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First results on assessing the reform options

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The Chinese pension system — first results on assessing the reform options

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Abstract

The aim of this paper is to analyse options for reforming the fragmented Chinese pension system that covers only 55 % of urban employees and a very small part of the rural population. After a brief history of pensions in China we present recent reform proposals and then discuss principles of pension reforms, with particular attention to reducing the pension contribution rates so that compliance could improve and coverage increase. As the Chinese population is ageing fast, we are presenting transition to a notional defined contribution (NDC) system as a model for adjusting the pension rules for increasing longevity. Transforming the accrued pension rights into NDC accounts and starting to apply the new NDC-inspired rules on indexation is not necessarily a jump into the unknown for the Chinese pensions system. Rather, it could be a useful and long-awaited clarification to the rules and a way to move towards a more uniform system nationwide. With the help of a simulation model based on Chinese data we produce scenarios for a range of pension reforms and assess their properties.

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1. Introduction and aim

Pensions in China face a dual challenge: (1) the current system covers only a small fraction of the population and does not function as intended, and (2) population ageing is progressing fast.

Low coverage and systemic flaws

Under the basic pension scheme for urban employees, pension expenditure was 2.5% of GDP in 2008 and revenue from contributions was 2.7%. As revenue has constantly exceeded expenditure, reserves have accumulated, amounting to 3.3% of GDP in 2008.[1] These figures are relatively small, and the pensions of the rural population added hardly anything to them. The main reason is, however, that less than 30% of all employees were covered and most of the rural elderly received no pension.

The current multi-pillar pension system for urban employees is fragmented, it does not work as intended and compliance with the rules is low. The multi-pillar system established in the 1990s was supposed to introduce individual fully funded accounts to top up the basic pension (20% of average urban wage), but due to problems in implementation (including fraud) the accounts are virtually empty as contributions were used to pay the pensions of current pensioners (or maybe even other expenditures). Thus, the question is how to cope with the accrued pension rights, i.e. whether to refill the individual accounts or to accept that the system has de facto become close to an unfunded PAYG system and set up modified rules from now onwards.

The current system is supposed to cover all 302 million (in 2008) urban employees, but in fact contributions are paid by or on behalf of 55% of them. Compliance is low because the contribution rate is relatively high (total of employer and employee contributions typically around 28% of wage), and probably because people do not trust the system due to unclear rules and suspicion that the system is not sustainable and that contributions might be used for other expenditures than their declared purpose.

The urban scheme covers some public service units, mainly in the education and health sectors. The rest of them and government civil servants have their own pension systems financed from government budgets. Their expenditure is estimated at roughly one per cent of GDP.

As for the 473 million rural area employees, in 2008, only 56 million, i.e. 12%, were covered by the public pension system. The number of retirees was 5.1 million, who received quite low pensions: in 2005 their monthly average pension was 58 Rmb (Birmingham and Cui, 2006).[2] Extending coverage to the rural population is a challenge that is clearly recognised by the Chinese authorities, as demonstrated by the government plan issued in August 2009[3] (see below).

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[1] Unless otherwise indicated, the source of the data is the National Bureau of Statistics of China (NBS 2009), China Statistical Yearbook 2009. We refer above to revenue from contributions, while total revenue according to NBS (2009) was 3.2% of GDP of which 0.5% was a transfer from the government according to the Ministry of Human Resources and Social Security of China (MHRSS). The assets are managed at provincial, city or county level (Impavido et al., 2009). The assets managed by the National Social Security Fund (NSSF), 2.4% of GDP at the end of 2009, come on top of them.

[2] For the order of magnitude: 58 Rmb (yuan) is equivalent to 6-7 euros according to the nominal exchange rates (2010); however, according to IMF/World Economic Outlook data, the purchasing power of the euro in China is 4.5 times the value in the EU-15 (the Member States before the 2004 enlargement), thus in terms of purchasing power 58 Rmb in China is about €30 in the EU-15.

[3] State Council Document 32, dated 1 September 2009.

The population is ageing fast — reforms are indispensable

The Chinese population, totalling 1.3 billion, is ageing fast. China's population over the age of 65 is now (2010) 111 million, and is expected to grow to 331 million by 2050. Life expectancy at birth is projected to increase from 73 years at present to 80 by 2050.

Population ageing seems to be the fastest in the world: the ratio of 65 year-olds to those aged 15-64 years is currently 11% and will increase to 38% by 2050 (according to the United Nations projection medium variant, the figure for 2050 is higher only for the most affluent welfare states where it is currently around 25%). This is shown in Figure 1, which also depicts the projection from the model used here that roughly follows the UN projection. The slowing pace in the UN projection for 2045 and 2050 can be doubted, as based on the same fertility and longevity assumptions our projection gives a more persistent rise. Our projection also indicates that the dependency ratio is heading towards the same level as in the most affluent welfare states.

Figure 1. Old-age dependency ratio in China and in the rest of the world
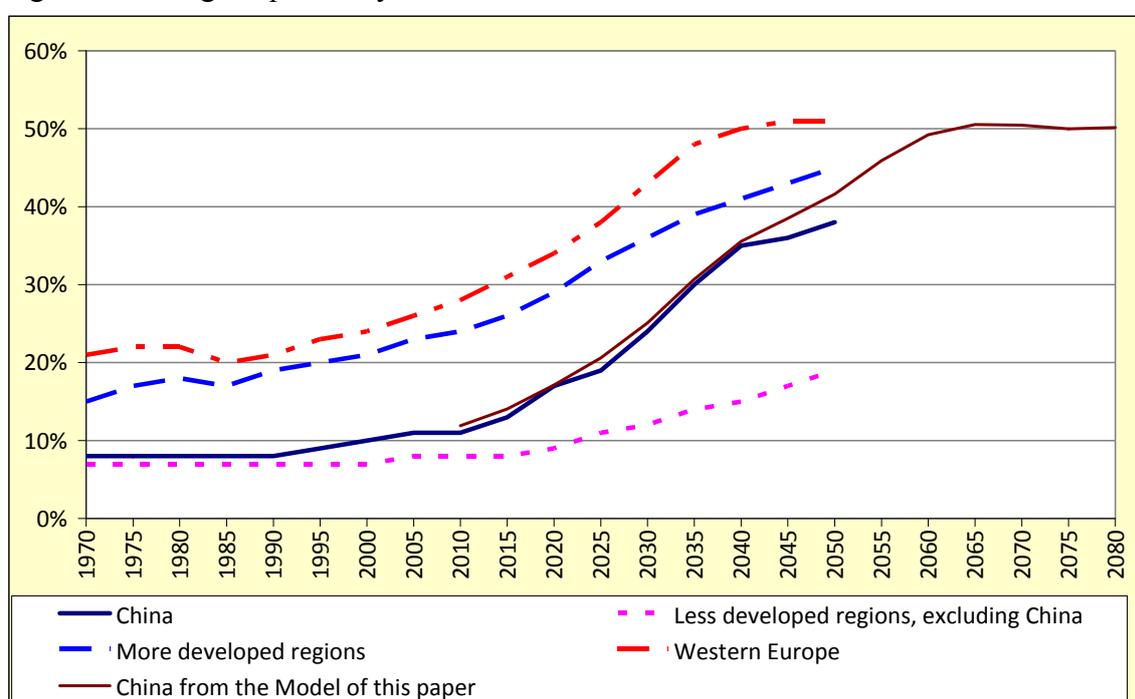
Legend: the old-age dependency ratio is the ratio of the population aged 65 years or over to the population aged 15-64, in %. For definitions of the regions see http://esa.un.org/unpp/index.asp?panel=5.
Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, http://esa.un.org/unpp. For the model result, author's calculation using the China Pension-System Simulation Model, see below.

The aim of this paper

As previous pension reforms have not succeeded in creating a stable and financially sustainable pension system, the Chinese authorities and experts have been considering proposals to reform the structure and expand the scope. A number of proposals have in the last few years been tabled jointly by Chinese and non-Chinese experts (for example, China Economic Research and Advisory Programme, 2005a and b). Some of these proposals are based on the view that it should be accepted that the system has become virtually a pure PAYG system; they therefore recommend moving to a so-called notional defined contribution (NDC) system, inspired by reforms in Sweden, Latvia and Poland. In an NDC system the contribution rate is determined, the contributions accumulate on a

notional capital account, which earns an administratively set return (for example, rate of increase in the wage bill), and at retirement the pension is determined by an annuity factor based on the retirement age (possibly chosen by the beneficiary under flexible rules) and the estimated remaining life expectancy. An NDC system can be unfunded or partly funded. In neither case is there a strict link between pension rights and assets held by the system.

The aim of this paper is to look into the various reform proposals and present model simulations to analyse their implications and offer alternative reform options, and perhaps most importantly, a template for designing new reform options and expressing them in terms of the key pension system variables. The general thrust will be to move from the fragmented system to more coherent rules following NDC principles, bearing in mind that NDC is not a panacea and leaves scope for different applications. Also, a fully funded, private sector-managed defined contribution (DC) second pillar is a possibility that could accompany the NDC pillar.

Analysing the reform options should be of interest to the government authorities as they bear the responsibility for the functioning of the system. Announcing reforms convincingly and early enough is important for the citizens as they should be able to form realistic expectations regarding their retirement age and pensions.

There are, however, also wider reasons for studying pensions in China. Low-cost unskilled labour from rural areas is an abundant source of labour supply. Pensions and their financing will affect its cost. Also, the supply of labour is affected by retirement age: it is obvious that the retirement age has to be raised sooner or later in order to alleviate the pension burden. The supply of labour and its cost, including pension contributions, will affect the production of goods and services. Therefore, pensions affect China and China affects the global economy as it is a large economy: measured in purchasing power standards, it is currently second only to the US, more than double that of Japan and more than three times that of Germany. Even if measured in current prices and exchange rates, it is in 2010 overtaking Japan to take second place.[4]

In addition to affecting the cost of labour, pensions also affect savings and therefore have repercussions on the external balance of the economy.[5] Due to its size, China will affect 'global imbalances', i.e. the current accounts of other countries, and their economic conditions in general. In the current discussion on remedies to the global economic crisis the view that China could and should boost domestic consumption is constantly repeated both by the Chinese authorities and others.[6] Here, Chinese pensions are a crucial factor and will remain so for 2-3 decades.

Outline

We start with a brief history of pensions in China (Section 2) and then present recent reform proposals (Section 3). To outline new reform options we first discuss principles (Section 4), proceed to reform scenarios produced with the China Pension-System Simulation Model (Section 5), assess the results (Section 6) and summarise them with concluding remarks (Section 7).

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[4] If currency areas are considered, the euro area is in second place before China.

[5] While savings in China are obviously affected by pensions, they may have also been affected by other factors, such as housing policies (see Chamon and Prasad, 2008).

[6] For example, the G-20 leaders stated in September 2009 that their members with sustained, significant external surpluses pledge, among other measures, to improve their social safety nets for strengthening their domestic sources of growth (G-20 Leaders' Statement, 2009).

2. Pensions in China: a brief history

Soon after the founding of the People's Republic of China (PRC) in 1949, a centralised pension system was established, with 3% of wages collected for revenue. It was mostly administered at local level by the trade unions. In 1969, amidst the Cultural Revolution, the trade unions were dismantled and state-owned enterprises (SOEs) were made responsible for pensions. This was the origin of the very fragmented system that still prevails today.

The second stage began in the late 1970s, under Deng Xiaoping, when economic reforms were initiated, including looser pension eligibility criteria. This resulted in a dramatic increase in the number of pensioners. The one-child policy was also instituted in this period, leading to a fall in the fertility rate to well below the replacement rate (which is roughly 2.1 per woman). According to China's Census, fertility is currently 1.3, while the UN estimate is 1.77. Pensions became an increasing burden for SOEs, which were also put under pressure in many other ways under the adjustment to a more market-oriented economy. The government — at its various levels — was called on to take over pension obligations. This led to an attempt in the mid-1980s to establish a nationwide municipal pooling of pensions, which again became very fragmented due to various disparities across regions and sectors (Williamson and Deitelbaum, 2005).

The third phase emerged in the early years of the 1990s, as it was recognised that the system was not only fragmented (with problems of portability etc.) but also that its financial sustainability was seriously jeopardised by the expected demographic change. This led to an attempt to build a multi-pillar system with basic pensions topped up by mandatory individual accounts and, in addition, by voluntary pension savings supported by tax concessions. The process introducing these principles was initiated in 1991 and was followed by several directives struggling with the balance between the target of establishing unified rules for the whole country and leaving choice to the provinces. Note that this process coincided with the publication of the famous 1994 World Bank report that prompted the move towards a significant fully funded, individual-based second pillar. In 1997 the World Bank published a report recommending for China a multi-pillar system, with 9% of wages going to the first pillar and 8% to individual accounts in the second pillar (Agarwala, 1997; and Piggott and Lu Bei, 2007). The former was supposed to deliver a 24% replacement rate and the latter 35%. The report saw some problems with the financial sustainability of the first pillar and also recognised that for the projected outcome from the second pillar the rate of return on assets was assumed to be higher than the rate of growth of the economy, which was and still is far from obvious.

In July 1997, State Council Document No 26 laid down broad principles and left scope for differing implementation by the provinces. Broadly, the document specified the first pillar — pure PAYG for Defined Benefits (DB) aimed at delivering, based on contributions paid over 15 years, a pension of 20% of city average pay — and a second pillar of individual accounts. The retirement age was set at 60 for men, 55 for women in management cadre and 50 for women workers. The main deviation from World Bank recommendations was that the contribution rates were set considerably higher (see below some comments in retrospect). Employers and employees were originally supposed to contribute 28% of wages, of which 20 percentage points (pp) were paid by the employers. Seven pp of this was supposed to go to individual accounts, gradually decreasing to 3 pp. Half of the 8 pp contributions from employees was initially supposed to go to individual accounts, and this was supposed to be gradually increased to the full 8 pp by 2005.

