Public Disclosure Authorized

Public Disclosure Authorized

WPS 1674

POLICY RESEARCH WORKING PAPER 1674

How Can China Provide Income Security for Its Rapidly Aging Population?

Barry Friedman
Estelle James
Cheikh Kane
Monika Queisser

If China implements a partially funded multipillar pension system, that reform must go hand-in-hand with reform of the financial sector and restructured investment procedures that emphasize the "right" mix of competition, diversification, and regulation. Otherwise, pension reform will ultimately fail.

The World Bank
Policy Research Department
Poverty and Human Resources Division
October 1996

Summary findings

Friedman, James, Kane, and Queisser discuss key choices policymakers face about China's pension system in the face of a rapidly aging population. (Many developing countries face the same problem, but China's problems are exacerbated by the long-term effects of its one-child family planning policy.) They describe the problems the current pay-as-you-go system faces in the near and long term and simulate policy options for solving those problems.

They find that simple design changes — such as reducing the generous benefit rate, moving toward price indexing rather than wage indexing, and raising the retirement age — are necessary but not sufficient conditions for making the pension system sustainable. Partial funding is necessary to avoid large increases in future contribution rates.

They investigate the impact on the old-age system and economic growth of a multipillar system that includes a modest mandatory tax-financed basic benefit plus a mandatory fully-funded defined-contribution (individual account) scheme.

Implementation of a partially funded multipillar pension system must go hand-in-hand with reform of the financial sector and restructured investment procedures that emphasize the "right" mix of competition, diversification, and regulation. Otherwise, China's pension reform will ultimately fail.

This paper — a product of the Poverty and Human Resources Division, Policy Research Department — is part of a larger effort in the department to analyze the impact of pension systems and pension reform. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Selina Khan, room N8-024, telephone 202-473-3651, fax 202-522-1153, Internet address skhan8@worldbank.org. October 1996. (51 pages)

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be used and cited accordingly. The findings, interpretations, and conclusions are the authors' own and should not be attributed to the World Bank, its Executive Board of Directors, or any of its member countries.

Produced by the Policy Research Dissemination Center

HOW CAN CHINA PROVIDE INCOME SECURITY FOR ITS RAPIDLY AGING POPULATION?

by

Barry Friedman, Brandeis University
Estelle James, World Bank
Cheikh Kane, World Bank
Monika Queisser, World Bank

Table of Contents

HOW CAN CHINA PROVIDE INCOME SECURITY FOR ITS RAPIDLY AGING POPULATION?

Abstract i

I. Introduction and Summary 1

II. The Current System: Problems and Alternative Solutions 4
The Short Run Problem: High Costs for SOE's and Limited Pooling . . . 4
The Long Run Problem: Population Aging and Limited Coverage 7
Alternative Policy Solutions:
Simple Design Changes Versus Basic Reform 8

III. Effects of a Continued and Reformed PAYG System 10
Basic Assumptions 10
Cost of the PAYG System Under Alternative Reform 13
The Current System 14
Benefit Rate and Retirement Age:
The High Cost of Early Retirement 15
Price Versus Wage Indexation 16
Financial Market Reform 17
Combined Reforms and Coverage Expansion 18

IV. Partially Funding in a Multi-Pillar Systems 19
The Rationale for a Multi-Pillar System 20
Risk in the Single-Pillar and Multi-Pillar Systems 24
The Cost of the Multi-Pillar Systems; and How
to Finance the Transition 26
Transition Costs Paid by Present Worker Cohorts 27
Transition Costs Spread Over Many Generations Through Borrowing 27
Extended Coverage and Broader Pooling 28
Comparisons Among Alternative Systems 30
Use of SOE Assets 31

