L$  occurs as a result of manufacturing technology advancement or capital investment  $I/K$ , which is strengthened by low costs of financing. As such,  $K/L$ ,  $I/K$ , and real interest rates should not be used together. Fourth, the shift in the sectoral income distribution bad for the household sector is made worse by a huge labor supply (Gong & Yang, 2010). Thus surplus labor can be used as a key regressor jointly with  $K/L$  or  $I/K$  but not along with  $W/Y$ .

Our regressions are specified in accordance with the theoretical discussions and stylized facts presented earlier as well as the related studies in the previous literature. Three regression models are used to elucidate the effects on the aggregate saving rate of the sectoral income distribution and other economic, demographic, and institutional factors, as presented below:

$$\begin{aligned}
 \text{Sectoral saving propensity}_{it} &= S_i^P(\text{sector-specific factors}_{it}) + \varepsilon_{it}, \text{ for } i = \{H, G\} \\
 \text{Sectoral saving rate}_{it} &= S_i(\text{sectoral income distribution}_t, \text{sector-specific factors}_{it}) + \varepsilon_{it}, \text{ for } i = \{H, NH\} \\
 \text{National saving rate}_t &= S(\text{sectoral income distribution}_t, \text{othersectoral factors}_t) + \varepsilon_t
 \end{aligned} \tag{3}$$

In Eq. (3) the first model is the regression for sectoral saving propensities that hinge mainly on sector-specific factors. This empirical analysis of saving behavior is performed only for two sectors ( $H, G$ ), with the  $F$  sector excluded since its propensity is 100%. Two regressions are separately run for the two sectors in this model that is based on explanatory factors identified in previous studies. The two-stage least squares (2SLS) estimator is used in each regression to curb the problem of endogeneity and maintain the consistency of estimation. This problem may arise from a feedback effect (i.e., reverse causality) because more saving facilitates higher investment. Such an effect is likely to become stronger in the other two models since saving may encourage investment to the extent that the resulting factor substitution can lead to a drop in labor income.

The second model is the regression for sectoral saving rates, with the *F* and *G* sectors merging into the *NH* sector for a more focused analysis. Both the sectoral income distribution and sector-specific factors are included as explanatory variables because saving rates are engendered by income shares and saving propensities according to our Eq. (1). Dummy variables are used to address the structural shift as shown by earlier data plots. The 2SLS treatment is nested into the seemingly unrelated regressions (SUR) as stage-3 estimation for the model. This 3SLS arrangement is employed to deal with endogeneity while accommodating sectoral heterogeneity and cross-sector interrelation, which is good for higher efficiency and consistency. Pooling time series across sectors also allows us to extract more information from the sample with a greater degree of freedom.

The third model is the regression for the national saving rate based on our Eq. (2). The auto-regressive distributed lag - error correction (ARDL-EC) method is invoked to identify determinants of aggregate saving, with log-differenced values used for variables as their growth rates wherever applicable. This method is helpful for nullifying time trends, avoiding endogeneity issues, and ensuring estimation consistency. Both the sectoral income distribution and other cross-sector factors (such as  $S_{NH}/S_H$ ) are incorporated into the equation for an aggregate analysis. Sector-specific factors are also included since saving rates are influenced not only by between-sector distributional factors but also within-sector saving behaviors. Special consideration is given to the structural shift that occurred around 2000 and had asymmetric or nonlinear impacts on aggregate saving, and this can be done by using dummy variables or cross-sector regressors. Whichever technique is adopted depends on statistical testing for overall significance of estimation.

Various tests are performed to acquire reliable estimation. First, demographic and employment factors are treated as strictly exogenous and other variables as weakly exogenous, as in the literature (Edwards, 1996; Horioka & Wan, 2007; Schrooren & Stephan, 2005). The Durbin-Wu-Hausman (DWH) statistic is used to test the presence of endogeneity. Second, lagged values of weakly exogenous regressors are adopted as their internal instrumental variables (IVs) that are uncorrelated with disturbances. External IVs are also invoked to overcome endogeneity following the literature (Adam, Katsimi, & Moutos, 2012). The Sargan test is employed to check for the validity of selected IVs. Third, McElroy's  $R^2$  is calculated to measure the goodness-of-fit in estimation. A high enough level of this index implies that the model fits data well due to system estimation. Fourth, the Breusch-Pagan statistic is utilized to test whether SUR error terms across equations are contemporaneously correlated. The rejection of no correlation hypothesis is an indication of efficiency gains from system estimation. Fifth, the Hausman test is conducted under the null hypothesis that the 2SLS is consistent while the 3SLS is both consistent and efficient. No rejection of the null suggests the superiority of the 3SLS to the 2SLS estimator. Sixth, many more tests, such as the augmented Dickey-Fuller and Phillips-Perron unit root tests,<sup>3</sup> the Bounds test, and the Ramsey RESET test, are carried out to ensure legitimate ARDL-EC model specifications and seek out statistically precise estimation results.