These parameter values were supposed to lead to a 58.5% replacement rate: 20 pp (on average) from the DB PAYG pillar, and 38.5% from individual accounts, according to the following formula: an 11% of wages contribution over 35 years, placed in the individual accounts with a rate of return equal to the average wage increase, generates a capital equal to 3.85 times the annual wage at retirement which is then divided by 120 to give the monthly pension, i.e. assuming 10 years of remaining life expectancy. This gives a pension equal to 38.5% of wage (Leckie and Pai, 2005). Upon death of the employee or retiree the balance on the account was inheritable. Because of this and also the fact that the remaining average life expectancy at retirement was then already more than 10 years and will go on increasing in future, the system was never sustainable financially.

The rules were supposed to be introduced gradually so that employees who started working after 1996 were only covered by the new system, while pensioners who had retired before the end of 1996 received pensions from the old system at the municipal level, and those in between were covered by the old and new systems on a pro rata basis (Williamson and Deitelbaum, 2005; Drouin and Thompson, 2006; Zhang, 2007; Leckie and Pai, 2005; Li et al., 2008; Herd et al., 2009; Impavido et al., 2009; Hu and Davis, 2009; and OECD, 2010).

The system did not work in the way it was intended. In particular, with large-scale SOE restructuring, many laid-off workers were given immediate pensions at quite young ages (even at 40). Under these circumstances, the individual accounts broadly became empty as the administration used the revenues to pay the pensions of current retirees. In 2001, as a result of State Council Document No 42, a pilot programme was launched in Liaoning province, among other things separating the DB PAYG pillar from the individual accounts. A 20% of wage contribution from employers went to the DB PAYG pillar, and the employee contribution was raised to 8%. In addition, employers were encouraged in various ways to make contributions to the voluntary pillar. For the first pillar, the new rules provided an incentive to make contributions beyond 15 years by raising the maximum pension to 30% of city average pay.

As mentioned above, the balance on individual accounts at retirement is converted into monthly payments by dividing it by 120, i.e. assuming an annuity factor of 10. Document No 42 reconfirmed this factor and stated explicitly that 'when the accumulation in the individual account runs out, the individual account pension will then be paid from the social pooling fund'. The authorities thereby became liable for the deficit. In late 2000, being aware of financing difficulties at provincial level, the central government established the National Social Security Fund (NSSF) as 'a strategic reserve fund'. The deficits were supposed to be filled partly by transferring part of the SOE wealth to the NSSF: 10% of the proceeds raised from initial public offerings (IPO) was supposed to be remitted to the NSSF. However, the Chinese equity market did not perform well and the 'IPO tax' took part of the blame, domestic offerings were suspended from the transfer to the NSSF (Leckie and Pan, 2007). Furthermore, pension fund losses due to corruption were encountered in several provinces, including a major fraud case in Shanghai in 2006.[7] At the end of 2009 the NSSF was reported to have assets equal to 2.4% of GDP.

In 2004-06, the Liaoning pilot was extended to ten other provinces (out of 31 provinces; these 11 cover 39% of the Chinese population; see Salditt et al., 2007, p. 18). The contribution shares of the central and local governments depend on the fiscal position of the pilot province. In 2008 the total transfer from various levels of the government was

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[7]   Mr Chen Liangyu, then Shanghai Secretary of the CPC and Head of Shanghai's NSSF, was dismissed for alleged corruption and 'misuse of Shanghai's social security funds'.

0.5% of GDP. One of the symptoms of the fundamental problems is that government financing became permanent and indispensable.

These factors, and others, led to limited success in establishing a financially sustainable pension system. For the sake of brevity, the reader is invited to look for further details of the current system and its problems in the references given above and e.g. Dunaway and Arora (2007), Clarke (2008) and (2009), Leckie and Pan (2007) and Sin (2008).

The bottom line of this brief description is that the 1997 reform for the urban areas did not succeed in establishing a coherent nationwide system, but rather something very patchy. It was supposed to have a significant funded pillar, but the estimated reserves were about 5% of GDP at the end of 2008, only a fraction of the original blueprint. Today, only 55% of employees in urban areas are covered, and most of the rural population are not covered at all. The aim of the pilot programmes mentioned above is to gain more experience of revised and refined rules in order to set up a more comprehensive reform plan. This is the reason behind the new proposals and initiatives we turn to next.

3. Recent proposals

Chinese pension reform has attracted a lot of attention internationally since the 1990s, and for good reason: it concerns a major economy that has already become a key player in international trade and finance. Perhaps even more importantly, the range of reform options was, and still is, very wide, and thus the way China moves will have an impact on the world economy. It is hardly surprising, therefore, that the Chinese pension system has been one of the playgrounds in the controversy between those advocating a large role for mandatory fully funded personal accounts and those in favour of (mostly) PAYG government-managed DB public pensions.[8]

Early expressions of this controversy can be found in the volume edited by Yin et al. (2000), which is a collection of papers from both Chinese and non-Chinese experts. Martin Feldstein represents the first school and Henry Aaron the second. Recently, in a World Bank volume, Feldstein and Liebman (2008) reiterate their support for moving to a fully funded DC system while proposing to cope with the transition costs by swapping the implicit pension debt for explicit public debt.[9] In the same volume, Li et al. (2008) advocate a move to an NDC system, which combines some features of both funded DC systems and unfunded PAYG systems.

Meanwhile, a joint study of Chinese and non-Chinese experts was published under the China Economic Research and Advisory Programme (2005a and b), which makes extensive recommendations for policies and system design. Two members of the team, Nicholas Barr and Peter Diamond, published the same views in Barr and Diamond (2008) and developed them further in Barr and Diamond (2010). This team forcefully recommends a reform whereby individual pension accounts are organised on an NDC

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[8]   For the main arguments, see Orszag and Stiglitz (2001), Feldstein and Liebman (2002), Oksanen (2004) and Oksanen (2010).

[9]   Feldstein and Liebman (2008) claim that a 8% contribution rate would produce a 35% replacement rate from a fully funded system. With our demographic assumption and a significantly increased retirement age (see below), this requires that the rate of return on assets exceeds the rate of GDP growth by 3 percentage points. In our scenarios below we cautiously assume that the interest rate (and rate of return on DC system assets) is below the growth rate for the next 30 years.

basis. For them, it should be accepted that individual accounts have de facto become only very partly funded, and that filling the empty accounts should not be targeted, as this would place an undue burden on current workers.

This same view is taken by Zhang (2007) and, as stated above, by Li et al. (2008), and it is also endorsed by Williamson and Deitelbaum (2005). Zheng (2007) recommends that pension contributions to the 'social pool' of DB PAYG pensions should be reduced to 8 pp of wages and that 16 pp should go to individual accounts, which should be part-funded and operate (at least in part), on the basis of NDC. The remaining 4 pp of the total contribution of 28% of wages would be placed in the second-pillar fully funded DC scheme.

Feldstein and Liebman (2008) effectively reproduce the World Bank recommendations of 1997 and consider that an 8% payroll tax should be placed on the newly established fully funded individual accounts. They repeated, without much caution, that this would produce a 35% replacement rate, which together with (reduced and better targeted) social pool pensions would — for them — be a reasonable and sufficient level of pensions. They would eliminate the pension contributions paid to the first pillar, cover accrued pension rights by issuing public debt, and serve the debt and the basic social pool pensions from broad-based taxes, such as VAT.

Under certain simplifying assumptions, maintaining an unfunded pension system and a transition to fully funded individual accounts combined with financing of accrued pension rights by issuing public debt (thus swapping implicit debt for explicit public debt) would produce an equivalent outcome for pension benefits and total financing costs. The proponents of moving to full funding emphasise the benefits of alleviating the distortions to labour supply, as part of the financing burden is transferred to taxes other than payroll tax. They also see significant positive effects from giving a boost to financial market institutions.

However, the proponents of maintaining the broadly unfunded system see a danger in increasing public debt by, say, 100% of annual GDP, and thus having equal volumes of assets managed by the private (mandatory) pension funds. For them, to make this major shift in financial markets when the institutions and their supervision are not fully developed, as in China, is a potentially dangerous gamble. Also, having pensions mainly based on DC, i.e. making workers' pensions depend on the rate of return on the financial market (under the fully funded arrangement), would put ordinary people at excessive risk, whereas maintaining risk sharing under a DB system is, in their view, more reasonable for mandatory social insurance.

Quite a few of the proponents of the PAYG system find the NDC-based PAYG to be the most promising for China, where pension rights need to be adjusted to demographic ageing. According to their views, it is an advantage of the NDC system that the pensions are not at risk in the financial market, but an administratively set rate of return is applied to the individual accounts (under the conditions in China most authors prefer the increase in average wages as the most appropriate rate of return). Seen in this light, the NDC system is a modified DB system where benefits are based on individual contributions and indexed to average wages, retirement age and expected longevity. It thus significantly helps avoid the problems of sustainability that the traditional DB systems with fixed replacement rate and retirement age encounter under reduced fertility and increasing longevity. Due to population ageing the parameters of standard DB systems need to be revised, but this is always a difficult process (politically and otherwise). The NDC rules make these required adjustments automatically, or to be more precise, quasi-automatically since full autopilot is not feasible as explained further below. This is

considered to be especially useful for China, as a rapid process of demographic change will take place in the next 20-30 years and beyond.[10]

The controversy between the proponents of fully funded DC and therefore financial market-based pensions (resembling voluntary saving instruments) and those who see public pensions as social insurance, where the government acts as a broker for intergenerational solidarity and corrects the market failure by providing DB pensions (or NDC as their variant), will not go away easily, in China or anywhere else. This controversy is at the same time economic, social and ideological and the adversaries attach different weights to the various issues concerned. We shall below provide simulation results to illustrate the implications of the competing reform options for China.

Whatever differences they otherwise have, there is one common worry that is shared by experts from both schools of thought: a significant increase in retirement age is badly needed in China as otherwise the pension system will become unsustainable (or at least difficult to manage) whatever basic financing mode is applied. This will have important repercussions for the whole economy via the supply of labour. An increase in retirement age will mean that labour supply in urban areas will increase, as the existing urban labour force would remain active for more working years, while there will still be a large pool of excess labour in rural areas. The latter is mainly unskilled, but as compulsory free education is being established in rural areas, more labour with increasing skills will become available in due course. These large sources of increasing effective labour supply (despite low fertility) will mean that the transition process of the Chinese economy will continue for many decades. This will mainly happen regardless of the pension system reforms, but it will have a significant effect on pension financing, especially if the increasing labour force is successfully made to contribute to pension financing.

Simulations with the World Bank PROST model

The reports and papers referred to above discuss most of the pertinent pension system issues for designing reforms for pensions in China and give at least preliminary projections for key variables in future. However, they do not convert their recommendations into scenarios that would systematically and transparently illustrate the reform options.

As a notable exception, fortunately, Sin (2005) presents a set of simulation results for the urban pension system produced with the World Bank PROST model.[11] Three factors emerge as the most critical for establishing a financially sustainable system that would provide at least a minimum socially acceptable level of pension (around 40% replacement rate): (1) correcting the annuity factor from 120 to correspond to realistic life expectancy at retirement; (2) gradually raising the retirement age to 65; and (3) succeeding in increasing coverage from the current 50% of urban population to a significantly higher level.

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[10] Clarke (2008) makes recommendations explicitly arguing that a DB system offers advantages over NDC. However, he also recognises that a DB system needs to be adjusted for affordability through conditional indexation. Therefore, for the urban population, his DB and NDC are not necessarily that far apart, depending on the detail. With regard to pensions for rural areas, he might be right in proposing a primarily tax-financed system where contributions would merely be for recording entitlements rather than for providing the bulk of the financing.

[11] Pensions at a Glance, Asia/Pacific edition (2008), contains simulations for replacement rates.

Sin's scenarios show a wide range of options, starting from the baseline without reforms that would require a 37% contribution rate to be technically sustainable. As a contribution rate of that order is not feasible in reality the system would soon collapse. Sin's various reform scenarios then show that changing the benefit rules and retirement age can help a lot and the required contribution rate could fall to below 20%. Stronger reforms would reduce the contribution rate even further, and pension fund reserves would still increase to close to the relative figures seen in the wealthiest industrial countries. Thus, Sin (2005) provides a wide range of options that inspire further analysis.

4. Principles and features for new scenarios

Establishing a pension system is different from managing a mature system

There is broad agreement that despite the efforts over the past 15 years, the Chinese pension system is still very limited and fragmented and its future direction is unclear. China is therefore still dealing with the issues of *establishing* a proper public pension system. China only started to adopt market economy principles three decades ago; it was confronted with the need to establish nationwide social policy institutions when SOEs were relieved of their pension liabilities. Therefore, designing scenarios for *establishing* a proper public pension system has to be based on broader issues than the internal rules of the pension system. This means that any analysis geared to analysing the current problems in industrial welfare states by looking at a systemic transition where the starting point is a mature (or close to mature) PAYG system (pure PAYG or part-funded) is not a suitable approach for China.

For example, referring to basic concepts in pension economics, a framework to analyse the consequences of population ageing and pension reforms for both explicit and implicit public debt is presented by Beetsma and Oksanen (2008). They define 'actuarial neutrality across generations' as a benchmark for setting pension system rules for demographic transition. Their neutrality rule may give some guidance for dealing with intergenerational fairness in the industrial welfare states with a mature pension system hit by population ageing. There, the main problem is to prevent a skyrocketing expansion of the pensions system brought about by population ageing if preventive reform actions are not implemented. For China, however, their framework is better used for analysing deviations from 'actuarial neutrality' as there obviously are factors that may well justify expanding the public unfunded pension system. This, in general, leads to an increase in total public debt, i.e. the sum of net explicit debt and implicit debt, over a transition period lasting several decades.

The vicious circle of high contribution rates and low coverage

One of the most pertinent issues is low coverage in the urban system. It is a vicious circle of high contribution rate (around 28% of wages) leading to low compliance and therefore to the need to maintain the high contribution rate. What is the leeway to turn this around by cutting the contribution rate?

For a simple calculation let's assume a normal working life of 35 years and note that life expectancy at the age of 60 is currently 19 years for men and 22 for women. If they retire at the age of 60 with a pension of 50% of the unit wage, the contribution rate should in the public unfunded system be around 28% (this takes roughly into account mortality below age 60). So, the 28% is justified.