V. Conclusions and Risks 33

Appendix: Notional Defined Contribution Plans 38

Tables
1. Population Aging in China 40
2. Baseline and Alternative Assumptions 41
3. Break Even Contribution Rates for Reformed42
PAYG Defined Benefit System 42
4. Uniform Contribution Rates for Partially Funded
Defined Benefit System 43
5. Replacement Rates Under Multi-Pillar System,
for 19 Years of Expected Retirement 44
6. Annual Contribution Rate Needed for Multi-Pillar System,
Including Transition Costs 45
7. Uniform Contribution Rate Needed for Multi-Pillar System,
With Borrowing to Cover Transition Costs 46
8. Annual Surplus and Total-Funded in Transition
Account and Pillar I 47

Figures
1. Trade-Off Between Retirement Age and Contribution Age 48
2. Trade-Off Between Retirement Age and Replacement Rate 49
3. Pension Relative to Average Wage Under Price
and 50% Real Wage Indexation 50
4. Relative Position of Young, Old and Very Old Under Price
and 50% Wage Indexation 51
5. Impact of Expanded Coverage on Contribution Rate,
and Comparison to Transition Costs 52

6. Comparison of Alternative Systems 53

References 54

HOW CAN CHINA PROVIDE INCOME SECURITY FOR ITS RAPIDLY AGING POPULATION?

I. Introduction and Summary

As in many developing countries, China's population is aging rapidly, due to fertility policies that have depressed the number of children combined with rapid medical improvements that have prolonged life for the old (Table 1). By 2030 over one quarter of the world's old people will live in China. While those over 60 accounted for 9% of China's population in 1990, they will be 22% in 2030 and 26% in 2050. It will take China only three decades to reach the 1990 OECD level of 18%, while in most OECD countries it took nearly a century for the proportion over 60 to double from 9% to 18%. In 2030, China's proportion will be 50% higher than many of its likely competitors in Asia, such as India, Indonesia, Malaysia or Vietnam.

This aging process will have far-reaching consequences. Socially, the family will be strained, perhaps more than in other countries, because of China's "one child policy". Economically, escalating costs associated with the aging population could put China at a competitive disadvantage relative to its neighbors. If current systems are unchanged, rising payroll tax rates needed to cover sharply increased medical and pension costs could dampen China's growth in wages and employment, induce evasion and escape to the informal sector, and will inevitably mean large intergenerational redistributions. China is considering a number of reforms to prevent this from happening.

This paper focuses on the pension system, discusses key policy choices, and evaluates their impact on costs and benefits as China's population ages. Part I describes the current pay-as-you-go (PAYG) system and the problems it faces in the short and long run; such a system is very sensitive to changing old age dependency rates. In a PAYG system, the pensions of old people today are financed by contributions of young workers today, rather than by their own savings in the past. Parts II and III simulate several policy options for solving the problems that will be faced by this system in the near future. Simple design changes involve reducing the generous benefit rate, moving toward price rather than wage indexation of pensions and raising the retirement age. The trade-offs among these options are explored in Part II. The central question asked here is: Will these

reforms alone suffice to solve the aging problem? Simulations indicate that the answer is "no".

More basic reforms would move away from a straight PAYG system to a partially funded system that smooths contributions over time. In addition, partial funding can enhance economic growth by increasing capital accumulation. While China's rate of voluntary saving is very high now, it may not be so high in the future, so policies that augment long term saving may be desirable. If the savings are well invested, this ultimately raises the affordable benefit or lowers the required contribution rate.

This leads directly to a key issue--how should the funds be managed to maximize the returns? Who should choose the investment managers? What incentives and constraints will the managers face? Should the funds be publicly or privately controlled? Another important question is the choice between defined benefit and defined contribution plans. In a defined benefit plan, pensions are promised that usually depend on the number of years worked and the wage in the last few years of employment, but the future contribution rate needed to pay for these promises--and therefore their credibility--is unspecified. In a defined contribution plan the contribution rate is defined and the pension ultimately depends on accumulated contributions plus investment returns, but future interest rates and benefit amounts are uncertain.