## 5.2. Estimation results

A single-regression model is estimated via the 2SLS procedure for the sectoral saving propensity, with estimation results reported in Table 2(A) for the household sector and in Table 2(B) for the public sector. The results in Table 2(A) are interpreted here. First, household saving is strongly and positively influenced by the reciprocal of young and total dependency ratios and the ratio of working adults to household dependents as expected. These effects having to do with the one child policy are also obtained in other studies associated with life cycle hypothesis (Bonham & Wiemer, 2013). Second, the estimated impact on household saving of reform created uncertainty (for which a negative proxy is used) is significantly positive as asserted by the precautionary motive hypothesis. The traditional job security provided by Chinese firms was substantially reduced after the reform, with employment in state- & collective-owned firms cut by more than half during the 1995–2005 corporate restructuring. The increased exposure of workers to an uncertain future heightens their precautionary motives for saving as insurance against risk. Our result, though in line with some studies' in the literature, is at odds with the findings in others (Chamon & Prasad, 2010; Kraay, 2000; Wei & Zhang, 2011). Third, institutional factors are also found to have significant effects on household saving. China's social expenditures have been shifted via market reforms to the household sector as its private burdens. As a result from this institutional shift, the costs of education, healthcare, and housing are on the fast rise that is expected to continue indefinitely. China's rebuilding of social safety net lags behind and is widely believed to be unreliable. Increased savings by young couples for their children's future education are more or less offset by increased spending by older couples on their children's current education, and such compositional effects across age groups also apply to healthcare and housing expenses (Yang et al., 2011). Our result shows that those opposing forces for consumption spending have a strong negative net effect on household saving. Fourth, the imbalanced gender ratio and fast housing appreciation are found to have positive impacts on household saving; the housing impact is a bit significant but the gender impact seems weak. Our gender impact is somewhat similar to what has been established in the literature (Wei & Zhang, 2011), but our housing impact is different from mixed findings in the literature that are opposing to each other (Chen & Yang, 2013; Wang & Wen, 2012).

Estimation results in Table 2B for the public saving propensity are briefly explained below. First, infrastructure construction is found to have a direct and significant bearing on public saving. This finding accords well with the result from previous studies (Chen & Yao, 2011). As is widely perceived, every Chinese government at all levels (central and local) operating like a big company has a strong preference for capital investment and industrial development (Lin & Chen, 2013). Our estimation simply gets this policy orientation confirmed once again. Second, we find that public saving in China responds significantly to social programs that move closely with institutional shifts. Most shifts are such that the government draws back from social programs via reforms in the name of efficiency, and lower social spending strengthens its capability of saving aimed for investment (Xu, Zhang, Ding, & Tang, 2010).

<sup>3</sup> These test results and diagnostic checking results are not presented in the paper but will be available upon request.



Table 2A

2SLS estimation results for the household-sector saving propensity.

| Variables                | Reg1                 | Reg2                 | Reg3                 | Reg4                 |
|--------------------------|----------------------|----------------------|----------------------|----------------------|
| Demographic factor (I)   | 1.385***<br>(0.301)  | 0.864***<br>(0.204)  | 1.259***<br>(0.276)  | 0.749***<br>(0.176)  |
| Housing price index      | 0.067*<br>(0.040)    | 0.069*<br>(0.042)    | 0.080**<br>(0.039)   | 0.079*<br>(0.041)    |
| Demographic factor (II)  | 0.894<br>(0.575)     | 1.174**<br>(0.564)   | 0.941<br>(0.573)     | 1.201**<br>(0.558)   |
| Uncertainty of life      | −0.365*<br>(0.202)   | −0.550**<br>(0.218)  | −0.395*<br>(0.206)   | −0.579***<br>(0.220) |
| Institutional factor (I) | −0.638***<br>(0.148) | −0.636***<br>(0.157) | −0.551***<br>(0.160) | −0.568***<br>(0.165) |
| Constant                 | −68.818<br>(55.595)  | −90.829<br>(55.547)  | −81.582<br>(54.014)  | −98.755*<br>(54.049) |
| Adjusted R <sup>2</sup>  | 0.943                | 0.937                | 0.941                | 0.936                |
| DWH test                 | 3.4286               | 5.374                | 3.461                | 4.331                |
| [p-Value]                | [0.064]              | [0.020]              | [0.0628]             | [0.037]              |
| Sargan test              | 5.1546               | 6.3125               | 4.6617               | 5.726                |
| [p-Value]                | [0.2718]             | [0.277]              | [0.198]              | [0.2206]             |

Note: *Demographic factor (I)* refers to the ratio of labor force to total dependency in Reg1, the ratio of labor force to young dependency in Reg2, the reciprocal of total dependency ratio in Reg3, and the reciprocal of young dependency ratio in Reg4. *Demographic factor (II)* stands for the ratio of male to female gender. *Uncertainty of life* is characterized by the share of state-sector employment in total employment as a negative proxy for this regressor. *Institutional factor (I)* is captured by the share of education, healthcare, house expenses in total private consumption. *Housing price index* that has to do with private saving is an endogenous variable to which the ratio of gross fixed capital formation to GDP is applied as an external IV. The exogeneity of this index is rejected by the DWH test, and the validity of its IV cannot be rejected by the Sargan test. All variables (dependent or explanatory) are found to be stationary at some significance level by the augmented Dickey-Fuller and Philips-Perron unit root tests, so that there is no spurious regression at this level in Table 2A. Standard errors are in parentheses, with statistical significance indicated by \*\*\*  $p < 1\%$ , \*\*  $p < 5\%$ , and \*  $p < 10\%$ .