But it is quite likely that the wage tax of around 28% is prohibitive for expanding the coverage. Note that other taxes on wages are also quite high, 12-16% of the wage, making over 40% in total (and a 16% contribution to funds for housing purchase comes

on top of this; see Hu and Davis, 2009, and Clarke, 2009). It is plausible that wage taxes as a whole are to the right of the peak of the Laffer curve: cutting them could bring more revenue to the coffers of the state as compliance could improve. If this can be combined with raising the retirement age, even more leeway is available for a transitional period of a couple of decades. True, as this leeway is only transitory, the improved financial balance should not be all used for cutting the current contribution rates.

For wider options to break the vicious circle we should look more broadly at what has happened in the Chinese economy over the last 30 years. GDP has been growing on average at the rate of 10% a year, and income (and, correspondingly, private consumption) per capita has expanded by 9% (8%), making the current level 11 (9) times the level in 1980. Does this give leeway to pension policy?

Past and current efforts of a generation may justify public pensions without pre-funding

A useful reference here is Western Europe in the 1950s and 1960s where public pension systems became broadly unfunded. This was the result of giving the first generation of retirees benefits that clearly exceeded the value of the contributions they had paid into the system. However, we can consider this justified as they had worked hard rebuilding the economies ruined by WW II, and government finances were strong, i.e. saving in the public sector was high, including in the form of building public infrastructure. Thus, the generation working in 1950 until the early 1970s did not formally cover with their contributions to the public pension system the value of the pensions they subsequently received (which meant that the systems became broadly unfunded). However, they had worked hard and saved collectively in other forms, laying the basis for more wealth for themselves and for future generations.[12]

Similarly, pensions in China could be seen in the light that the generations that suffered from the Cultural Revolution and were able to start the economic and social transition only three decades ago have already made a huge contribution to building a more wealthy society for themselves and future generations.

Thus, reforming the public pension system in China can be justifiably based on the real assets of the government (not least infrastructure and SOEs, which are adjusting to market economy principles) and its financial assets (foreign assets holdings through its sovereign wealth funds and central bank), which grossly outweigh the relatively small public debt.

The strong financial position of the government can be used for reducing the contribution rates to make them better suited for improving compliance and expanding coverage. Solid finances will help to meet the costs of honouring the accrued rights (under reasonably generous indexation rules to share the fruits of growth more broadly), establish pension rights for the elderly who did not fully contribute, or refill the accounts from where the funds disappeared due to incomplete rules, mismanagement, corruption or fraud.

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[12] This is a broader justification for establishing an unfunded public pension system than the one presented by Barr and Diamond (2008) for the US. They say that '[i]t can be argued that a decision … to grant full benefits to early cohorts represented a humane response to the suffering imposed by the two world wars and the Great Depression: it reduced elderly poverty …'. For (continental) Europe the above justification is not based on what the elderly had suffered, but rather on what they had contributed. By establishing an earnings-related broadly unfunded pensions system and making it expand they extracted though pensions some of the results of their own work and of (unexpectedly positive) economic development. Consequently, the European systems became PAYG, but they also became mostly earnings-related and twice as big as the public pension system in the US.

The retirement age needs to be raised for long-term sustainability

As these arguments are based on past and current features, it is equally important to design the rules in such a way that they also take into account the projected demographic change early enough so that expenditures do not explode with the change in the age structure. Most importantly, this will require the retirement age to be raised. Therefore, the rules for pensions need to contain proper incentives to work significantly longer than the current retirement age. This should be relatively clear from a long-term perspective, but in the case of China it has to be recognised that raising the retirement age significantly will not be self-evident as the pool of underutilised labour in rural areas seeking employment will remain large for quite a long time.

Interest rate will be lower than rate of growth

The large supply of labour will mean that the economy can still grow relatively fast for 2-3 decades. This has consequences for a key variable related to pensions, namely the difference between the interest rate and the growth rate. We tend to assume that in the industrial welfare states the interest rate is somewhat higher than the rate of growth. In China it has been grossly the other way round. This was the case also in Western industrial countries in the golden age of growth from the late 1940s until the early 1970s when public pension systems were established. In China, the relatively low interest rate will not necessarily mean that the economy is dynamically inefficient, and that the capital stock should be (quickly) reduced. On the contrary, a high rate of growth — consistently higher than the interest rates — can still continue as the excess labour is being gradually utilised and the continuous flow of (technological and institutional) innovation, including reorganisation of state owned enterprises, drives the process, bringing about unexpectedly positive results. This description of an economy cannot be valid 'forever', but in China this kind of growth process can last for several decades, as it did in the Western world until the early 1970s. The future of the public pension system should be analysed in the light of this process.

One consequence of this is that with regard to the rate of return on pension contributions, a fully funded pension system placing its assets in financial market instruments is not necessarily superior to a public scheme where the expansion of the economy is shared between the members by linking the internal rate of return of the system (to be obtained in the form of pensions) to the general rate of growth. Yet, as will be argued below, the level of pensions that can be reasonably expected from the public pillar in China will be clearly lower than currently prevailing in Western Europe. Therefore, additional pension saving in a fully funded mandatory or voluntary pension scheme and various other forms of private saving will have their roles. Thus, there is no reason to take an extreme view and totally exclude financial market-based pension saving.

Rural pensions

Since soon after 1949, the Chinese population has been divided by the *hukou* registration system into urban and rural citizenship. The system regulates citizens' rights, especially limiting those of the rural population working in the cities. Pension systems, among many other government policies, make this segregation.

Most of the reform proposals referred to above are restricted to discussing the options for urban population pensions, although quite a few at least mention that old-age security of the Chinese rural population is also an issue. The 1991 decisions also covered pensions for rural employees, to be financed by a contribution rate of 3%. Coverage remained low and changes in organisations and policies since the late 1990s have led to the system shrinking (Birmingham and Cui, 2006), so that in 2008 only 12% of rural employees

were covered, and the average pension was very low (see footnote 2 above). The majority of the population still live in rural areas, and the age structure there is changing even more than in the cities (see Figure 2 below).

The issue with rural pensions is recognised, for example, by Clarke (2008), Sin (2008) and Barr and Diamond (2008, 2010). Herd et al. (2010) and OECD (2010) provide useful insight into the complex relationships between old-age support and land ownership, especially with regard to the changes in property rights in rural areas and converting land to non-agricultural use, including new property laws issued in 2002 and 2007. The problems with rural pensions have been recognised by the Chinese authorities, and a new response came in August 2009 when they issued a plan to establish a new system, gradually targeting universal pension coverage by 2020. The benefits will be relatively modest. Financing will come mostly from the central government, the effort being shared with the governments of high-income provinces (see below). Although there are many linkages between the urban and rural social security systems (especially through the workers from rural areas working in the cities), and discontinuing the *hukou* system is currently under discussion, the two systems will probably co-exist for quite some time. Therefore, it is advisable to keep them apart for analysis, as we do here, while our model also allows us to run scenarios where they converge.

One-child policy

In this context, especially with regard to rural areas, we should think about a possible link between the one-child policy (which effectively means that the fertility rate is below two, even though not quite one) and pensions. Here, fundamental analytical and normative issues regarding the responsibility of the state are triggered. For a reference, there is a line of research emerging with the hypothesis that public pensions cause a reduction in fertility (Cigno and Werding, 2007). We may doubt whether expansion of public pension systems in Western Europe since the mid-1970s had this effect, as there may have been many other societal factors that contributed to the decline in fertility. However, it is probably a plausible view that in developing countries fertility is high because there is no pension system and also because well-developed financial markets are lacking and hence do not offer instruments for private pension saving. Thus, people have many children in order to guarantee sufficient support when older. If so, it also follows that establishing a public pension system in developing countries should help to reduce population growth (which is probably desired in view of the limited resources globally).

Here, for China, we can turn this reasoning at least partly around: it pursued a 'one-child policy' by regulation. Although this policy has been more relaxed in rural areas, the migration of descendants to cities has meant that many elderly people in rural areas are left without sufficient family support. Remittances from their children, who have moved to a city and visit them occasionally, help to a certain degree, but this support might not be sufficient and its continuation might be too uncertain. This turns the argument regarding the link between public pensions and fertility decline the other way round: as the state induced the decline in fertility by regulation, the state must take responsibility, both financially and otherwise, for support for the elderly who are left with only narrow or no family-based security and, for example, expand public pensions to the large rural population.

NDC system as a reference and blueprint

As explained above, the advantage (and purpose) of the NDC system is to help attain financial sustainability of the pension system under population ageing. Its main feature to this effect is that the benefits are affected by the longevity increase — the benefits are calculated using the latest available projection for longevity of the beneficiary at the moment of retirement. This also means that this same effect can be attained by modifying the rules of a more traditional DB system by introducing a longevity factor into the determination of the benefits, as has been recently done in some countries (e.g. Germany and Finland).

An NDC system introduces notional accounts to register the contributions and a rule for determining the annuity payments, i.e. the pension benefits. Other key factors are the rules for the rate of return on the individual accounts and for indexing the pensions in payment. An NDC system can operate without (significant) reserves like a DB pure PAYG system, but it may have significant reserves, also like a DB system. A key feature of both of these systems is that the benefits are not directly affected by the assets (or liabilities) of the system or by the return on them (or interest on debt), as they are in a fully funded DC system; yet, indirect links may work as interest on assets brings resources to the system.

Without going into detail, it should be noted that the NDC system without assets is fully in financial balance in a steady state and under the conditions that the rate of return on the notional accounts is equal to the rate of growth of the covered wage bill and that this same rate is used for determining the annuity payments. If these conditions are not fulfilled the system deviates from the equilibrium and explodes. This happens in general also if and when the system starts from out of equilibrium or is hit by an unexpected change in its key factors, e.g. a change in longevity while the pensions in payment are not adjusted.[13]

For this reason, the NDC system cannot work under full autopilot, but some additional rules for adjustment or discrete decisions are needed. An expression of this is that the 'automatic balancing mechanism' in the Swedish NDC system was recently, in a situation caused by the financial crisis, not implemented according to predetermined rules as more leeway for determining the pensions was considered more appropriate and policy discretion overtook the supposed autopilot.

Perhaps more importantly, it should be noted that the transition from a traditional DB system to NDC always requires specific rules, and these rules do not directly follow from the basic NDC rules. If the transition starts from a mature DB system, the initial problem is normally a deficit as contribution payments are frozen but expenditures to honour accrued rights are still rising.

Applying the NDC rules for China, or any country which does not yet have a fully fledged public pension system, actually encounters an opposite feature. To make the point in a simple way, consider a country without any public pension system that establishes a system emulating the NDC rules. It then in fact establishes a funded system as pensions are paid out only when the participants retire and start claiming their

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[13]   Valdés-Prieto (2005) constructs an NDC model where the pension debt of an initially solvent plan is securitised using bonds indexed to the covered wage bill. This makes the system financially sustainable under autopilot. However, in a case where coverage is supposed to increase significantly one may ask whether such a system is fair across generations as the incumbent contributors would benefit from new entrants coming in. As it is difficult to see that this would always be the case we do not consider this option here.

pensions based on their individual account balance. The main difference between this and a fully funded DC system is the interest rate: in NDC it is determined administratively while in the latter it is the rate of return on assets as they de facto accrue.

As noted, coverage in the Chinese pension system for urban employees is only about 55%. So, if and when the coverage increases, the revenue from the new participants brings in a significant accumulation of reserves. For this reason the transition to an NDC system does not necessarily cause a deficit (as it did in the European countries) but rather a surplus.

Why is then a shift to NDC-type rules advantageous for China? The main reason is that the country will have to deal with rapid population ageing, and it is probably wise to tackle it now that the process is only starting and there is still time to establish new rules.

Summing up

The deadlock of the poorly functioning Chinese urban pension system (low coverage and high contribution rate) can be tackled with basic concepts of pension economics. The choices are:

(1)   The system is geared to move to fully funded individual accounts; current employees should bear a double burden or accrued rights should be covered by issuing debt. Both of these options might be unfeasible, the former because of unacceptably high contribution rates, and the latter by leading to unacceptably high public debt.

(2)   Accept that the system is virtually PAYG and follow the principle of actuarial neutrality, meaning that the implicit pension debt is carried over to the next generation and each working generation pays for its share of serving that debt and for its own future pension (Beetsma and Oksanen, 2008). Note that in this case the additional revenues from possible expansion of coverage and from an expanding labour force due to migration to urban areas should not be extracted only to the current employees but put into a reserve fund for the benefit also of all future generations.

(3)   Recognise that at least the older members of the currently working generation and current retirees have already contributed significantly to the wealth of the nation and can therefore justifiably be provided with pension benefits which exceed the level that they have paid for in the form of pension contributions. In pension economics this is called an 'introductory gain', a gain that is received by the first generation when a PAYG public pension system is established. In China this can justify cutting the contribution rates to a level that would improve compliance. Further down, the rules should take into account the increase in longevity so that the retirement age will rise. NDC-type rules can serve both of these principles if accompanied by appropriate transitional arrangements for the first phase of 2-3 decades. With regard to generosity, the level currently prevailing in more affluent welfare states is probably not viable in China. This will mean that there will be a need for both basic social pensions for the low-income elderly and additional pension savings managed by various types of financial institutions operating in gradually opening and more efficient markets.

5. The China Pension-System Simulation Model for reform options

To illustrate a wide range of pension systems (and their reform options) we use here the China Pension-System Simulation Model, which covers the key features of a public pensions system and is calibrated for the Chinese demographics and economy. As the Chinese pension system is so patchy and comprehensive data are not available, there is no practical way to capture all its details. The initial system calibrated to the model is therefore grossly stylised. However, this is not a serious drawback as the main purpose here is to present various options for reforms, in particular for transition to NDC and accompanying DC and flat-rate pensions, and allow for any changes in the retirement age.

One main advantage of the model here, compared to previous exercises, is that urban and rural sectors are made separate so that they have separate demographics and separate pension system rules. The model can be used very flexibly with regard to the assumptions on various exogenous variables related to the economy, such as wage growth (separately for urban and rural), interest rate and inflation.

Naturally, the model is simple in that the agents in it (workers and pensioners) are representative individuals for each group formed by gender, urban and rural and yearly cohort. The model is partial in the sense that it only consists of the pension system and does not contain endogenous links from the pension system to the rest of the economy. However, this limitation does not hamper our first results as we concentrate on cases where pensions are indexed to the unit urban wage and we express the main results as percentages of GDP. Also, even if we do not have an endogenous link from pensions (and their financing from contributions based on wages) to the supply of labour (employment rate in each group) or to the interest rate, we can run the model for any combinations of these variables we deem reasonable and interesting.