In Part II the entire system is assumed to be defined benefit and any funds that accumulate are publicly managed. Part III investigates the effects of instituting a multi-pillar system that includes a modest mandatory tax-financed basic (defined) benefit plus a mandatory fully funded defined contribution (individual account) scheme. The first pillar is publicly managed and designed to provide a social safety net through redistribution targeted toward low income workers, while the second pillar requires people to save in their own individual accounts and is privately managed. Thus the multi-pillar system combines publicly and privately managed components, that are pay-as-you-go and defined benefit, funded and defined contribution, respectively. (See World Bank 1994, which describes this system and its advantages in a more general context).

Many Chinese officials consider such a system desirable--but implementation has been stalled by the transitional costs that would be implied. Shifting to a multi-pillar system would require paying off the implicit debt (honoring the

promises) of the old system while also funding the individual accounts in the new system, a requirement which, in many countries, has stopped such reforms. This paper investigates ways in which this debt could be paid off, including the feasibility of borrowing in the early years and repaying later on, with taxes or proceeds from SOE assets as alternative sources of funds for repayment. The Conclusion summarizes the recommendations that come out of this analysis, as well as the inherent risks.

Under reasonable assumptions, it seems that maintenance of the current PAYG system will require a doubling of the current payroll tax rate by 2030 and a trebling by 2100. Simple design changes to the PAYG system substantially cut these rate increase, but do not appear to be a sufficient solution. However, a combination of these design changes--together with partial funding and a transition to a multi-pillar system in which the funds are competitively managed--will enable China to provide income security for its aging population into the twenty first century with a lower contribution rate than it currently requires, without large intergenerational transfers, and with beneficial effects on the broader economy.

Simulations show that the pay-off of the pension debt is quite manageable, in part because of the low initial coverage rate for the country as a whole. It can be financed by a 1.5% payroll tax for 105 years or 3% for 55 years (or the equivalent in other taxes or SOE assets), while the new system as a whole (including the transition cost) would require an 18% payroll tax--quite reasonable by international standards, for an aging population.

This transition is greatly facilitated by:

1) borrowing to pay off the pension debt, thereby spreading the transition costs across several cohorts;

2) coverage extension and broader pooling, which spread the costs and risks of the basic benefit across a wider group of workers and enterprises within each cohort; and

3) China's rapid rate of economic growth, providing the benefit formula does not require pensions to go up as fast as wages.

Necessary institutional conditions for the success of the new system are:

1) the ability of the central government to obtain compliance from local governments and nonstate enterprises and

2) financial markets and regulatory policies that enable the pension funds to be allocated to their most productive uses and to earn a rate of return that reflects this productivity.

These results should hold for other countries as well, especially for Asian countries that presently have high growth and low coverage rates.

II. The Current System: Problems and Alternative Solutions

The formal pension system in China is largely urban-based, PAYG and offers a defined benefit that depends on the worker's wage in the last year of employment. Covered retirees also receive housing, medical benefits, other services and inflation subsidies. In urban areas the pension system has been largely focused on state owned enterprises (SOE's) and older collective enterprises (COE's). Only a minority of workers are covered in the new non-state sector (joint ventures, joint stock companies, private companies, foreign enterprises, self-employed), which accounts for a rapidly growing share of employment. Very few workers in rural areas, including workers in the rapidly expanding township and village enterprises (TVE's), are part of any formal pension plan. Less than a quarter of the working-age population over-all is covered.

The Short Run Problem: High Costs for SOE's and Limited Pooling

During the period of the Cultural Revolution, each state enterprise was responsible for paying the pension benefits of its own workers, on a PAYG basis. This meant that older enterprises with many retirees had far higher pension costs than young enterprises. Although wages were low, partial compensation was provided in the form of high wage replacement rates upon retirement. Since the proportion of old people was generally small and the government stood ready to fund any deficits, this high cost and the disparity among enterprises did not matter in a planned economy. However, it became an increasing problem when the Cultural Revolution came to an end and China's economy became more market-oriented. Declining state enterprises found it difficult to keep their pension promises, uneven payroll taxes exacerbated their inability to compete, and banks were pressured to help enterprises meet their obligations by making unsound loans that might never be repaid.