Third, the accumulation of forex reserves contributes to public saving mostly in a weak manner; the contribution is just a side-effect of the passive response of monetary policy to capital flows across borders. This policy intervention in forex markets, while intended to maintain currency stability and trade growth, results in more money creation and higher imputed seigniorage, thus increasing public revenue and saving rate; yet we find that this effect is weak. This result is similar to a previous finding that the suspected currency undervaluation may be a small contributor to Chinese saving (Hung & Qian, 2010). Fourth, the dummy variable aimed at reflecting time trends carries a very significant estimate, indicating that there does have been a steep increase in public saving since 2000 (Chen et al., 2014).

The 3SLS system estimation of two equations is conducted for the sectoral saving rates, and its results are recorded in Table 3 with their explanations given below. Two observations can be made from comparison between system estimation in Table 3 and single regression in Tables 2A and 2B. First, although the estimation results for sector-specific factors are largely similar in economic sense between Tables 3 and 2A, 2B, these factors are estimated with slightly differing degrees of statistical significance in the two tables. This is not surprising because the sectoral income distribution, while compatible with sectoral saving propensities after being added to the regression, exerts its own strong effect on sectoral saving rates as predicted by our earlier theoretical discussion. Second, various measures or determinants of the sectoral income distribution are used in Table 3 for robustness check and efficiency enhancement.<sup>4</sup> Almost all of them turn out to make a highly significant contribution to the sectoral saving rates (these key regressors are called the common factors; surplus labor is such a factor as well). For the first time in the literature, our result supplies solid empirical evidence for the consensus reached recently in descriptive discussions on the role of sectoral income distribution (Chen et al., 2014; Li & Yin, 2007).

It is worthwhile to provide further discussions about the effects of sector-specific factors. For the household sector, demographic factors surviving the inclusion of distributive factors still have strong influences on sectoral saving rates in Table 3. This arises due to the one child policy. Current spending is lowered thanks to fewer children in Chinese families, leaving more money for saving given income. The policy also makes it infeasible for parents to obtain support from their child when s/he grows up to work, forcing them to save for their own retirement. The long tradition of the Chinese civilization by raising kids as old-age insurance will cease to work for the elderly. The old dependency ratio, albeit lower than the young ratio, is rising slowly over time, implying a start-up of population ageing. This change is supposed to reduce household saving, but the current expectation of future ageing may induce people to save more now since social programs are expected to remain weak (Chao et al., 2011).

For the non-household sector, two points are worth discussing. First, why are the public and corporate sectors combined into the NH sector in this study? Doing so is due to the fact that SOEs are the economic backbone of the nation, constituting a large portion of the Chinese economy. They are just part of the state sector; their profits must be turned over to the state on top of their tax

<sup>4</sup> Efficiency gains will increase if regressors are less correlated between equations but their residuals are more correlated (Greene, 2012; pp.294–295).

**Table 2B**  
2SLS estimation results for the public-sector saving propensity.

| Variables                 | Reg1                  | Reg2                  | Reg3                  | Reg4                 |
|---------------------------|-----------------------|-----------------------|-----------------------|----------------------|
| Infrastructure investment | 3.265*<br>(1.685)     | 3.461***<br>(0.552)   | 3.444***<br>(0.554)   | 7.280***<br>(1.519)  |
| Foreign reserve index     | 3.688**<br>(1.473)    | 0.017<br>(0.051)      | 0.036<br>(0.067)      |                      |
| Institutional factor (II) | −1.889**<br>(0.902)   | −1.774**<br>(0.898)   | −1.709*<br>(0.890)    | −4.087***<br>(1.061) |
| Structural shift          | −21.584***<br>(4.567) | −33.631***<br>(6.871) | −33.199***<br>(6.775) | −15.405**<br>(6.794) |
| Constant                  | 27.205*<br>(14.051)   | −46.378**<br>(22.878) | −47.957**<br>(23.265) | 49.361**<br>(21.765) |
| Adjusted R <sup>2</sup>   | 0.883                 | 0.624                 | 0.629                 | 0.572                |
| DWH test                  | 3.44                  | 5.344                 | 4.7676                | 3.1898               |
| [p-Value]                 | [0.0636]              | [0.0208]              | [0.029]               | [0.074]              |
| Sargan test               | 0.3029                | 4.2937                | 4.2738                | 1.493                |
| [p-Value]                 | [0.859]               | [0.1168]              | [0.118]               | [0.4739]             |