The model allows an infinite number of combinations of assumptions regarding demographic, economic and pension system variables. We offer in this paper a few scenarios, starting by demonstrating that population ageing requires significant changes in the Chinese pensions system as otherwise it is not viable, and we then present reform options that are financially sustainable and serve as blueprints for possible reform. It will be made clear that there is a wide rage of such options and the present paper aims to enrich the discussion on them. The model can be used for further reform options as suggestions emerge.

The time horizon for exogenously determined variables stretches to 2060. This is sufficiently long as it (nearly) covers the expected lifetime of those entering the labour force now; it is also adequate for analysing intergenerational distribution as it covers 2-3 consecutive generations (the average age of mothers giving birth is 20-30 years and increasing). The assumption that changes in exogenous variables cease by 2060 is merely technical: we make this assumption in order to be able to verify whether the model (and especially the pension system) under each set of assumptions implies a steady and sustainable path over an infinite future. This is done by running the model and showing the results until 2120 to see whether each set of rules is inherently sustainable. If it is not, the rules need to be changed sooner or later. Technically, the model does not prevent us from assuming any further changes in exogenous variables after 2060, but as they become more uncertain the further we look, the relevance of the results diminishes. Covering the key issues for the next 50 years is sufficient for our purposes here.

In general, almost all assumptions on demographics, economy and pension system can be easily changed for making sensitivity tests and investigating further variants as more reliable estimates and forecasts become available.. We explain now the main structure of the model and the most important assumptions.

Demographics

The demographic block is based on the most recent data on the age structure by gender in China. For constructing the projection we use the UN population projection medium variant to 2050 as a source of key data and as reference. It is used for longevity and fertility in China as an aggregate, and we add a further one-year increase in longevity for 2060. We use the current figures for mortality by age and gender (UN Demographic Yearbook 2007). The model rescales them according to the projected changes in longevity and produces a full age-gender matrix for each year in future.

Figure 2. Old-age dependency ratio in China in urban and rural areas
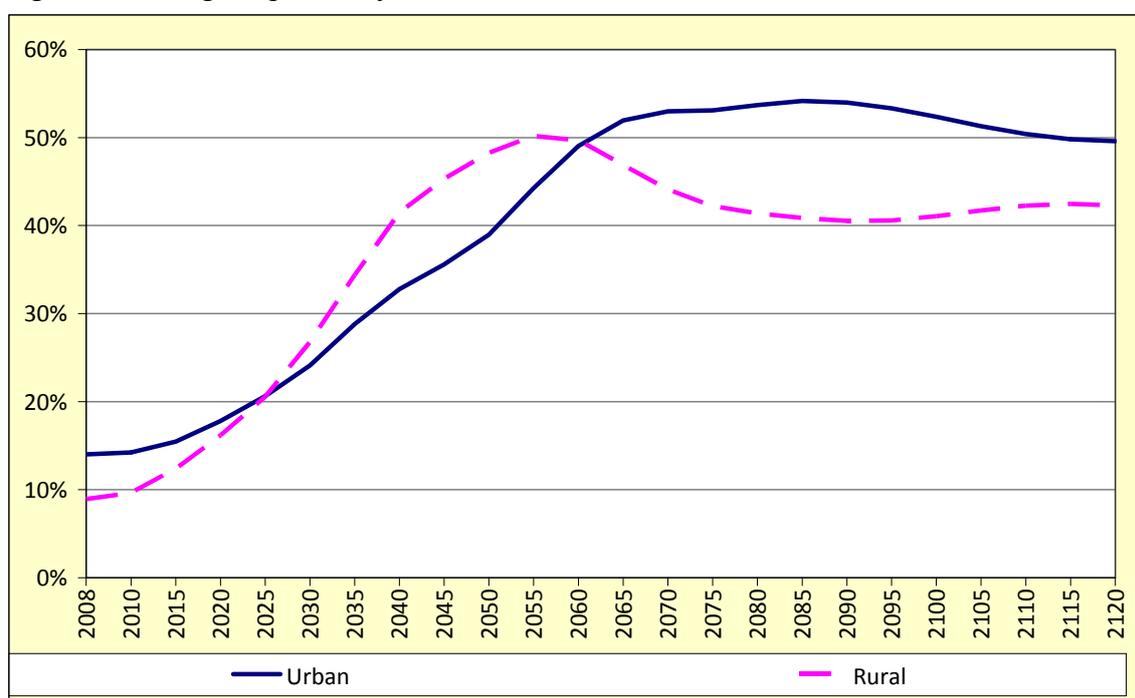
Legend: the old-age dependency ratio is the ratio of the population aged 65 years or over to the population aged 15-64, in %.
Source: author's calculation using the China Pension-System Simulation Model, see the text.

In addition, as it is essential for our exercise to look into urban and rural pension systems separately, the demographic scenario is constructed separately for urban and rural areas. This is done by the author based on indicative data from various sources. We assume that the difference in longevity between urban and rural areas is now five years, narrowing to four by 2060. The model rescales the age-gender mortality figures accordingly. Nationwide fertility is currently according to the UN projection at 1.77 per woman in fertile age and converges to 1.85 by 2050. We assume that it is currently 1.3 in urban areas and 1.95 in rural. We set them to converge so that the country average follows the UN projection. We set our fertility estimates for 2060 so that the shares of urban and rural population remain constant in the ultimate steady state (fertility in rural areas has to be a little higher to compensate for the higher female mortality rates at all ages). This way the model can produce a fully stable structure of the economy, in a steady state,

albeit with an ever-shrinking population as the ultimate fertility rate is assumed to be below reproduction (which is about 2.1).

One key advantage of our model is that it contains the migration flow from rural to urban areas. We shall see below that in the next few decades it is in some respects even more important for the urban pension system than population ageing alone. We have to accept to make here only very rough assumptions as it is a mixture of official and unofficial movement and the data are therefore not accurate, and in any case it is difficult to project. Currently 46% of the population is urban. The Chinese authorities have mentioned 70% as a target by 2050 (OECD, 2010). We assume simple numbers for the migration flow by age (converging to zero by 2060) which lead to the 70% in 2050 target. We simply assume that people acquire the urban demographic characteristics when they move.[14]

The implications of the demographic projection for the old-age dependency ratio, defined as the ratio of the number of 65+ year-olds to that of 15-64 year-olds, both nationwide and separately in urban and rural areas, are shown in Figure 2. The increase is relatively faster in rural areas, partly as we assume that the migrants are dominated by working-age people, exceeding the urban ratio in 2025 and reaching the peak of over 50% in 2055. Its steady-state level is lower than in urban areas due to our assumption that longevity in rural areas will remain lower than in urban areas also after 2060 (an assumption that does not affect our main results).

Economy

Technically, our reference unit is the *urban real wage*, which is used for determining the pension contributions, henceforth the 'contributory wage'. It is calibrated at 2/3 of the urban average wage reported in official statistics as this, together with other assumptions made, gives in the model the reported total contribution revenue of the urban pension system in 2008 (2.7% of GDP). It is assumed to increase in 2010 by 8% and then gradually decline to 2% by 2060. This may be simple, but it is justified for the first results.[15] The same is valid for *inflation*. We set it at 3% per annum, which we understand to be a conventional assumption. Other assumptions on wages, prices and indexation are technically possible in our model; with them each of these assumptions would matter and a large number of their combinations could be explored.

The model is specified for wages, employment and thereby for the wage bill, while the other components of GDP remain outside. However, for convenience, we want to express the results as percentages of GDP, and we therefore need an assumption of the *relative change of wage bill growth and GDP growth*. The issue is that in China the share of the wage bill in GDP is currently quite low, around 40%, while the share of the return on capital is large. Correspondingly, private consumption is at only 36% of GDP, while investment and net exports are large. We simply assume that the wage bill will first in 2010 grow one percentage point (pp) faster than GDP, and that this difference then gradually vanishes to zero by 2060. This implies that the fraction of the wage bill of GDP

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[14]   The model does not incorporate the flow back to rural areas when people migrate back to rural areas after having retired from urban employment. This omission does not disturb our pension calculations if and when they still receive the urban pension. However, the indicator of urbanisation should be modified to take their number into account.

[15]   The latter assumption, especially the increase in real wage 50 years from now, is not crucial for our results as for the scenarios reported here we assume that the pensions both in their accumulation phase and in payment are indexed to the urban wage rate.

increases by 7 pp by 2030 and 11 pp by 2060. This may still imply a relatively low wage share internationally, but this could be justified by the need for infrastructure investment (including for reducing air pollution) and, in general, by relatively high investment and growth in China over many decades to come.

The *rural wage rate* is initially set at 33% of the urban wage rate, based on rough figures on income differences between urban and rural areas (based on NBS 2009). This ratio is assumed to increase smoothly to 70% by 2060. Obviously, this is again a very rough assumption, and it affects the results to some extent. Alternative figures could be used for further testing.

The model technically allows many variants to set the *interest rate*, linking it to inflation or urban wage, total wage bill or GDP growth. Separate interest rates can be entered for the rate of return on DC pension fund assets, the liabilities or assets of the public pension system and the calculation of implicit pension debt (= the present value of accrued rights). We could take GDP or wage bill growth or inflation as the reference and add or subtract any freely chosen margin which can vary over time. For the scenarios reported, we choose the same uniform figure for all these interest rates, using GDP growth as the reference. Over the past decade the interest rate on government bonds has been mostly around 5-6%, with the exception of 2008 when it was higher (during the first phase of the global financial crisis). Referring to GDP growth at around 9% and inflation of about 2% we set the interest rate at 5% below GDP growth in 2010 and assume that this declines to zero by 2040, and a positive margin of 1% emerges by 2060. Separately, we set the administratively controlled *interest rate on the NDC accounts* equal to total wage bill growth (note that for the assets or debts of the NDC scheme the interest rate proper is assumed).

Employment

We have age- and gender-specific data on employment rates separately for urban and rural areas from the Chinese Census 2005. Broadly speaking, following these data, in our model, in 2008 in urban areas 72% of 18-59 year-olds are employed, while the figure is 21% for 60-69 year-olds. In rural areas practically all are working at ages 18-59 and the figure is 65% for the 60-69 year-olds. A declining proportion of 70+ year-olds are also working. In the model receiving a pension does not mean that one stops working. Especially in rural areas almost all are working as other subsistence options are meagre.

Calibration of pensions for the initial year 2008

Our main target here is the urban basic pension system, leaving out government civil servants and those in public service units (mainly in the education and health sectors) that are covered directly from government budgets.

The very scattered urban pensions system cannot be easily captured. In brief, we first observe that in 2008 the average pension is 48% of the statistical average wage, which makes it 71% of the assumed contributory wage. We then calibrate the baseline for the continuation of the initial rules as a simplified DB system, inferring that a 2% per year accrual starting from age 20 produces a scenario where the average pension for an urban-born representative employee is maintained.

The contribution rate is set at 28% of the (contributory) wage. The coverage in the urban system is calibrated to conform to the reported 55% of those employed. We also have in the model a variable for the percentage of those covered who contribute each year. Without much insight into this, we put it at 90%, reflecting various possible reasons for not contributing, such as unemployment or working temporarily in the informal sector. For the retirement age in 2008 we put 60 for urban men and 55 for women.

These assumptions, including that for the contributory wage rate, give the reported total contribution revenue and pension expenditure in 2008. We leave out the 0.5% of GDP transfer from the government as the idea is to present scenarios for a self-sufficient earnings-related system. The possible transfer from the government and its use can then be discussed separately. For the reserves of the system in 2008 we put a round figure of 5% of GDP.

For the rural area the initial system is quite small — we have put in simple numbers that replicate the recorded expenditures. As the assumption on retirement age means hardly anything for our initial year 2008 as the coverage is so low, we set it at 60 for both genders already for 2008 as this is the retirement age to be implemented in the new rural pension system.

Baseline for the urban system

The baseline is constructed to show the implications of the initial assumptions combined with the process of ageing. For *urban employees* the current employment and coverage rates are maintained, as are the assumed 2% per year pension accrual and indexation to urban wages. Men's retirement age is maintained at 60 and for women it is assumed to be raised from 55 in 2008 to 58 by 2020 and then to 60 by 2030 (there is no firm basis for this assumption — it can be recalibrated). The contribution rate of 28% of wages is maintained. The 2008 employment rate for 60-69 year-olds is assumed to increase a little, from 21% to 25% by 2020, reflecting the view that it may increase slightly due to improving health status even if the pension system rules do not change.

As is easily understandable, the urban pension system is not sustainable under the assumptions made. Contributions exceed expenditures until 2025, but then the system goes into deficit and its debt explodes; see Figures 3-4 (henceforth, for short, contributions minus expenditures without interest is called deficit).

The pensions of new retirees reduce from the initial 71% of the contributory wage to below 60% by 2045 (Figure 5). This follows from the lower than average pensions of the migrants as they will have a shorter contribution history than the urban-born representative employee of our model. We see from the graph that our model is technically consistent in the sense that when migration has ceased, the average pension returns to its initial level. However, the main implication is that the system is not financially sustainable on its own, but would require either a significantly increased contribution rate or a 4% of GDP subsidy from the government (Figure 3).

Reformed Defined Benefit system for the urban areas: raising retirement age, maintaining replacement rate and assuming coverage increase

In the UN population projection that we follow here, life expectancy is projected to increase by 6.3 years from now until 2050 (and we assume it to increase one more year by 2060). As a response, we assume for urban males a five-year increase in retirement age by 2020, a further two years' increase by 2030, and one more for women by 2040. This brings the ultimate retirement age for males to 67 and for females to 64. Frontloading the increase as compared to the more gradual increase in life expectancy reflects the idea that the necessity to make a significant change is recognised and accepted. The retirement age is defined in the model so that it triggers the pension, but the person may continue working, although he/she no longer pays pension contributions.