In response to the difficulties enterprises have had in paying pensions, over the past decade most municipalities have tried to "pool" the contributions, benefits and risks across enterprises. Pooling has eliminated some of the problems, but since the state sector is growing slowly relative to the rest of the economy, the ratio of pensioners to workers is high for the pool as a whole. Moreover, since pooling is incomplete, risk-sharing is limited and state enterprises still do not operate on a level playing field with each other or with nonstate enterprises. In some cities only part of the total pension bill is pooled, so that enterprises with large proportions of retirees still pay higher contribution rates, and different groups of enterprises in a locality (SOE's, COE's) often belong to different pools. For example, in Shenyang, each enterprise is supposed to pay 40% of its own pension bill, plus an 18% payroll tax to finance the remaining 60% on a pooled basis.

Some municipalities have a concentration of declining state enterprises with many retirees and few workers, while others have relatively new enterprises with few retirees. The pools can provide pensions to workers if a small number of enterprises go bankrupt, but their capacity to absorb a wave of bankruptcies has not been tested. Pension portability is usually permitted within the pool, but since the pools are limited in scope so too is worker mobility. Portability of pensions across municipalities and provinces requires special arrangements which may not be feasible. The management and record-keeping burden of the pension system still rests heavily on the individual enterprises; potential economies of scale from centralized administration are not realized.

In addition, SOE's in financial difficulty are sometimes excused from paying their share of the pension burden, eleven industries are allowed to maintain their own pools on a nation-wide basis, and nonstate enterprises which constitute the growth sector are only sparsely covered. The latter groups tend to have a relatively young work force and few retirees; their exclusion avoids cross-subsidization away from them and keeps the dependency and contribution rates high for the others.

Benefit rates continue high relative to wages, in part because (partial) wage indexation of pensions is used. The average replacement rate is over 80% of wages, compared with 40-60% in other countries. And the duration of retirement is long, since retirement ages are low relative to the rising life

expectancy in China. The high costs of these high benefits lead to evasion and exemptions, which raise the required contribution rate still higher. Although pension costs are only 15% of the covered wage bill, the average break-even payroll tax rate exceeds 20%, higher than in most OECD countries. The cumulative tax for all social insurance often exceeds 35%, the cumulative cost of all benefits for retirees is much greater, and imperfect labor markets may prevent these costs from being passed on to workers in the form of lower wages. Consequently, an enterprise may lose competitiveness not because its efficiency in its core business is low, but because it, or its municipality, has many retirees, hence high costs of pensions and other generous social services (health care, housing) that they provide to retirees, a legacy from the past. Restructuring of SOE's has been slowed down by these costs. (For further information on historical background and current problems see Friedman and Hausman).

Thus, pooling at the municipal level alone has not solved the short run financial problem of the SOE pension system or its impact on the broader economy.

The Long Run Problem: Population Aging and Limited Coverage

Added to this immediate problem in the state sector is the longer run problem caused by rapid population aging. The system old age dependency ratio (i.e. the number of pensioners divided by the number of covered workers) will double from 21% in 1995 to 42% in 2030, continuing to 55% in 2050 and 71% in 2100, respectively, if retirement age, urban/rural migration and coverage do not change (Table 1). Realizing that the costs implied under a PAYG system would become unaffordable and distortionary, the Chinese government is anxious to partially prefund its future pension obligations.

Prefunding would not only smooth the contribution rate over time and reduce intergenerational transfers, it would also enhance economic growth by accumulating savings for long term investments and facilitating financial market development. However, in China as in other countries, it is proving difficult to finance the transition from PAYG to funding--paying the benefits of current retirees while also prefunding future retirees. Because of the desire for prefunding, individual retirement accounts for covered workers are being set up in most municipalities, but because of the practical difficulties these tend to be "notional" accounts, with bookkeeping entrees and few real assets. From a

financing point of view, notional accounts are not very different from PAYG (see Appendix).