Note: *Infrastructure investment* is measured as the portion of gross fixed capital formation financed by governments in Reg1 and Reg4, and the ratio of gross fixed capital formation to GDP in Reg2 and Reg3. *Foreign reserve index* is the ratio of forex reserves to GDP in Reg1, the growth rate of forex reserves in Reg2, and the growth rate of real forex reserves in Reg3. *Institutional factor (II)* is the portion of government spending on social programs (such as education and healthcare). *Structural shift* that occurred around 2000 after the Asian financial crisis is captured by a dummy variable. The inverse of wage share in GDP is used as an external IV for *Infrastructure investment* while lagged values of *Foreign reserve index* and *Institutional factor (II)* are used as their respective internal IVs. The exogeneity of the three regressors is rejected by the DWH test, and the validity of their IVs cannot be rejected by the Sargan test. All variables (dependent or explanatory) are found to be stationary at some significance level by the augmented Dickey-Fuller and Philips-Perron unit root tests, so that there is no risk of spurious regression at this level in Table 2B. Standard errors are in parentheses. \*\*\*  $p < 1\%$ , \*\*  $p < 5\%$ , and \*  $p < 10\%$ .

obligations. Some studies simply attribute high Chinese saving to the behavior of the public as well as the household sector without involving the corporate sector (Chen et al., 2014; Xu et al., 2010). Yet this neglect is quite questionable; corporate saving is too important to ignore, as is indicated in Fig. 1 (left panel) and Fig. 3 (left panel) and also implied by our regression result. Second, the government (or the *NH* sector) is a public sector with social functions (to a large extent) so that its sector-specific factors actually have spillover effects on other sectors (the *H* sector). For example, as a benefit to households but a cost to governments, social programs if greatly weakened can become a significant force to push up public saving as well as private saving, as evidenced by our estimation in Table 3. A rise in public revenue or corporate profits implies that more of national income is distributed to the investing *NH* sector while less of it is left to the consuming *H* sector. Such biased distribution tends to make the *NH* saving rate increase faster than the *H* saving rate, thereby lifting up the aggregate saving rate.

A single-equation model is estimated in Table 4 for the national saving rate by means of ARDL as a dynamic technique applied to China data. This empirical work is mainly used as a robustness check for our key results about the effects of sectoral income distribution. The findings from Table 4 estimation are briefly summarized below. First, the sector-specific factors now become weaker in explaining national saving when various measures or determinants of income distribution are included as a cross-sector regressor. Second, estimates for all these measures are rightly signed and statistically significant and such distributive factors common to all sectors have robustly strong impacts on national saving. Third, the household sector is found to give way to the non-household sector in dominating the evolution of China's aggregate saving rate, as is implied by the significant estimate for the cross-sector ratio of *NH*-saving to *H*-saving. Fourth, GDP growth is estimated to have a significant and positive effect on this saving rate as expected. These findings are largely consistent with the results recorded in Table 3 in terms of common factor effects. For sector-specific factors, however, some of their estimates are incorrectly signed or turn insignificant in the reported regressions. This arises perhaps because cross-sector income distribution overrides individual sectoral behavior in estimating national saving. Such an outcome can only be spotted in Table 4 as a more aggregate analysis at a truly macro level.

### 5.3. Discussion on driving forces behind sectoral income distribution

It is worthwhile to talk further about sectoral income distribution as an underlying determinant of China's aggregate saving in relation to its growth strategy. China's high saving is engendered by its biased income distribution towards its non-household sector and is also reinforced by its huge stock of surplus labor. The redundant labor supply lowers real wage and depresses consumption demand, making it necessary to rely on export trade for economic growth. Trade expansion requires industrial development that in turn entails massive investment. Capital formation needs sustainable financing from sufficient saving that can be more effectively supplied by the non-household rather than the household sector. The *NH* sector takes various measures to support preferred technological development, with high domestic saving maintained through low interest rates, favorable corporate taxes, and stagnant labor remuneration. The resultant rise in factor substitution leads to worsening income inequality that is bad for boosting consumption but good for stimulating profits and savings. A vicious circle thus created has continued for decades until now and may be ultimately disrupted by the Trump trade war. Our results provide empirical evidence from which policy implications can be extracted