Figure 3. Chinese urban pension system: contributions minus expenditures, % of GDP
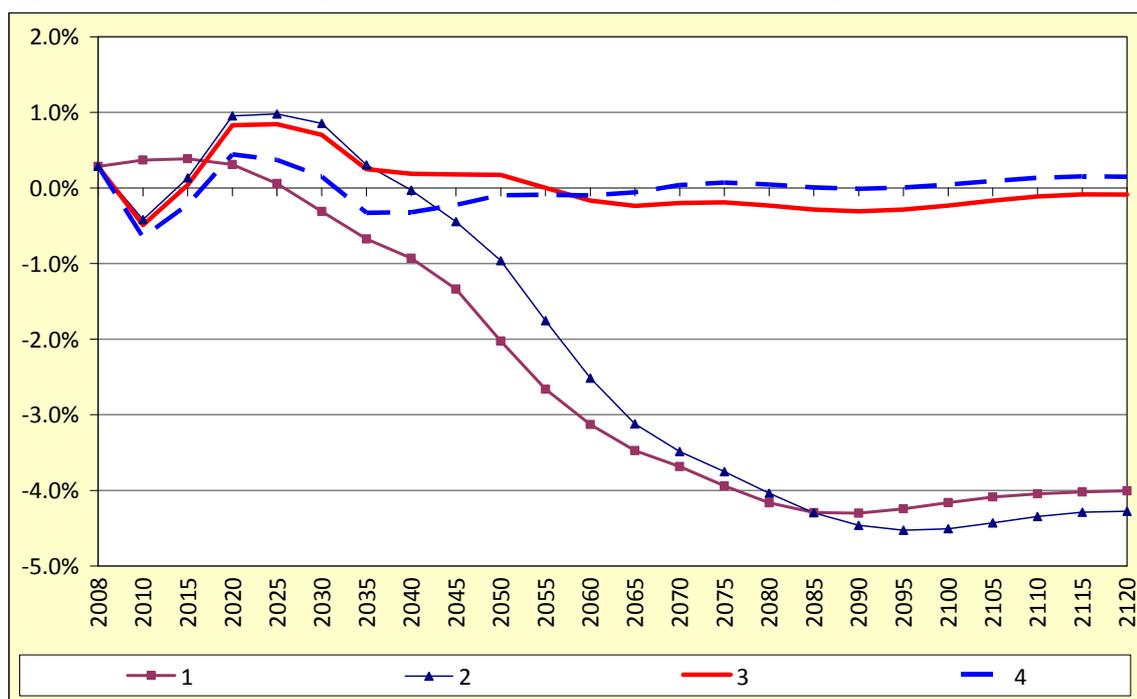
Legend: contributions and expenditures without interest on assets or debt.
    1. Baseline — 2. Reformed DB
    3. NDC reform with 20 % pension contribution and 2.4 % flat-rate pension
    4. NDC reform with 16 % pension contribution and 0.3 % flat-rate pension
    For details see the text. — Source: see Figure 2.

Figure 4. Chinese urban pension system: accumulated assets, % of GDP
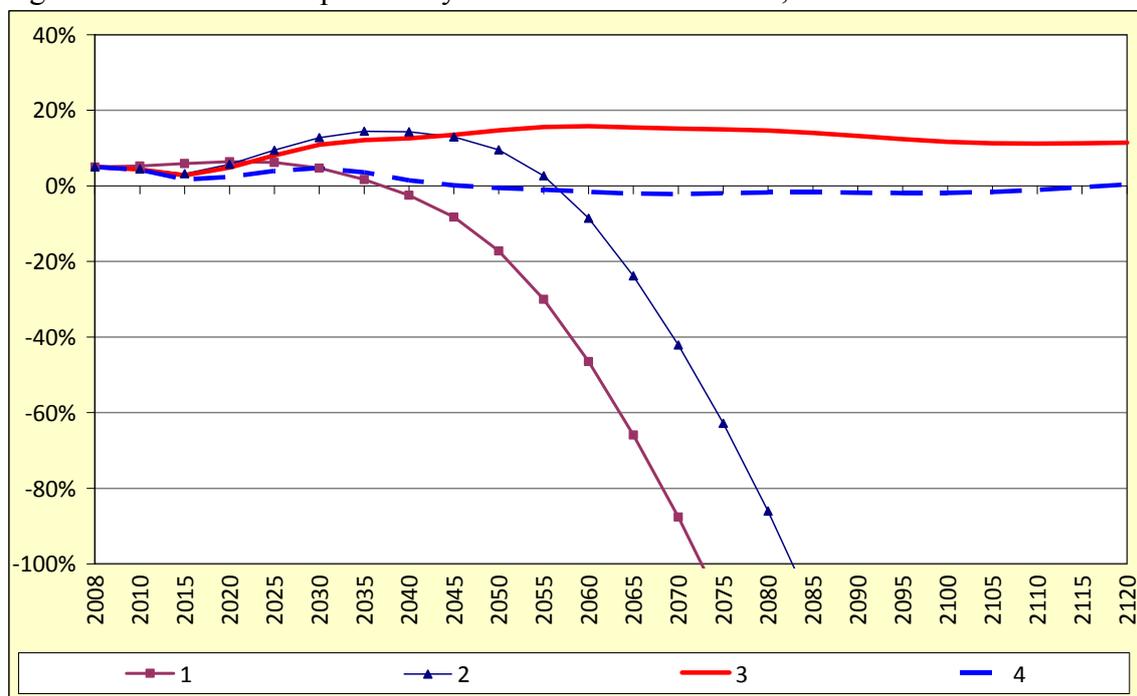
Legend: contributions and expenditures including interest, accumulated over time.
    1. Baseline — 2. Reformed DB
    3. NDC reform with 20 % pension contribution and 2.4 % flat-rate pension
    4. NDC reform with 16 % pension contribution and 0.3 % flat-rate pension
    For details see the text. — Source: see Figure 2.

Figure 5. Chinese urban pension system: entry pensions, total, % of wage
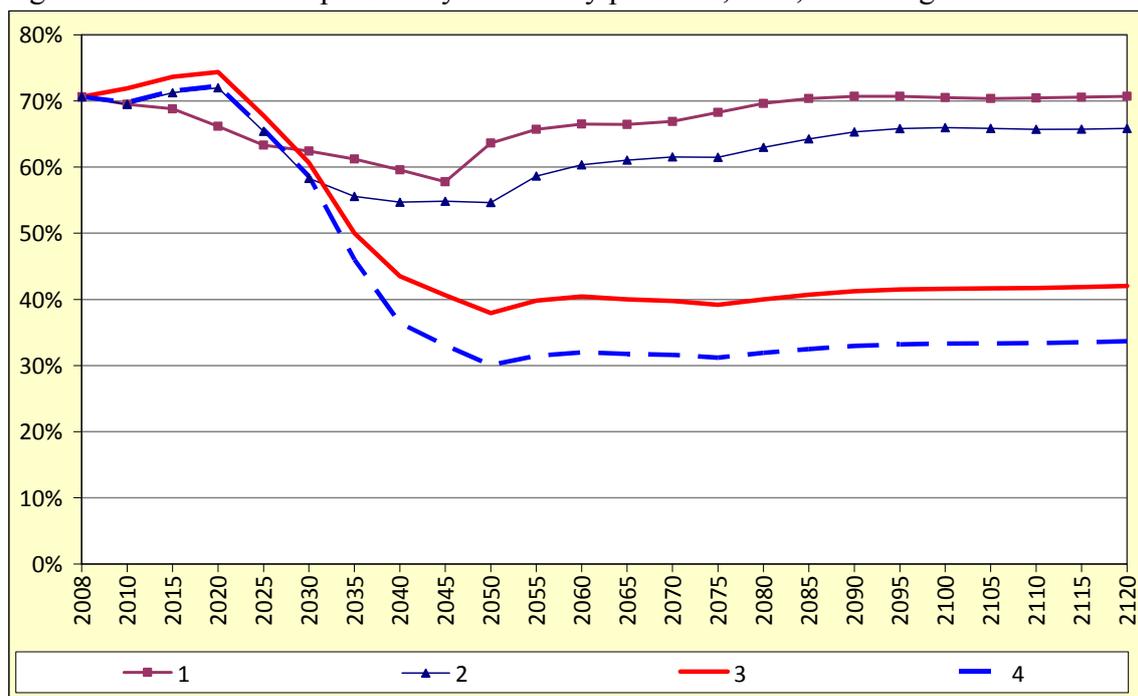
Legend: sum of DB, NDC, flat-rate and DC pensions, average for both genders; pensions are expressed as percentage of contributory wage; for further details see the text.

    1. Baseline — 2. Reformed DB
    3. NDC reform with 20% contribution, 2.4% flat-rate pension and DC pension with 4% contribution
    4. NDC reform with 16% contribution, 0.3% flat-rate pension and DC pension with 4% contribution
    Source: see Figure 2.

The employment rate in urban areas at 60-69 is initially 21% in 2008. With the increasing retirement age we assume it to rise to 40% by 2020 and gradually further to 65% by 2060. Note that these figures include also those working after having become eligible for a pension. We are here not assuming a bigger increase in the employment rate of the urban elderly as they have to compete for jobs with the still ample source of labour in the rural areas.

In the reformed Defined Benefit (DB) scenario accrued rights are maintained, but new accrual from 2010 onwards is reduced to 1.78% per year. This is based on a hypothetical case where the reference person, who previously worked for 40 years, will work five years more and acquire the same replacement rate as before. Over the transition the replacement rates will be higher as accrued rights are maintained while additional rights by working longer will be acquired.

We now also assume that the pension contribution rate is reduced from 28% to 20% in 2010. As stated above, the 20% would not be sufficient to finance the current pension expenditure, and even less so its increase due to increasing longevity. However, the reduced contribution level could be justified by two considerations: (1) current workers have already contributed significantly to national wealth, and (2) the reduced contribution level would lead to an increase in coverage and bring more revenue to the system. We assume that due to increasing confidence, pension system coverage will increase to over 90% of the employed by 2020. Remember that of those covered 90% are assumed to contribute each year.

With these assumptions, as the contribution rate is reduced to 20%, the system first goes into a deficit of 0.4% of GDP for two years, but as increased coverage brings additional revenue, it again turns to surplus, peaking at 1% of GDP, and remaining so until 2040.

However, as the ageing process continues, a deficit emerges and debt explodes (Figures 3-4). The pensions of new retirees first increase because additional rights accumulate due to the rising retirement age, and then decrease as in the baseline (Figure 5).

This scenario shows that the assumed increase in the retirement rate combined with maintaining the initial level of pensions is far from sufficient for sustainable financing.

The announced new system for rural areas

The current expenditure on *rural pensions* is so small that it is not worthwhile to present a separate projection replicating the current data. Instead, we model the new rural pensions according to the plan issued by the Chinese government in August 2009. According to the information given (and interpreted) by Herd et al. (2009) the new plan will expand gradually so that by 2020 the rural population over 60 years old is fully covered. A flat-rate pension of 55 Rmb per month (about €25 purchasing power in EU-15) is paid, which is estimated to make up 15% of rural per capita household income.

In addition, contributory pensions are set up with individual choice with regard to contributions. As indirect compulsion, participation is required in order to be eligible for the flat-rate pension. As a rule, a minimum of 15 years of contribution history is required; people older than 45 years are required to make an additional contribution to fill the missing gap. The over-60s receive the flat-rate pension if their adult children join the scheme. The government declared it as a target that the contributory scheme adds 10 percentage points of household income to total pensions.

We follow the information from Herd et al. (2009) that according to the plan, coverage should be 10% at the end of 2009, 50% in 2012, 80% in 2017 and 100% in 2020. They point to an estimate for rural average household income and wage, and suggest that the 25% target expressed as a percentage of the former is equal to 15% of rural average wage. Based on this we simply assume that the basic flat-rate pension is 9% of the rural wage, to be paid from 2010 to all covered, and that the second component gradually increases from zero in 2009 to 6% by 2025 (i.e. over 15 years). Technically, these together are inserted as a flat-rate pension in the model, and expressed as a percentage of urban wages according to our assumption of the rural/urban wage ratio.

With regard to financing, the plan allows the participants to choose their payments to the contributory pillar at between 100 Rmb and 500 Rmb per year. We put in 3% of wage, which is a rough average figure in this range. For the rest, we simply record the balance of expenditures and contributions to be covered by the central government, sharing the burden with local governments in higher-income provinces in the east.

The rural pension system is set up as being sponsored by the government, so the essential information is the deficit that needs to be covered by the government. It increases to 0.5% of GDP by 2025 when full coverage and the target pension level are supposed to be reached. As ageing continues, the financing need exceeds 1% of GDP by 2040, which is roughly its level in the (hypothetical) ultimate steady state; see Figure 6 (for GDP the figures from the previous scenario with increased employment are used).

Figure 6. Chinese rural pension system: expenditure, contributions and deficit, % of GDP
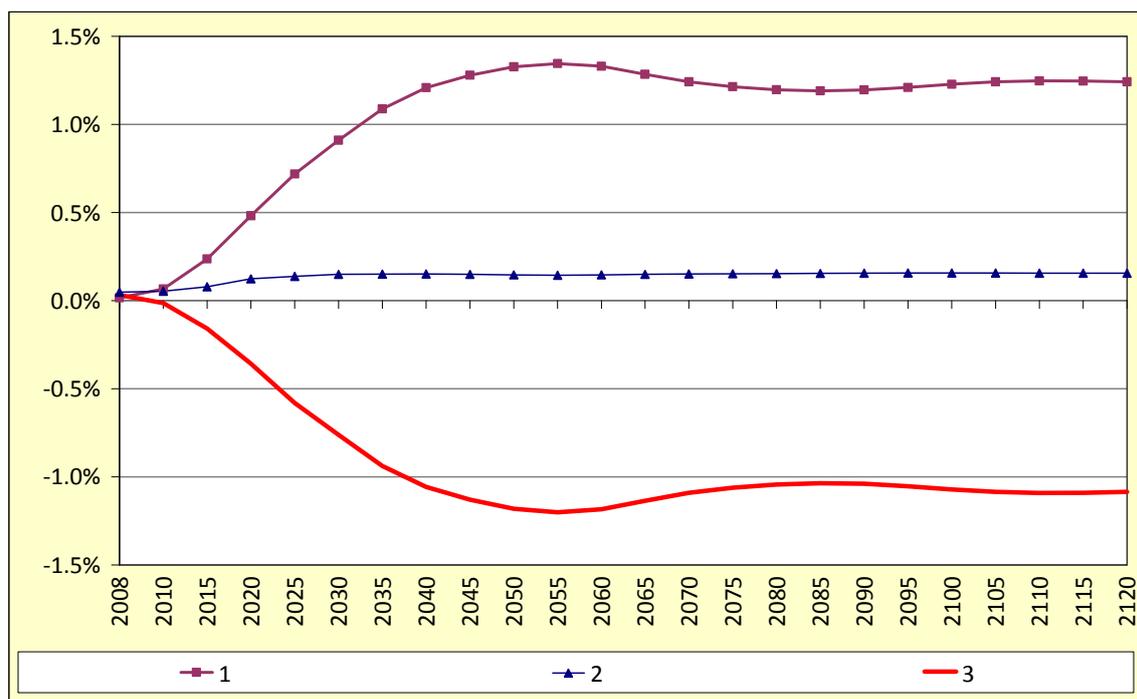
Legend:
1. Pension expenditure
2. Revenue from pension contributions
3. Deficit = pension expenditure minus contribution revenue, interest not included.
Source: see Figure 2.