Another aspect of the long run problem is the fact that the vast majority of Chinese workers, including most urban workers in nonstate enterprises, most rural workers and all self-employed and agricultural workers are not covered by any formal pension plan. As the extended family support system breaks down due to the one-child policy and increased migration from farm to city, many old people will find themselves without any means of financial security. Defined contribution plans were recently offered to rural workers by the government on a voluntary basis, but the small contributions made and the low (negative real) interest rate paid imply that only a negligible annuity will be available when these workers retire. This problem could explode in the future if preventative action is not taken now. Extending mandatory coverage to the dynamic nonstate sector, including the rural TVE's, in a well-structured system would enhance the long term security of these workers--but at existing payroll tax rates might choke off the current rapid growth rate of their enterprises.

Alternative Policy Solutions: Simple Design Change Versus Basic Reform

The remainder of this paper contrasts three alternative policy approaches to solving the immediate SOE problem as well as the longer run problems of population aging and incomplete coverage:

(1) continuation of pure PAYG, with design reforms such as reduced replacement rates, use of price rather than wage indexation, increased retirement age, and extended coverage together with expanded pools;

(2) partial prefunding of the single pillar defined benefit plan;

(3) partial prefunding in the context of a multi-pillar system which includes two mandatory parts--a tax-financed basic benefit (Pillar I) plus a fully funded defined contribution scheme (Pillar II).

Two sub-cases of the multi-pillar system are distinguished--one in which the current generation of workers pays off the old pension debt (finances the transition) through a high payroll tax; and a second in which borrowing spreads this burden over many generations.

These alternative policy solutions imply different time patterns of required contribution rates, which is one focus of this paper. The time pattern of contribution rates has an efficiency dimension: If the distortionary effect

of higher taxes depends on the square of the tax rate, then tax rates that are uneven over time may increase the total distortionary impact on labor supply, its allocation to the informal versus the formal sectors, and the degree of evasion. The pattern of tax rates over time also has a bearing on intergenerational equity: If one believes that each generation should pay equivalent tax rates for equivalent benefit rates, tax smoothing is equitable, while if one believes that wealthier generations should pay a progressively higher tax burden and should face negative redistributions, one would probably want a rising tax burden over time. But viewed from the perspective of procedural fairness, one might argue that the present generation should not impose an increasing tax burden on future generations, who are not around to fend for themselves. Finally, very high tax rates may simply not be politically acceptable, and may imply that benefit promises will be broken in the future.

Simulations show that, while the simple design reforms slow down the rise in required contribution rate substantially, in the long run under PAYG population aging dominates, implying high dependency and cost rates and a large pension debt from which it will be even more difficult to escape. In contrast, the shift to a multi-pillar system is not economically or politically feasible in the short run if the current generation has to pay the full transition costs, which raises their contribution rates substantially.

However, if the design changes are accompanied by a transition to a multi-pillar system that is financed by borrowing, both the short run and long run peaks of required tax rates are avoided. Initially the payments to current pensioners are debt financed, but as these pensioners die off the debt is repaid out of taxes or SOE assets. As one solution: A payroll tax rate of 17.4%, carried between 1995 and 2100, is sufficient to fully finance the basic benefit (7.3%), the individual accounts (8.5%) and the pay-off of the existing debt to current pensioners and older workers (1.6%), while yielding an expected long run pension benefit that is 60 percent of the average wage in the economy or 55 percent of the final year's wage for the average member of the retiring cohort. It also builds up a large stock of long term saving for productive investment. China's high growth rate, when combined with price rather than wage indexation, plus the possibility of extended pension coverage, yield a financial surplus in the short

run that can be transformed into a long run benefit via this shift to a preferred pension system.