**Table 3**  
3SLS (i.e., 2SLS + SUR) estimation results for the *NH* and *H* sectoral saving rates.

| Variables                     | Reg1                | Reg2                 | Reg3                 | Reg4                 | Reg5                 |
|-------------------------------|---------------------|----------------------|----------------------|----------------------|----------------------|
| Household sector              |                     |                      |                      |                      |                      |
| Common factor (I)             | 0.214***<br>(0.017) | 0.186***<br>(0.024)  | 0.227***<br>(0.016)  | 0.177***<br>(0.024)  | 0.226***<br>(0.028)  |
| Demographic factor (III)      | 0.544***<br>(0.106) | 0.662***<br>(0.134)  | 0.478***<br>(0.100)  | 0.668***<br>(0.134)  | 0.697***<br>(0.080)  |
| Housing price index           |                     |                      |                      |                      | 0.076***<br>(0.027)  |
| Uncertainty of life           | −0.189**<br>(0.077) | −0.047<br>(0.049)    | −0.154**<br>(0.074)  | −0.030<br>(0.048)    | −0.422***<br>(0.146) |
| Institutional factor (I)      |                     |                      |                      |                      | −0.279***<br>(0.072) |
| Non-household sector          |                     |                      |                      |                      |                      |
| Common factor (II)            | 0.522***<br>(0.111) | 0.992***<br>(0.065)  | 0.030***<br>(0.005)  | 0.748*<br>(0.405)    | 0.004<br>(0.011)     |
| Surplus labor                 |                     |                      |                      |                      | 1.262***<br>(0.280)  |
| Forex reserve index           | 0.136***<br>(0.029) | 0.037*<br>(0.019)    |                      | 0.261***<br>(0.065)  | 0.150***<br>(0.038)  |
| Institutional factor (II)     | −0.019<br>(0.101)   | −0.202*<br>(0.104)   | −1.013***<br>(0.180) |                      | −0.807***<br>(0.287) |
| Structural shift              |                     | −5.032***<br>(1.937) |                      | −3.797***<br>(1.198) | −5.711**<br>(2.859)  |
| Tests for the entire system   |                     |                      |                      |                      |                      |
| McElroy R <sup>2</sup>        | 0.8989              | 0.889                | 0.6748               | 0.8877               | 0.878                |
| Breusch-Pagan (B–P) statistic | 3.052               | 7.88999              | 8.6459               | 5.1575               | 8.312                |
| [p-Value]                     | [0.0806]            | [0.0049]             | [0.003]              | [0.023]              | [0.004]              |
| Hausman statistic             | 0.79                | 1.24                 | 0.95                 | 1.32                 | 0.23                 |
| [p-Value]                     | [0.8526]            | [0.7436]             | [0.812]              | [0.723]              | [0.999]              |

Note: *Common factor (I)* is the household income share. *Demographic factor (III)* is the ratio of labor force to young dependency in Reg (1, 3), the ratio of labor force to total dependency in Reg (2, 4), and the reciprocal of total dependency ratio in Reg5. *Common factor (II)* is the non-household income share in Reg (1, 2), the capital-to-labor ratio in Reg (3, 5), and the growth rate of capital formation (i.e., investment /capital) in Reg4. *Forex reserve index* is the ratio of forex reserves to GDP in Reg (1, 4) and the growth rate of real forex reserves in Reg (2, 5). *Institutional factor (II)* is the fraction of government spending on social programs. *Structural shift* is associated with one dummy variable in Reg (4, 5) to reflect the changes that have taken place since 2000 after the Asian financial crisis, and with another in Reg2 to capture the changes triggered by China's mid-1990s forex reform. Lagged values of endogenous variables are used as their internal IVs in 2SLS estimation. The necessity for SUR system estimation and the superiority of the 3SLS to the 2SLS regression are, respectively, confirmed by the B–P and Hausman tests. All variables (dependent or explanatory) are found to be stationary at some significance level by the augmented Dickey-Fuller and Philips-Perron unit root tests, so that there is no risk of spurious regression at this level in Table 3. Standard errors are in parentheses.

\*\*\*  $p < 1\%$ .

\*\*  $p < 5\%$ .

\*  $p < 10\%$ .

for those issues (Kehoe & Smith, 2018; Laffargue & Yu, 2015).

For greater clarity, it is necessary to reiterate what factors contribute to the change in sectoral income distribution. Since the rise in the non-household income share mirrors the fall in the household income share and since households' labor income dominates their capital income in China (Xiong, 2013), it suffices to focus only on its labor market that becomes worse for the working class. On the supply side is the large stock of surplus labor that moves in line with the huge population. As estimated in Table 1 of Zhao, Jiao, and Han (2018), the ratio of surplus labor in agriculture to rural employment increased from 21.63% in 1984 to 45.25% in 2015, and surplus labor also exists in urban areas but to a lesser extent. Rising surplus labor as a demographic change is equivalent in effect to the labor supply curve shifting to the right, leading the equilibrium wage to decline, albeit good for higher employment.

On the demand side for labor is the corporate sector that experiences a steady trend rise in the ratio of capital to labor as estimated by Zheng, Hu, and Bigsten (2009) and as shown in our Table 5 with updated data:

That the  $K/L$  ratio keeps on increasing is a global phenomenon (Karabarbounis & Neiman, 2014), which occurs in China for three reasons. First, as shown in the left panel of Fig. 4, there is a trend fall in lending interest rates, with lower costs of capital conducive to greater usage of capital. Second, as implied also in the left panel of Fig. 4, there is a steep increase in total spending on research and development relative to GDP, with rapid advances in manufacturing technologies making it necessary to speed up the use of more capital for efficient production. Third, the corporate income tax change in China is good for capital construction since the tax rate for all firms dropped from 33% in 1994–2007 to 25% in 2008–2016 and the tax rate has since fallen to 20% for micro-sized firms and 15% for high-tech firms (CCITL, 1994, 2008, 2017). The rising ratio of  $K/L$ , indicating the increased substitution of labor with capital, reduces firms' demand for labor, thus pushing the labor demand curve to shift to the left and resulting in lower levels of both wage and employment in market equilibrium.