Transition to Notional Defined Contributions in the urban system

The problem with our reformed DB scenario for the urban system is clearly that pensions are not duly adjusted to increasing longevity. In general, a DB system can be adjusted for this, as has happened in some European countries, and financial sustainability can be secured. However, as explained above, the main advantage of an NDC reform is that longevity enters into the calculation of the annuity when the balance in the notional account is transformed into a pension at the given retirement age. Therefore, an NDC blueprint can set a useful reference for a parametric reform of a DB system, and possibly trigger more comprehensive reform proposals.

For China, we now look into transition to an NDC system also because individual accounts have been part of the reforms and they resemble notional accounts, although not by deliberate planning but rather as a consequence of problems in implementation.

For a blueprint for China, we now assume that, in addition to raising the retirement age, the system moves to NDC from 2010 onwards so that the 20% contributions from all participants at age 40 or less in 2010 are registered in the NDC accounts. All previously accumulated pension rights are respected and starting from 2010 the accrual rate of those above the age of 40 is reduced to 1.78% as in the previous scenario.

For the rules of the NDC system we now turn to a number of specific rules, going into greater detail than the very basic NDC system without assets often presented in the literature.[16]

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[16] See, for example, Palmer (2006) and Gronchi and Nisticò (2008).

The rule for the rate of return on the balance in the notional account during the accumulation phase has to be set. Setting it at the growth rate of the covered wage bill (which is required for the satisfactory steady-state results) is not justifiable for the Chinese case: why should the incumbent workers benefit from the expansion of the coverage and increasing number of participants flowing from the rural areas to the cities? While other options are technically possible in our model, we set it at the growth rate of the total wage bill. Note that in the ultimate steady state the latter is equal to the rate of growth of the covered wage bill as the transitional factors have disappeared.

The indexation of pensions in payment also needs to be set. We set it at the urban wage rate, being aware that this does not take into account the constantly decreasing labour force in the new steady state. So, we know that our assumption is not consistent with full balance in the very long run, but for the same reason as above, we do not want to use the rate of growth of the covered wage bill here.

Next, we need to specify the rule for calculating the annuity. A simple way is to divide the balance on the account by the expected lifetime at retirement. This is done in real-world applications as it is easily understandable. However, it has to be decided whether static mortality figures for that year are applied or whether their expected change over the projected retirement period is taken into account. We use the latter here as it is more correct. Another question is whether the expected change in the interest rate is taken into account in determining the annuity. We shall use a calculation where it is not.

We use gender-specific annuity factors, meaning that given the NDC balance at retirement men have higher pensions. With unisex annuity factors the results for financial balance and average pensions would be roughly the same as here.

Further, the annuity calculation determines the entry pension, and it has to be decided which index it follows. We assume that pensions in payment follow the unit wage, although we recognise that future changes in employment (which affect the contribution base) also affect the balance of the system and therefore, in a mature system, indexing to the wage bill can be more correct.

One more issue is what happens to the NDC balance of participants who die before reaching retirement age. In some real-world applications it goes to the heirs. We exclude this here and assume that the account balance of those who die before retirement remains for the system. This corresponds to the normal DB pension rule.

Possible inheritance of the account balance is linked to survivors' pensions. They and also disability pensions are left outside our simple model of representative agents. We could add a roughly estimated additional burden from these pensions, but we rather leave it out here and prefer to wait for an extension of the analysis to cover these pensions more properly.

These various issues, albeit not an exhaustive list, show that there are quite a few questions to be answered when setting up an NDC system. We know that the answer to each of them affects the financial sustainability of the system, at least in principle. We also know that an NDC application that starts from out of equilibrium in general never automatically settles down to a perfect long-term balance, but some additional adjustment is always needed (see above). This does not, however, mean that the NDC blueprint should be rejected. Its advantage is in any case that its basic rules respond to increasing longevity by reducing pensions at any given retirement age, thereby significantly easing (if not solving) the issues with long-term financial sustainability of public pensions. If the employees have a choice as to when they claim their pension and cease to make contributions, the NDC rules provide close to actuarially fair incentives to postpone that date.

As we can already envisage that these rules lead in the long run to a significant decline in the replacement rate, we add a four percentage points contribution to a newly established fully funded mandatory pillar (which could also be interpreted as an amount of voluntary pension saving). The outcomes of the two pillars are reported separately.

Like in the previous scenario the public system first goes into deficit (due to the reduction in contribution rate to 20%) but due to coverage expansion the surplus then increases to 1% of GDP over 2020-2030. The assets of the system reach 16% of GDP by 2040, and as contribution revenue still exceeds expenditure and the interest rate is assumed to exceed the growth rate, their amount expands without limit. This illustrates the general point that with a somewhat richer structure than the very basic steady-state NDC model, some kind of additional balancing mechanism or fine-tuning is needed. In this case the system can be modified to be more generous. Naturally, there are countless ways to do it by changing one or other parameter.

To illustrate the order of magnitude of the leeway we present a scenario where an additional flat-rate pension is paid to all urban pensioners after the same retirement age as for the NDC pensions. We find that a 2.4 pp flat-rate pension can be paid starting from 2010 and the system is still sustainable: its assets reach 15% of GDP by 2050 and stabilise at around 11% (Figure 4). Expenditure for this additional flat-rate pension reaches 0.2% of GDP by 2040 and stabilises at 0.3% of GDP in the steady state. Thus, we have identified an expenditure flow that is not large but could anyway alternatively be used for other purposes, for example survivors' pensions.

When the youngest male entrants to the system in 2010 retire in 2057 the average NDC entry pension is 32% of the contributory wage (Figure 7). At the same time the DC pension based on the 4 pp contribution reaches 6% of wage, increasing to 8% in the steady state as we assume that the rate of return on its assets relative to GDP growth rises. The total pension decreases to around 40% of wage. This scenario for the urban system is financially stable, and expenditure from the first pillar (NDC + flat-rate) stabilises at 4.3% of GDP, and in the second pillar at 1%.

As the total contribution rate in the new two-pillar system is 24%, it can be considered to be too high, and possibly jeopardise the assumed improvement in compliance and coverage. Therefore, we present an alternative scenario where the contribution rate to the NDC pillar is set at 16%, and combine it with the same 4% contribution to the second pillar as above. It turns out that this scheme can afford to pay only a tiny 0.3 pp of wage in flat-rate pensions. The assets of the system fall below the initial 5% of GDP and stabilise at zero (Figure 4). The NDC pensions reach 25% of wage, and the total pension, together with the DC pension, is 33% of wage (Figure 8).

The assets of the second pillar reach 23% of GDP in 2057 when the first members with full career retire. Their amount then increases marginally for the steady state as the assumed rate of return on assets gradually increases from below the rate of GDP growth until 2040 to one percentage point above.

Other possible fully balanced NDC scenarios could include a further increase in the retirement age. Such scenarios could also be interpreted to calculate the retirement age an individual should choose for obtaining any given target for the replacement rate.

Figure 7. Chinese urban pensions: entry pensions under NDC option 1, % of wage
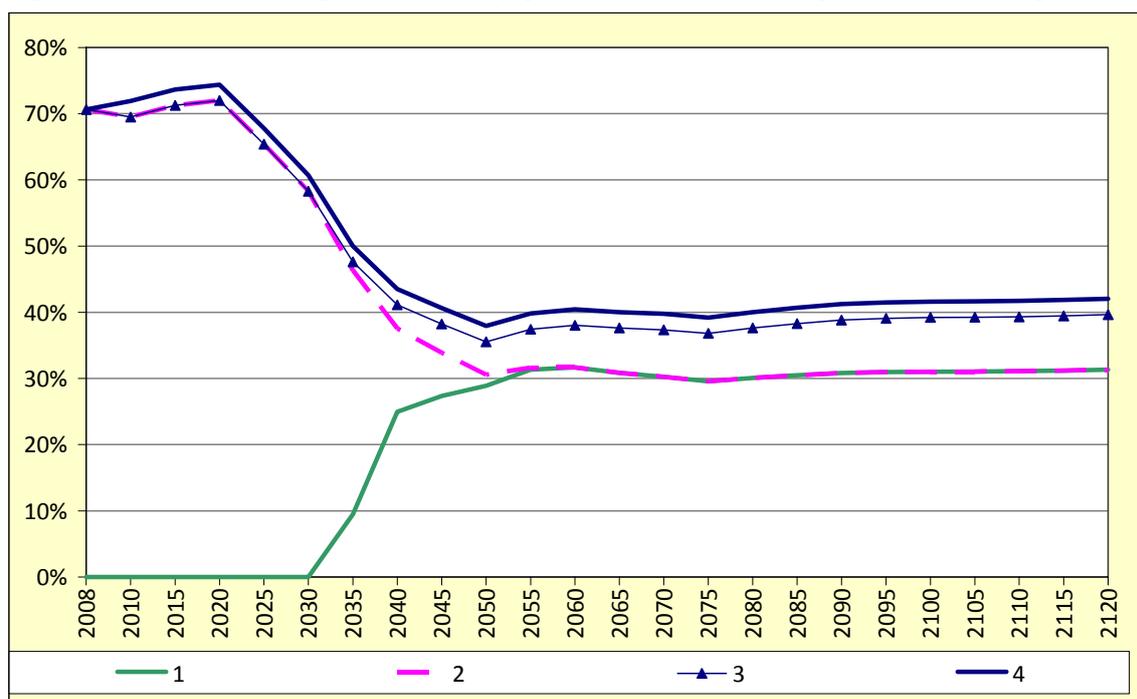
Legend: transition to NDC system with 20 % of wage contribution; pensions are expressed as percentage of contributory wage; for further details see the text.
1. NDC entry pension — 2. Sum of old system DB and NDC entry pension
3. 2 + DC entry pension — 4. Total entry pension including flat-rate pension (2.4 %)
Source: see Figure 2.

Figure 8. Chinese urban pensions: entry pensions under NDC option 2, % of wage
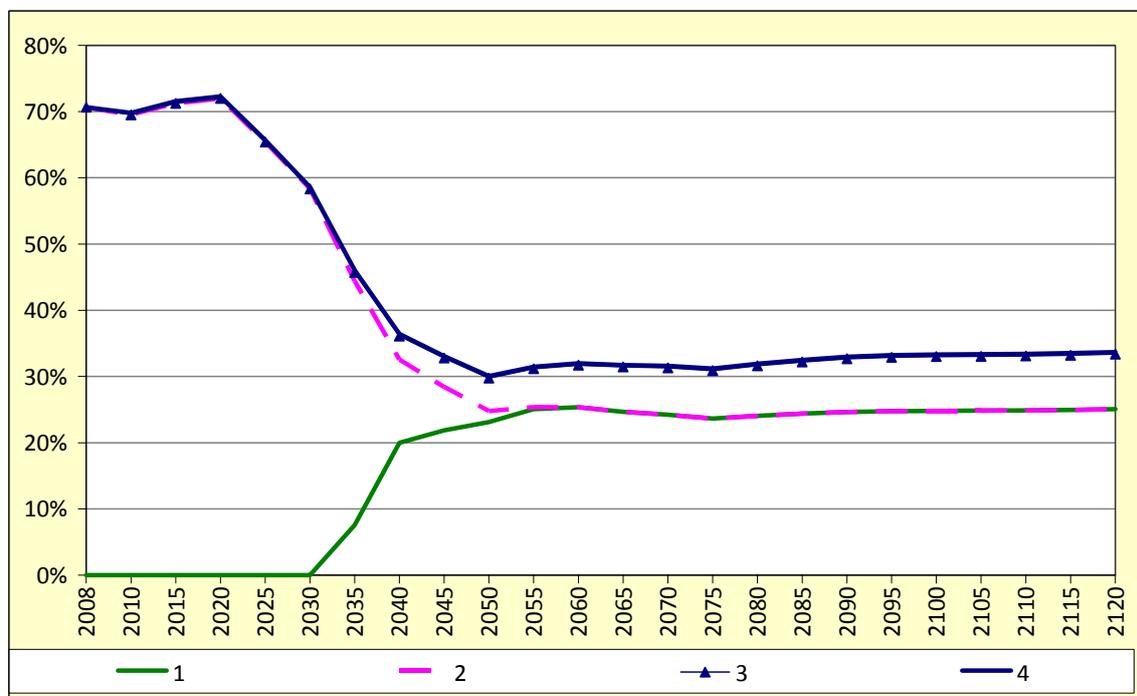
Legend: transition to NDC system with 16 % of wage contribution; pensions are expressed as percentage of contributory wage; for further details see the text.
1. NDC entry pension — 2. Sum of old system DB and NDC entry pension
3. 2 + DC entry pension — 4. Total entry pension including flat-rate pension (0.3 %)
Source: see Figure 2.

6. Assessment and discussion of the results

Retirement age increase

Our simulations for the urban system show that, for public pensions, reducing the contribution rate to 20% of wage, deemed to be necessary to increase the coverage, will require the retirement age to be raised significantly, to 67 for men and 63 for women (by 2030, and thereafter to 64 for women) and the rules for pension benefits to be revised so that the replacement rate reflects the remaining life expectancy at retirement. Otherwise, the pension system is not financially sustainable.