III. Effects of A Continued and Reformed PAYG System

This section analyses the impact of a continued PAYG system on the level and time pattern of pension system costs, given China's demographic and economic projections. Design reforms considered are a reduced replacement rate, an increased retirement age, and a shift to price rather than wage indexation--all of which help, but not enough. These results also apply to a pure notional account system, which is similar to the system that some Chinese cities are now using (see Appendix). The impact of partially funding this defined benefit plan is also considered.

Basic Assumptions

For pension planning very long time horizons are essential, both at the individual and economy-wide levels. From the time a worker enters the labor force and begins retirement planning to the time he or she dies and stops collecting a pension, a period of 70 or more years may elapse. If individuals do not plan ahead for this long period, they may find themselves with insufficient resources at the end of life.

At the societal level it is very difficult to change old age policies abruptly, because existing policies have been built into peoples' expectations and plans. In particular, it is difficult to change expenditures on cohorts that have already retired. For example, the legal retirement age can only be raised gradually, the increase only applies to newly retiring cohorts, and pension benefits are rarely reduced after retirement except through inflation and indexation methods. Thus, policies can have very different effects on costs over the long and short run; to get a full picture it is necessary to simulate alternative pension systems over a period lasting 100 years or more--in this paper until 2100--albeit recognizing that forecasts of the basic economic and demographic environment become less reliable as we go out further in time.

For these simulations we start with World Bank population projections for China, 1995-2100.[1] Our baseline and alternative assumptions about the rate of real wage growth, interest rate and other economic and policy parameters over this period are given in Table 2 . In most countries the interest rate tends to exceed the rate of wage growth by more than 2%, over long periods. But in China the opposite is true at present. China's rate of real wage growth over the past decade has been almost 6% annually, while the real interest rate available to domestic savers in recent years has been negative, due to controlled nominal rates that are less than the inflation rate (1994 Statistical Yearbook of China, Beijing: State Statistical Bureau). In our baseline simulations we accordingly use a rate of wage growth that exceeds the interest rate initially and vice versa after 2011, assuming that financial markets have been reformed and wage growth has slowed down in the interim. We also carry out sensitivity analysis to these variables by experimenting with scenarios in which wage growth is lower and financial market reform faster or slower.[2]

The continuation of current evasion and exemption rates of 25% are also assumed. Enforcement techniques will probably improve in the future, reducing these leakages, but the expansion of the nonstate and informal sectors will have the opposite effect, so as a baseline the continuation of the 25% noncompliance rate is probably not unreasonable. It is also modest by comparison with other low and middle income countries, where workers often qualify for benefits despite the fact that their enterprises have not paid the full contributions; this raises the break-even contribution rate, possibly inducing greater evasion. Obviously, if China is able to reduce its noncompliance rate, this would correspondingly improve the financial situation of its pension system. One of the best ways to do so is to choose a system that costs less and reduces incentives to evade.

---

[1] These projections assume increasing life expectancy, while the Chinese have used projections which do not take this into account. Therefore, our data show a continuing increase in the demographic dependency rate (Table 1) while the Chinese data imply a levelling off after 2030.

[2] In addition to the economy-wide wage growth, which is uniform for all cohorts, we assume that for the first 30 years of working life the worker receives a wage increase for experience and on-the-job training of 1% per year. While age-earnings profiles have been realtively flat in China in the past, they will probably become steeper in the future, as the transition to a market economy proceeds. Thus the average wage of the retiring cohort will be higher than the average economy-wide wage. The same pension amount will then yield a lower proportion of final year's wage (called the replacement rate) than of the economy-wide wage (herein called the benefit rate).

Another method is to choose a system, such as a multi-pillar system with a defined contribution component, whose costs and financial sustainability are less sensitive to evasion rates, as illustrated in this paper.