**Table 4**  
ARDL-EC estimation results for China's national saving rate.

| Variables                     | Reg1                  | Reg2                  | Reg3                  | Reg4                   | Reg5                  |
|-------------------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|
| Common factors                |                       |                       |                       |                        |                       |
| Wage/GDP                      | −0.604**<br>(−2.876)  |                       |                       |                        |                       |
| Surplus labor                 |                       | 0.952**<br>(2.754)    |                       | 0.557***<br>(4.828)    |                       |
| Economic growth model         |                       | 0.247*<br>(2.080)     | 0.292***<br>(5.312)   | 0.520***<br>(8.793)    |                       |
| Real interest rate            |                       |                       |                       | −0.004*<br>(−2.366)    |                       |
| NH saving / H saving          |                       |                       |                       | 0.585***<br>(20.525)   | 0.598***<br>(8.069)   |
| Sector-specific factors       |                       |                       |                       |                        |                       |
| Demographic factor (IV)       | 1.254***<br>(9.127)   | −0.206<br>(−1.557)    | 0.255***<br>(3.489)   | −0.064<br>(−1.022)     | 0.241***<br>(5.771)   |
| Forex reserve index           | 0.015<br>(0.762)      | 0.060**<br>(2.912)    | 0.080**<br>(2.723)    | −0.005<br>(−0.781)     | 0.012<br>(1.140)      |
| Control variables             |                       | −0.359<br>(−1.170)    | −0.010<br>(−0.074)    |                        |                       |
| Error correction (EC)         | −0.736***<br>(−3.750) | −0.537***<br>(−3.123) | −0.619***<br>(−3.250) | −1.048***<br>(−10.555) | −0.726***<br>(−5.239) |
| Bounds test ( <i>F</i> -stat) | 7.352***              | 3.729**               | 6.766***              | 10.641***              | 11.381***             |
| Ramsey RESET test             | 1.183                 | 2.337                 | 0.677                 | 0.387                  | 0.872                 |

Note: *Economic growth model* refers to the capital-to-labor ratio in Reg2, real GDP in Reg3, and the ratio of industry value added to GDP in Reg4. *Demographic factor (IV)* is the ratio of labor force to total dependency in Reg(1, 2) and the ratio of labor force to young dependency in Reg(3, 4, 5). *Forex reserve index* is forex reserves/GDP in Reg3 and the stock of forex reserves in the other Reg's. *Control variables* are the housing price index in Reg2 and the fraction of public spending on social programs (i.e., *Institutional factor (III)*) in Reg3. Log transformation is applied to all variables except the real interest rate that may be occasionally negative. The intercept term is estimated but not reported. Only the long-run estimates are included in this table with the short-run coefficients omitted to conserve space. Short-run adjustments towards long-run equilibria are statistically strong as shown by significant estimates for the EC coefficient. The ARDL-EC model makes full use of information from the sample by using both level variables and their log-differenced values (i.e., growth rates) while resolving the problem of spurious regression by eliminating trends from the variables involved in co-integration estimation. The bounds test can be used to identify the existence of a levels equation regardless of whether the variables are  $I(0)$ ,  $I(1)$ , or are co-integrated (Greene, 2012; p.964). This test shows that the null hypothesis of no long-run relationships among the variables can be rejected in our case at high significance levels. Values of *t* statistics are in parentheses. The validity of the reported regressions is also indicated by the specification test.

\*\*\*  $p < 1\%$ .

\*\*  $p < 5\%$ .

\*  $p < 10\%$ .

**Table 5**  
The evolution of the capital-to-labor ratio ( $K/L$ ) over time in China.

| Year | K/L    | Year | K/L     | Year | K/L     | Year | K/L       | Year | K/L       |
|------|--------|------|---------|------|---------|------|-----------|------|-----------|
| 1971 | 4.7143 | 1981 | 8.2655  | 1991 | 12.9264 | 2001 | 127.0465  | 2011 | 1633.5832 |
| 1972 | 5.0488 | 1982 | 8.5695  | 1992 | 14.0617 | 2002 | 190.8307  | 2012 | 1946.8426 |
| 1973 | 5.3178 | 1983 | 9.0208  | 1993 | 15.5568 | 2003 | 267.6511  | 2013 | 2300.6676 |
| 1974 | 5.6448 | 1984 | 9.5020  | 1994 | 17.3552 | 2004 | 356.0381  | 2014 | 2673.3284 |
| 1975 | 6.0359 | 1985 | 10.1206 | 1995 | 19.4080 | 2005 | 462.2021  | 2015 | 3064.9593 |
| 1976 | 6.3893 | 1986 | 10.8502 | 1996 | 21.5550 | 2006 | 591.0707  | 2016 | 3464.3471 |
| 1977 | 6.7577 | 1987 | 11.6902 | 1997 | 23.7389 | 2007 | 744.5304  |      |           |
| 1978 | 7.1827 | 1988 | 12.5645 | 1998 | 26.1244 | 2008 | 931.0352  |      |           |
| 1979 | 7.5902 | 1989 | 13.2324 | 1999 | 28.6234 | 2009 | 1127.7692 |      |           |
| 1980 | 7.9657 | 1990 | 12.0791 | 2000 | 75.5147 | 2010 | 1367.9331 |      |           |

Note: The capital-to-labor ratio  $K/L$  is defined as the accumulated stock of real capital (1000 RMB) per worker, where the number of workers is collected from "Penn World Table PWT 9.0", and the updated capital stock is calculated according to the formula of  $K_t = (1-\delta)K_{t-1} + I_t$ , the rate of depreciation  $\delta = 5\%$ , the amount of real investment  $I_t$ , and the value of initial capital in 1952 (i.e., 6118.04 RMB).  $I_t$  is nominal investment (sourced partly from Zheng et al., 2009) adjusted by a deflator (taken from the "NBS Investment Price"). Admittedly, there is no consensus over the exact value of the  $K/L$  ratio since different researchers provide differing values for this complex index. Yet one thing that is certain among various studies is that this ratio maintains a significant upward trajectory.