We should note that under these policy assumptions the level of pensions from the public NDC scheme is not generous, and even less so if the contribution rate is 16%. The main reason is the rapidly changing population age structure, which leaves no easy way out. The cost of pensions is high as the number of years on retirement, even under our assumption of the significant increase in the retirement age, is about 18 for men and 23 for women. Note also that the pension is one tenth below the theoretical maximum as we assume that those covered do not contribute over 10% of their career.

If it is considered that additional contributions can be accepted, we have in these two simulations an additional four percentage points contribution to a fully funded DC scheme. This would give an additional pension of 6-8% of wage, and there is some scope in our scenarios for an additional flat-rate pension.

When to increase the retirement age is indeed a political question, but postponing it for too long may jeopardise the sustainability of the system also politically. Essentially, the population projection over the next three to four decades drives this result, and it is therefore not affected by uncertainty over the more distant future. It can therefore be considered as nearly a hard fact that to have more generous pensions requires a higher retirement age and/or a higher contribution rate. Recognising this, even a further increase in retirement age may have to be considered.

In all discussions on raising the retirement age the question arises as to whether it unduly hampers the job opportunities of the younger cohorts. Economists normally dismiss this worry and label it as a fallacy of a fixed number of jobs. We do not attempt to invent any new arguments about this, but it might be interesting to see the numbers of employed in our scenarios shown in Figure 9. They clearly indicate that the assumed migration from rural to urban areas is far more important for the supply of labour in urban areas than the assumed increase in retirement age. For example, in the next 20 years migration contributes more than a 50% addition to urban employment, and this still increases after that both absolutely and relatively. The incremental effect of the retirement age increase is only 6.7% by 2030, and the full effect is not more than 16%. With regard to the nationwide employment figures the increment brought about by the retirement age increase practically coincides with the decrease in the number of employed due to the lagged effect of lower fertility. So, in the dynamic Chinese labour markets the retirement age increase hardly poses a serious problem for the broad picture. This is, however, not to say that there are no issues involved, for example the health status of older workers, their training and determination of their wages.

Figure 9. Number of employed in the various scenarios (million)
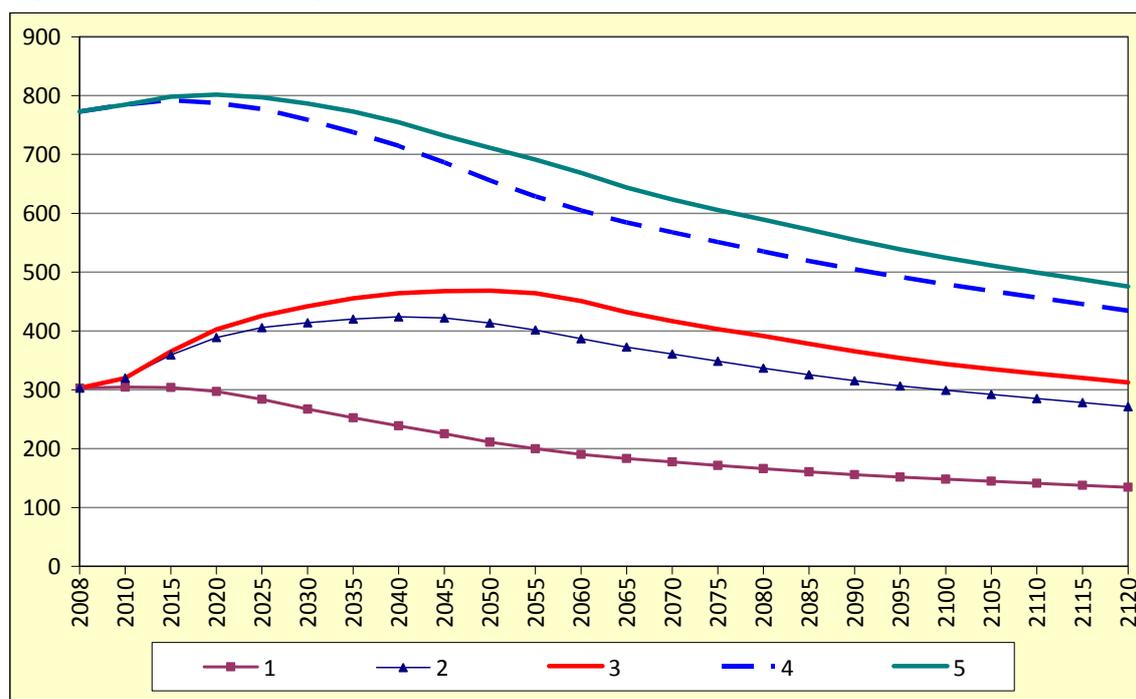
Legend:
    1. Urban employment without migration — 2. Urban employment baseline (with migration)
    3. Urban employment with increased retirement age — 4. Total employment baseline
    5. Total employment with increased retirement age (in urban areas)
    Source: see Figure 2.

Effects on savings

The model in the present study does not cover the effects of the pension reforms on savings and growth, and for example the external balance of the Chinese economy. Also here the problem can be the opposite to the one described for the European welfare states and the US, where the conventional wisdom is that public pensions have led to too low aggregate savings and therefore saving for future pensions should be increased. Instead, the conventional wisdom for China is that saving there is too high (contributing to the issue of global imbalances).

Note that in our two NDC scenarios the contribution of the pension system to government saving (under conventional national accounting) is first negative but then increases to 0.5-1 % of GDP for the 2020s. The system is supposed to be in surplus also without reforms — our baseline indicates a 0.4 % of GDP surplus over 2010-2020. However, in the baseline the surplus is based on the 28 % contribution rate while in the NDC scenarios the contribution rate is 20 % and the surplus is mainly brought in by the coverage increase, which is meant to steer the pension system to long-term stability both financially and socially. Note also that during its accumulation phase, the modest second pillar with 4 pp contribution rate contributes about half a pp of GDP to saving over a few decades.

Here, we should emphasise that assessing the effect of pension reform on total saving (and via that on the rest of the economy) has to be linked to government finances as a whole, i.e. its real and financial assets and debt. We can and should do this, for example, when analysing the option of filling the empty individual accounts with assets, which is one of the reform options or in any case a possible element. If this is done from additional contributions or if the government transfers to them money collected from

other taxes, then the current generation bears a double burden. If this is not considered fair or feasible, and the government fills the accounts by issuing debt (or selling assets), the outcome is roughly neutral for burden sharing and saving. This is the debt financing strategy advocated by Feldstein and Liebman (2008), and it could, if applied to the entire system, lead to a 100 % of GDP increase in public debt or the running-down of state-owned assets. This is just to state the relatively obvious main effect. How desired this refilling *cum* financing strategy is should be assessed on the basis of a full analysis of the capacity of the financial and other institutions to absorb such a large structural change.

For the full picture, it is also useful to note the empirical result reported by Feng et al. (2009) that the reduction of pensions with the pension reforms in the 1990s indeed led to an increase in household savings. Thus, further reductions in pension benefits deemed to be necessary for sustainability, as exemplified by our NDC scenarios, may lead to higher private savings, and this could possibly be aggravated by people's understanding that their time on retirement will be long even if the retirement age is raised.

As a caveat on this conclusion we should note that the sheer projections for the cuts in future benefits do not necessarily alone determine their saving for old age. It can also be that, currently, the lack of confidence in future pensions keeps savings high. If confidence in future pensions improves, even if their level is lower than the current uncertain level, this could lead to reduced saving. It is too early to judge this, but these complex issues should be carefully considered in assessing the macroeconomic impacts.

The relative merits of fully funded DC scheme versus NDC

Under our assumptions the 4 pp contribution to a DC pillar gives a 6-8 pp addition to the replacement rate and pension fund assets of around 25 % of GDP. In our straightforward setting, we can simply multiply all these numbers by two and obtain the results for an 8 % contribution rate that we find both in the World Bank recommendations of 1997 and in policy actually implemented. One interesting outcome is that the projection made in 1997 (and repeated by Feldstein and Liebman, 2008) that the 8 % DC contribution would give a 35 % replacement rate requires in our model that the rate of return on DC assets exceeds the GDP growth rate by 3 pp. No-one knew the future in 1997, but in retrospect we can note that the annual rate of real GDP growth was in 1997-2009 on average 9.7 %. So, how realistic would it have been to assume a 13 % rate of real return under whatever structural reforms were to take place in the Chinese capital market? Therefore, it seems that reality would probably not have reproduced the 1997 World Bank projections for the 8 pp DC contribution rates. Here, we also have to repeat that the much higher contribution rates set by the Chinese authorities in 1997 did not produce a well-functioning system either, as compliance and coverage remained low.

In our scenarios for the future we have assumed a prudent rate of return on assets, in fact below the rate of GDP growth until 2040. The outcome for the replacement rate supported by a 8 pp DC contribution is then less than half the 35 % cited above. This is to draw attention to this significant driver of all pension system scenarios. Under the assumption of relatively fast growth in China for a few decades more we fail to see how the rate of return on financial instruments available for pension saving could considerably exceed GDP growth. We could argue that there is rather a downside risk as, with gradually opening capital markets and expectations of appreciation of the renminbi, interest rates in China could persistently stay at a relatively low level due to market factors, even if the authorities were to lift their policy of keeping them low by administrative means.

If this is plausible, then it also follows that the practical arguments for reviving and expanding the fully funded individual accounts over the next few decades are

overshadowed by the NDC option. In an NDC the natural choice for the administratively determined rate of return is the increase in wages. No relatively safe assets can easily outperform that in China. So, a given addition to the contribution rate gives a higher prospective addition to pensions in an NDC system than in DC! Admittedly, setting up an NDC system so that it does not accumulate any significant amount of reserves means that the future generations need to carry the burden of the implicit pension debt. But as argued above, this can be justified by other contributions the current generations have made to national wealth.

Transforming the existing accounts into NDC accounts

As the current system of basic pensions and individual accounts is fragmented and not uniform across the provinces, there is no way to capture here all the initial institutional details and practical problems to be encountered in transforming the existing accounts into NDC accounts. However, in broad terms, the existing individual accounts, which are expressed as the capital value of the accrued pension right, regardless of the amount of financial assets backing them, could be transformed into NDC accounts by declaring a guaranteed rate of return equal to the rate of increase of average wages (in the region). As long as this guaranteed minimum is higher than the interest rate on (relatively secure) assets, the system would work like an NDC from the point of view of the participant. The accrued rights that are not expressed as an account balance, such as a basic pension linked to the local average wage, could also be transformed into an NCD balance (possibly kept as a separate account if there are practical reasons to do so).

Seen this way the transformation from the current fragmented system to NDC rules need not be a jump into the unknown but rather a process of clarifying various issues, notably the accrued rights, and linking them to objectively observed economic variables. Clarification of the accrued rights is surely also needed under any other reform option. Expressing pension rights as an account balance instead of a proportion of wage and replacing an indexation rule by a rate of return calculated from a wage index should not be seen as replacing the old system by something totally new. Rather, the NDC system can be a more easily understandable pension contract for the employees and also a useful way for the pension authorities to work out their own role and commitments.

Above, we simply assumed that those above 40 years at the time of the reform remain under the old DB rules; one could consider a higher age for shifting to the new system as the question is merely about the way their accrued rights are expressed and equal treatment could be desired.

Managing the assets

Apart from establishing the NDC accounts the second main issue is management of the assets held by the system, currently at about 5% of GDP including those held by the NSSF, and increasing in our first NDC scenario to 25%. In an NDC system this is separated from the management of pensions. This feature is probably an advantage of the NDC system over refilling the individual accounts with assets and moving to fully funded accounts.

To assess the refilling strategy it is helpful to distinguish two options: (1) refilling by a one-off capital transfer operation and (2) moving gradually to fully-funded individual accounts by ensuring that the new contributions to them do not flow out to current pension expenditures but that the government provides the required additional financing for the latter. The first option would require a multitude of capital transfers from the government to individual accounts (managed by provincial or local pension authorities). Estimating the amounts of missing assets would be a complicated task both politically and financially. For a reference, estimating the implicit pension debt of the EU

governments is only starting now that those estimates will be required for the supplementary accounts under the revised national accounting rules. This work will take several years (European Central Bank, 2010). Estimating the missing assets in China is even more demanding as the pension rights have not been fully clarified and, for example, agreeing on the interest rate to be used in the calculations is even more controversial than in mature welfare states with much deeper (though at times turbulent) financial markets. Such an exercise would not be feasible and practical as it would potentially disturb the work of the different actors (including various ministries) for years. Therefore it is probably not seriously considered.

The second option above is not necessarily infeasible and it is understood to be part of the ongoing pilot schemes in Liaoning and other provinces. It requires a subsidy from the government over several decades — part of the current 0.5% of GDP transfer from the government. It also requires that management of the assets on behalf of the participants be improved by clarifying the principles and practices, possibly introducing more competition and strengthening regulation.

The NDC blueprint avoids many of these requirements as the NDC accounts are merely for bookkeeping and determination of the pension rights and management of the true assets can be entrusted to a central body, and their purpose is rather smoothing the pension burden across the generations with no direct effect on individual accounts.

In addition, our two NDC blueprints show that the pension system would not necessarily require a permanent financial transfer from the rest of the government. It is in fact one of the purposes of our exercise to show that this is possible and then pass on the message that, ultimately, higher pensions require either higher contribution payments or raising the retirement age.

If it were that the government wanted to support the pension system financially through a capital transfer or permanent subsidy, motivated by, for example, the desire to transfer the proceeds from privatising state-owned enterprises to the population at large in order to boost private consumption, filling the empty individual accounts with assets is not the only option. This can also be done under a partially funded pension system with NDC accounts and more central management of assets. Another relevant use for a permanent subsidy from the government could be a basic social pension scheme as, according to our scenarios, the level of the financially sustainable earnings-related pensions seems to be relatively low (see below).

Rural system

The scenario we have presented for the rural pension system attempts to emulate the plan issued by the Chinese government in August 2009, targeting full coverage by 2020. The flat-rate pension, to which is added the individual accounts based on contributions estimated at 3% of rural wages, would give a pension of only 15% of rural wages. Financing this from the budgets of the central government and partly by the higher-income provinces would reach 0.5% of GDP in the early 2020s, increasing to 1.2% by 2050.