The urban share of the population is 27%, rural workers are not in any mandatory system, and civil servants are in a separate scheme not included in this analysis, so only 20% of all workers are covered in the baseline scenario. In an alternative scenario, urban in-migration, rural industry and coverage increase. This raises the urban share of workers to 46%, the share in cities plus rural industry to 84% and the total coverage rate to 63% by 2050.[3]

It is difficult to capture the parameters of the current Chinese system since each city has a somewhat different program and the picture presented by the data is sometimes different from the stated plan. As an approximation of China's current system we use a PAYG defined benefit system with an average pension for new retirees that is 80% of the average wage in the economy and replaces 73% of the final year's salary (see footnote 2), indexation to prices plus 50% of real wages (herein called 50% real wage indexation), and retirement at age 55 for women, 60 for men.[4] These parameters are changed in the reform scenarios. Differences across municipalities and provinces are ignored.

Survivors' insurance is assumed to take its current form--75% of the normal pension for one year only. Disability annuities are assumed to be provided at half the normal retirement replacement rate. Early retirement benefits are 75% of the normal replacement rate. Administrative costs are a modest 3% of expenditures in the existing PAYG system and 3% of revenues in the individual

---

[3] In these calculations, "urban" means current cities. Additionally, many currently rural areas will become "urbanized" through growth in density and industry. Urban migration in these simulations apply only to workers under age 35. This means that, although the migration is assumed to come to an end in 2050, the urban share continues to increase to 2100 and beyond because of population maturation--the death of cohorts that did not experience in-migration, and their replacement by cohorts that did migrate. Since population growth is projected to become negligible after 2050, the continued growth in urban population implies a small decline in rural population. See Table 1.

[4] National officials claim they want to reduce the benefit rate below 80%, but data suggest that the average pension has been about 80% of the average wage over the last few years. The normal retirement age has been 60 for men, 55 for women, but this simply gives us a probability distribution of retirement ages since many workers retire earlier or work later. The inflation adjustment has been tied to nominal rather than real wage growth, on an ad hoc basis in the past, but is gradually becoming systematized. Depending on the relative size of the real wage increase versus the inflationary increase, nominal wage indexation of 40-80% may imply that pensions are going up faster or slower than prices; we use 50% real wage indexation as a baseline. See footnote 7 for more details about inflation adjustment.

accounts of the new multi-pillar system (that do not yet have expenditures); actual administrative costs are unknown but are probably much higher, thereby raising the required contribution rate. These ratios are retained throughout this analysis.

Cost of the PAYG System Under Alternative Reforms

Table 3 compares the annual break-even contribution rates of the current system and several reform scenarios, all retaining the PAYG defined benefit format. The break-even contribution rate is the payroll tax rate that will just balance revenues and expenditures on a year-to-year basis, given the covered wage base and existing defined benefit formula.

Table 4, column 1, presents, for the same scenarios, the uniform or time-invariant contribution rate that would balance the system for the entire period, 1996-2100, instead of permitting the rate to change annually. It may be that 2100 is an overly-long time horizon, given that uncertainty about the underlying parameters increases as we move further into the future. Therefore, columns 2 and 3 show the two uniform rates that would balance the system separately for 1996-2150 and 2151-2100. The rate for the second half of the century is always higher than that for the first half, because the dependency rate rises through time--suggesting that a cut-off of 2050 is deceptive unless one makes some estimate about what lies around the corner.

The time invariant contribution rate, whether to 2050 or 2100 or some other year, implies that funds will be accumulated during the early part of the period and used up in the latter part--that is, the system becomes partially pre-funded instead of pure PAYG. This in turn raises the question of whether the funds will be managed to maximize the rate of return--a topic that will be discussed in Part III. In Part II we simply use the uniform contribution rate as a concise way to compare the long run costs of different reform scenarios in a single-pillar system, taking the interest rate as given.