The above analysis of demand and supply for China's labor market shows that the equilibrium wage should fall substantially as a result of the combined effects of a rightward supply shift and a leftward demand shift, though equilibrium employment on net balance may rise or decline depending on relative magnitudes of the right- and left- shifts. The actual situation in China is a trending

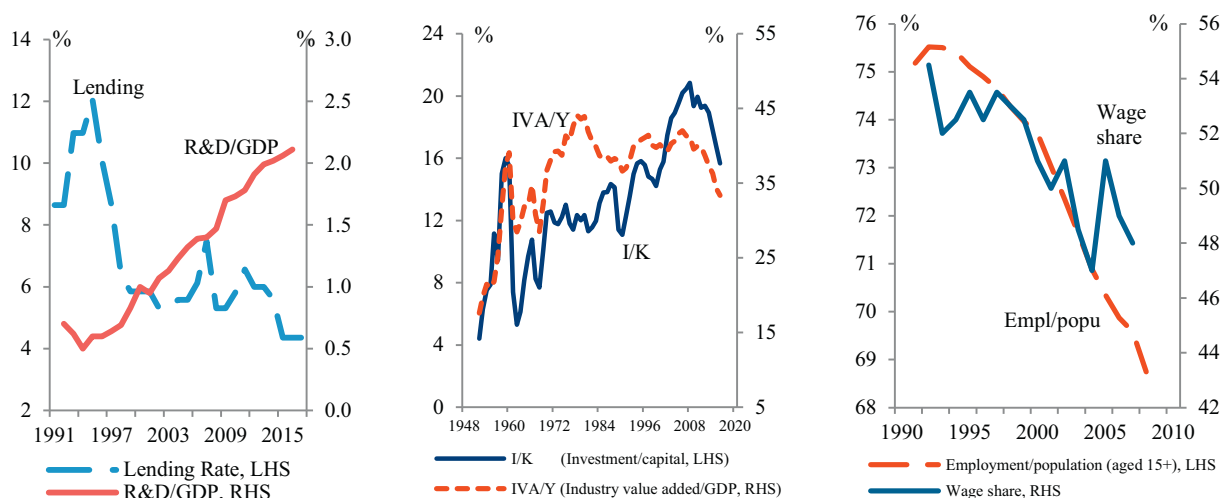


Fig. 4. Underlying factors behind worsening conditions for the working class in the labor market.

Note: Data sources for this figure are Ma and Yi (2010), China's Flow of Funds accounts, and the World Bank's World Development Indicator database. The definition of all variables is also given in these sources.

drop in the wage-to-GDP ratio accompanied by a downward slide in the share of employment in the population (aged 15–64), as shown in the right panel of Fig. 4. China's enormous saving makes it possible to undertake capital formation on a massive scale, leading to high capital growth ( $I/K = \Delta K/K$ ) and high industrial value added to GDP ( $IVA/Y$ ), as shown in the middle panel of Fig. 4. Although massive investment projects create a lot of construction jobs, an ever-rising capital-labor ratio ( $K/L$ ) after completion of one project after another may signal much more losses of job opportunities in many other industries under heightened substitution of capital for labor, with consequential adverse impacts falling on real wages for the vast majority of workers, as evidenced by the right panel of Fig. 4.

Numerous descriptive studies have emerged in the Chinese literature to explore the factors behind the change in sectoral income distribution and its implications for the recent spurt in the national saving rate (Wang, 2013). These studies are mostly based on China's Flow of Funds and resort to the primary and secondary distribution of national income as an easy approach to the saving issue (Pan, Du, & Cai, 2010). Some of those studies find that the household income share remains roughly stable in the primary distribution but experiences significant drops in the redistribution (i.e., income transfer) while at the same time the non-household share keeps on rising substantially in the secondary distribution and somewhat so even in the primary one (Zheng, 2012). Our explanation for variations in sectoral income shares, while largely consistent with that of those studies, makes it clearer how such variations are driven by the underlying factors.

This kind of explanation sheds light on the prominent impacts of those factors on the economy and society that go beyond just the national saving rate. Two such impacts, albeit not within the scope of this paper, are worth mentioning here due to their socio-economic importance. First, the current sectoral income distribution is biased towards the state sector controlled by the rich few at the expense of the general public that represents the vast majority of workers and farmers. Such biased distribution renders distributive inequality worsening and social unrest accumulating, with big trouble stored up for later. China would be confronted with political, social, and economic crises if continuing to neglect discontentment that prevails among people who live in destitution. Second, as less of national income is distributed to the consuming public, the domestic market would be shrinking and the reliance on export for growth could be aggravated. The growth strategy described above proves to be vulnerable to foreign attacks such as the tariff war launched now by the U.S. against China. Output growth that rests on foreign demand and domestic saving cannot be stabilized or sustained forever. Only when sectoral income distribution is corrected in favor of the working class can economic development be balanced to become healthy and sensible. The current trade war with the U.S. may not be as bad as it appears because this war is likely to push China growth to move on a sustainable path through structural reform. Under the intensified foreign pressure, whether fair or not, policy measures must be taken for effective reform with no more delay.