There could be social and political reasons for increasing rural pensions further. Setting up the new pension system with full coverage as announced helps in establishing the necessary administration that would be ready for possible further changes in generosity. Our model could also be used for further scenarios incorporating NDC and DC accounts and possible convergence towards the urban system.

Overall improvements

Our results are driven by the assumption that the reduction of pension contributions from currently around 28 % of wages would lead to a significant improvement in compliance and coverage of the system. Other reforms and improvements in the system may help or even be required to achieve that. One is to tackle the issues of portability of pension rights hampered by the fragmentation of the current system. Another is that typically at least 15 years of contributions is required to receive a pension, otherwise a lump sum is paid. Setting sufficiently similar rules over the provinces would improve portability, and this would make the vesting rules less binding. All this, together with financial sustainability, could enhance confidence and compliance and thereby coverage.[17]

Regarding the overall size of the public pension system, in our first NDC scenario based on a 20 % contribution rate to the first pillar total expenditure of the urban system in 2060 is 4.4 % of GDP and in the rural system 1.3 % of GDP.[18] Adding the cost of pensions of civil servants and public service unit personnel that is currently 1 % of GDP and obviously increasing, the overall expenditure after the foreseeable ageing would be perhaps 7 % of GDP. This is below the relative size of the public pension systems in the EU-15, i.e. the Member States before the 2004 enlargement, where their expenditure currently takes 10 % of GDP and is projected to increase to 13 % of GDP by 2060 (Economic Policy Committee (AWG) and Directorate-General for Economic and Financial Affairs, 2009). The relative numbers for the US are roughly half of these. As per capita GDP in China is currently at the level of 20 % of the EU-15 and as collecting pension contributions and taxes is generally harder in a low-income country, our scenarios for China may hit close to the size that can be managed credibly.

This raises the question as to how to assess adequacy of income support for the less well-off elderly. We are not addressing this with our model, where we assume a representative individual for each cohort (with only gender and urban/rural distinction) with average contribution history. This would remove the current rule that participants receive a basic pension equal to 20 % of local average wage after a relative short contribution period of 15 years. As in China, as everywhere, one of the purposes of public pensions is elimination of poverty among the elderly, a basic flat-rate pension scheme is probably an indispensable part of the system. If, as currently, everybody received a flat-rate pension and it were financed from pension contributions and taken away from those put into the NDC accounts, the link between the contributions and the benefits for the individual becomes weaker than in a strict earnings-related system such as the NDC. This impairs compliance and may cause evasion and lower coverage.

Also, a basic flat-rate pension for everybody is always costly. For example, from our model we can calculate that an additional pension equal to 10 % of average wage for all urban retirees (even with the assumed retirement age increase) would cost 1.3 % of GDP in 2040 and 2 % in 2060.

There is no general solution to the issue of providing adequate pensions at a reasonable cost, but the authorities must face the trade-off between competing goals and strike a compromise. One solution is to make the basic income support pension-tested, i.e. negatively dependent on the earnings-related pension so that it reduces to nil at a given

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[17] Increasing coverage would also even out the labour costs between the state-owned enterprises and the private sector as in the former coverage is currently 90 % while in the latter it is well below 50 %.

[18] The implicit pension debt (urban and rural schemes) reduces from the current 300 % of GDP (as calculated by our model for the baseline) to 160 % by 2060.

level of the latter. The disadvantage is that the implicit tax on the earnings-related pension is high for those who face the partial reduction. The advantage is that for those above the earnings level where the basic pension is nil, the link between their own contributions and benefits is strong.

Again, combining basic and earnings-related pensions is not new to the Chinese system, but a central feature since the reforms that started in the 1990s. Also, part of the means-tested cash transfer programme, popularly referred to as *dibao*, that currently takes 0.2 % of GDP, goes to the elderly. For the functioning of the earnings-related pension system it is generally favourable if the flat-rate pensions can be financed from other sources than taxes on wages. In China, proceeds from state-owned enterprises is one possible source and other options could arise from a more general review of tax collection from different sources (various incomes and consumption etc.) and levels of government (Hussain and Stern, 2008).

Health care expenditure

Public health care expenditure is as big an issue as pensions in China, like in other countries. In 2008, expenditure on basic medical care insurance for urban employees was 0.7 % of GDP, with reserves amounting to about 1½ years of expenditure. Recently, schemes have been set up for the rural population and for the urban population without employment. Even though the level of such expenditure is initially lower than on pensions, its increase might be even more difficult to manage as it is affected by many factors difficult to control and predict (medical technology, involvement of both public and private sector, risk and uncertainly at individual and aggregate level). The consequences for public finances are significant. The same type of relatively simple scenarios as for pensions could be useful to estimate the rough magnitudes and discuss sharing both the benefits and the costs across generations.

The consequences of the public health care programmes for the quality and quantity of labour and via this for the economy as a whole can be huge. There is also a link to the acceptability of pension system reforms as more healthy people can and probably will accept a higher retirement age.

Education

Public expenditure on education is also affected by the demographic variables, not least fertility. However, especially in China, judging intergenerational burden sharing, including contributing to pensions, should take into account that not only is the *number* of children relevant here but also the parents' expenditure in educating them, thus making an investment in the human capital of the younger generation, thus giving them more capacity to pay for the pensions of their parents. Both private and collective investment in education should be taken into account here.

We argued above that the efforts of the current old-age pensioners and employees can justify a pension reform that does not contain a significant accumulation of reserves in the system as the prefunding has already been made in various other forms in the past. The current level of education for the young financed or supported by the current working generation can be seen as an additional justification. The principle should be relatively clear while further considerations would be pertinent.

7. Summary and conclusions

Pensions in China face a dual challenge: (1) the current system covers only a fraction of the population and does not function as intended, and (2) population ageing is progressing fastest in the world: the ratio of 65 year-olds to those aged 15-64 years, currently at 11%, is projected to increase to 38% by 2050.

The current multi-pillar pension system for urban employees is fragmented, it does not work as intended and compliance with the rules is low. The system established in the 1990s was supposed to introduce individual fully funded accounts to top up the basic pension (20% of average urban wage), but the accounts are virtually empty as contributions were used to pay the pensions of current pensioners.

As for rural area employees, who are still the majority of workers, the pension system covers only a very small fraction of the population and provides very low pensions. Extending coverage is a challenge that is clearly recognised by the Chinese authorities, as demonstrated by the government plan issued in August 2009.

There are many linkages between the urban and rural social security systems (especially through the workers from rural areas working in the cities), and also various policies (including changes to the registration system) will probably enhance convergence. This process will, however, be gradual and therefore it is advisable to keep the urban and rural pension systems separate for analysis, as we do in this paper, while looking at scenarios where they may converge.

Urban system

A wide range of reform options have been advanced both by Chinese and non-Chinese experts. It is broadly agreed that the contribution rate at around 28% is an obstacle to increasing coverage, and even this level of contribution would be insufficient to support the current level of pensions as population ageing progresses. To solve the dilemma of high contributions and low coverage is not easy. Our analysis is based on the view that coverage cannot be increased without reducing the pension contribution rate significantly and adjusting the benefits so that the system becomes credible for coping with the ongoing rapid ageing of the Chinese population.

The proposals to pay for the pension rights accrued until now by issuing government debt and establishing a truly fully funded pension system from now onwards is one option, but the capacity of the financial markets and institutions to absorb this is not self-evident and in China one should also recognise that the rate of return on the assets in fully funded accounts will in the medium term future probably be less than the rate of growth of wages. Therefore, the conventional view that a fully funded system gives a higher return than a public PAYG system is not necessarily applicable.

In this paper we discuss the argument that, as in Western Europe from the late 1940s until the early 1970s, also in China it can be considered that at least the older members of the current working generation and current retirees have already contributed significantly to the wealth of the nation and can therefore justifiably be provided with pension benefits which exceed the level that they have paid for in the form of pension contributions. This principle and acceptance that the current system is virtually PAYG, can lead to an option which does not aim to accumulate significant reserves. It is also emphasised that it is important to design the new rules so that the projected increase in longevity is taken into account early enough — this primarily means that the retirement age should rise significantly.

These principles can be implemented under the so-called notional defined contribution (NDC) system, and is therefore according to many experts the most promising option for China or at least gives useful guidance for a comprehensive reform. It is seen as an advantage of the NDC system that pensions are not at risk in the financial market. The NDC system does not necessarily require large reserves, which can be an advantage in the case of China where the saving rate is already very high, possibly excessive. Under NDC, the benefits are adjusted according to retirement age and expected longevity. Thereby financial sustainability is quasi-automatically secured.

We discuss the NDC model and show that beyond the elementary principles there are quite a few aspects where there is scope for choice (indexing rules, longevity tables etc.) and that the transition for the first phase of 2-3 decades in any case always requires tailor-made rules. This is only natural, as an NDC system based on the elementary principles is in practice never sufficient for practical implementation but always requires some kind of additional elements for being fully balanced.

Using the China Pension-System Simulation Model we present a couple of NDC reform scenarios. All previously accumulated pension rights are respected. However, the implicit pension debt, also called legacy debt, does not become explicit debt of the government, neither does it require the current working generation to pay 'a double burden' (as is the case when moving to a fully funded system). Instead, under an unfunded (or partially funded) public pension system this burden is shared by all current and future generations.

As longevity is increasing we assume a gradual but significant increase in retirement age, to 67 for males and 64 for females. In the first scenario the contribution to the NDC pillar is 20% of wage and in the second 16%. We also assume a moderate Defined Contribution (DC) pillar with a 4% contribution.

Under these assumptions, notably due to the increase in coverage, with both contribution rate options, the pension system would accumulate reserves without limit. Therefore, additional (small) flat-rate pension can be paid on top of the NDC and DC components. With a 20% contribution rate, the total pension, including all three components, decreases to 40% of the contributory wage. With the contribution rate at 16%, it reduces to a little over 30%.

Thus, the unfortunate conclusion is that the projected pensions are not generous. This mainly follows from the population projection over the next three to four decades, and is therefore not affected by uncertainty over the more distant future. To have higher pensions requires higher pension contributions or a higher retirement age. Accepting this hard choice is not easy. The high cost of pensions primarily stems from the high expected number of years on retirement, about 18 for men and 23 for women in our scenarios even though we assume a significant increase in retirement age. This should lead to consideration of whether the retirement age should be raised further than assumed in our scenarios.

Rural system

The Chinese government issued in August 2009 a new plan, targeting full coverage of the rural elderly by 2020. The flat-rate pension, to which is added the individual accounts based on contributions at 3% of rural wages, would give a pension of 15% of rural wages. According to our scenario, financing the deficit from the budgets of the central government and partly by the higher-income provinces would involve a cost of 0.5% of GDP in the early 2020s, increasing to 1.2% by 2050. There could be social and political

reasons for increasing rural pensions further. However, even a 0.5-1.2% of GDP continuous expenditure flow cannot be persistently financed by issuing debt. The difference between expenditure and contributions has to be covered in an orderly manner from other revenue sources of the government as otherwise the credibility of the system is undermined.

<p style="text-align:center">*　　*　　*　　*　　*　　*　　*　　*　　*　　*　　*</p>

In our model, we cannot capture all the initial institutional details and practical problems to be encountered in reforming the Chinese pension system, but our NDC reform still gives some guidance. One question is how to transform the existing individual accounts which are only partially filled with real assets into the new NDC accounts. One option could be that the government guarantees a rate of return which is at least equal to the rate of increase of average wages (in the region). As long as this guaranteed minimum is higher than the interest rate on (relatively secure) assets, the system would work like an NDC from the point of view of the participant. The management of the assets, currently about 5% of GDP, and increasing in our NDC scenarios, can in this way be separated from the management of pensions. Similarly, possible transfer of assets from other government bodies to the pension system could be dealt with as a separate question, without a direct link to defining the pension rights.

Transforming the accrued pension rights into NDC accounts and starting to apply the new NDC-inspired rules on indexation is not necessarily a jump into the unknown for the Chinese pensions system. Rather, it could be a useful and long-awaited clarification to the rules and a way to leave fragmentation behind and move towards a more uniform system nationwide. This would also enhance portability of pensions and thereby improve functioning of the labour market , serving both economic efficiency and social fairness.

The level of public pensions is relatively modest both in our NDC scenarios for the urban system and in the scenario depicting the new system for the rural population. This will mean that there will be a need for two additional schemes, namely basic social income support for the elderly financed from government budgets and additional individual pension savings managed by various types of financial institutions.

Financing requirements for the basic pensions will compete with the availability of government funds to possibly refill the empty individual accounts of the current system. The NDC blueprint with increasing coverage would leave more scope for government support for basic pensions.

As part of additional individual saving can be in mandatory fully-funded DC accounts one of the essential questions is then how the compulsory pension contributions should be shared between the NDC accounts and fully funded DC accounts. There is no general guidance for this, notably over the 2-3 decades when the new schemes are established and the institutional structure of the economy is under fundamental transition as in China. Note that the contribution rate to the NDC system can be later increased or decreased without disturbing its principles. The desired relative size of the public pension system and private sector-managed pension funds will also depend on how the financial markets develop and what the targeted total saving in the economy will be.

We emphasise in the present study that saving in the economy as a whole, including the government-owned assets and public debt, should be taken into account when setting the targeted degree of funding in the public pension system. The NDC blueprint accepts that the public pension system can be only partially funded or not funded at all. China is an example where it can be considered that the current working generation and current retirees have already contributed significantly to the wealth of the nation and can therefore justifiably be provided with pension benefits which exceed the level that they

have paid for in the form of pension contributions. This principle would justify a low degree of funding and cutting the contribution rates to a level that would improve compliance. Also, an NDC outperforms the traditional Defined Benefit schemes by containing a firm link between individual contributions and future pensions and taking the increase in longevity into account so that the retirement age will rise.

<p style="text-align:center">*   *   *   *   *   *   *   *   *   *   *</p>

We have presented in this paper results from a pension simulation model calibrated for Chinese data and conditions. The purpose is to provide input to solving the dilemmas of the current fragmentation and move within 2-3 decades to a more coherent system. The results for an NDC pillar combined with basic social income support for the elderly and moderate DC pensions, geared to be financially sustainable under the rapid population ageing in China, could be used for designing pension reform proposals, covering a wider range of options. Designing coherent reform options and explaining their characteristics will hopefully facilitate political decision-making.

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