## 6. Conclusion

The current Sino-U.S. trade war is a very hot issue with serious repercussions for the world economy. People would get to know better that this problem is deeply rooted in another issue – high Chinese saving on top of low American saving – the issue that was hotly debated not long ago but still has not been resolved so far. This paper attempts to solve the Chinese saving puzzle by resorting to a sectoral perspective and putting emphasis on non-household-sector savings. This perspective was previously used in descriptive discussions but is now taken seriously into account in our formal study. The central contribution of this study is to provide empirical evidence on the important implication of sectoral income distribution shifts for dramatic variations in China's aggregate saving.

In this paper the real causes of China's high and rising rate of national saving prior to 2010 (i.e., before the economy reached a



“new normal”) are investigated through theoretical and empirical work. The stylized facts we document suggest that savings by the corporate and public sectors are more important than household-sector saving for the Chinese savings “glut”. All three sectoral savings approach their respective global top levels, jointly rendering China's national saving rate exceptionally high. Our empirical evidence with theoretical underpinnings shows that China's aggregate saving rate increases because its unequal distribution of national income becomes increasingly favorable to the investing non-household sector at the expense of the consuming household sector. Other economic, demographic, and institutional factors, such as the one child policy, reform-created uncertainty, economic growth strategy, massive capital investment, and monetary interventions in forex markets, are also found to play certain roles for the rise in China's sectoral and hence national saving rates.

The prospects of China's saving rate can be inferred from the results established above. This rate that reached its peak in 2008 is expected to trend down (e.g., from 52.5% in 2008 to 47.2% in 2015) (CSY, 2018). There are four reasons for such expectation. First, China can no longer rely on trade for growth owing to weakening external demands and intensified trade wars. To sustain growth, China will have to control its public investment and stimulate its domestic demand by distributing more income to the consuming public (with its scale of household spending expected to reach US\$ 5.8 trillion in 2018 in excess of the U.S. level) (CCTV, 2018), thus reducing the national saving rate. Second, the rise in taxes is expected to become smaller since China's economic growth is slowing down substantially. This tax revenue outlook, along with strong pressure for increasing public consumption and social welfare, will reduce the saving of government. Third, slower growth will leave smaller room for corporate saving. The rate of this saving may decline further since it is unlikely for corporate restructuring to reoccur in favor of firm profits, since SOEs can no longer delay dividend payments, and since labor costs are significantly rising due to minimum wage increases. Fourth, the government efforts to mitigate inequality can lower household saving since these efforts benefit low-income families with high spending propensities. Moreover, households' motive for precautionary saving will be weakened by the rebuilding of the pension system and by the less unequal access to the social safety net. Furthermore, both the total dependency ratio and the elderly population share are expected to rise quickly, and this tendency is associated with lower personal saving in high-income economies towards which China is heading.

Policy implications can also be obtained from our results. China is likely to remain on its high saving plateau that will still stay higher than other economies' for many years ahead. This claim is made for two reasons. First, China has entered the process of population ageing driven by its one child policy, so its government needs to maintain adequate saving to accumulate pension assets. Second, urbanization is just taking off in China while its industrialization remains to be completed, and this situation implies the necessity for building up physical capital through large enough amounts of savings. Faced with internal and external pressures, however, China has to undergo a transition from the current export-led, investment-driven growth model to a more balanced development strategy with no further increase in its rate of saving. Such a transition entails a long series of systematic structural adjustments. Among them are four policy options that are crucial and feasible in China, as stated below.

First, various forms of inequality (in income, wealth, social mobility, access to welfare programs etc.) must be reduced to alleviate social unrest and ensure growth sustainability. While minimum wage policy can mitigate income inequality, unfair access to socioeconomic mobility should also be changed by increasing government spending on rural education and poverty relief and by providing more low-rent housing and better service for the urban poor and new immigrants from rural areas. Second, housing markets that can affect saving behavior must be effectively managed since unequal access to homeownership may lead to greater wealth inequality under asset appreciation, and further to perpetuated inequality via cross-generation inheritance and intertemporal consumption. Such an adverse impact on lifetime wellbeing among the general public is too expensive to ignore by any society because it would otherwise risk spatial segregation and social tension. Third, urban job creation should be promoted by supporting small businesses and service sectors that are labor-intensive and by attenuating frictions in rural-labor migration. Finally, social welfare programs (in unemployment, education, healthcare, and pension) need to be strengthened because the current ones are still limited. This public policy can be valuable for continued flows of rural immigrants who seek urban jobs. Fiscal and taxation reform should be quickened to transfer more income from the corporate to the household sector and to make the social security net cover all workers and farmers.

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