The current system. Table 3, row 1, shows the break-even contribution rates that would be needed for the current system, given China's demographics and high labor force participation rate. In this baseline scenario, break-even contribution rates rise from 20% in 1995 to 37% in 2030, 49% in 2050 and 60% in 2100. If China chose to partially pre-fund the present system, the uniform contribution rate that would cover all costs until 2100 is 44% (Table 4, row 1,

column 1). If the contribution rate rose instead to 32%, this would carry China to 2050 (column 2), but for the second half of the century the required rate would jump to 55% (column 3).

Required contribution rates are even higher under the slow grow scenario (row 2), since revenues decrease commensurately with wage growth but expenditures decrease at a lesser rate (because pensions are only partially indexed to wages). If the high payroll tax is borne by workers, this high contribution rate means much lower take-home pay than they would otherwise get. If borne by employers, it means less competitiveness on international markets and more unemployment. In either case it means that the current generation of pensioners has gotten a bargain for which future generations pay a very high price.

Rows 3-6 retain the PAYG financing method and baseline scenario but add alternative policy reforms. Row 3 *reduces the benefit rate* to 60% *and the replacement* rate to 55% for new retirees; row 4 *increases the retirement age* (4 months per year for women until 60 is reached in 2010, then 2 months per year for both men and women until 65 is reached in 2040)[5]; rows 5 and 6 impose *price instead of 50% real wage indexation;* and rows 7 and 8 assume rapid or delayed *financial market reform*, respectively. Finally, row 9 shows *the impact of all these policy reforms if undertaken simultaneously* under PAYG and row 10 shows the *combined impact when coverage is extended* to increased urban migrants and to rural workers who have shifted out of agriculture into TVE's and private companies.

Benefit rate and retirement age: the high cost of early retirement. China's replacement rate is very high by international standards and its retirement age is low, hence its expected duration of retirement of 19 years is also high compared with other countries. If the retirement age is not raised, the duration of retirement will jump to 25 years by 2050, given life expectancy projections (Table 1). Reforming these two design features has a powerful downward effect on costs, especially in the long run. The uniform contribution rate to 2100 is cut 10 percentage points, one quarter of total cost, for each of these reforms.

---

[5] Some Chinese workers retire under special early retirement programs. In these simulations we assume these programs continue to exist in their present form when the normal retirement age increases. It is possible, on the one hand, that the allowable early retirement age will rise if the normal retirement age increases. On the other hand, it is also possible that more people will find some way to get early retirement if the normal age rises. These simulations assume unchanged early retirement propensities.

If the uniform rate is allowed to change in 2051, it is cut 6-7 percentage points for the first half of the century, but much more--14-18 percentage points--for the second half (Tables 3 and 4, rows 1, 3 and 4, respectively).

Figure 1 shows the trade-off between retirement age and contribution rate, holding benefit rate constant at 60%, and Figure 2 shows the trade-off between retirement age and benefit rate, holding contribution rate constant.[6] A gradual rise in retirement age from 60 to 70 for men and women reduces the break-even contribution rate by 1-2 percentage points per year of increase (Figure 1). A gradual rise in retirement age (holding contribution rate constant) raises the feasible benefit rate by 3-4 percentage points per year of increase (Figure 2).

The increase in retirement age has a double impact--reducing lifetime payouts while increasing lifetime contributions. Since raising the retirement age is a sensitive issue in many countries, including China, it is important for them to be aware of this high opportunity cost. Indeed, many countries want to reduce the retirement age to reduce unemployment--and China also encouraged people to retire early when shedding labor from SOE's. But actually, early retirement only hides true unemployment--which may be attractive politically but is costly economically. Pensions are more expensive and last for a much longer time period than unemployment benefits, hence require a higher payroll tax that raises labor costs. Retired persons are less likely to look for jobs than unemployed workers. For both reasons, an early retirement age may lead to a lower level of employment and output. Instituting a higher retirement age to increase the supply of labor will be particularly valuable after 2030, when the working age population contracts due to population aging--but to have it in place then, the process must begin soon.

Price versus wage indexation. Only the shift from 50% real wage to price indexation affects current pensioners, and this saves an additional 6 percentage points in the long run (row 5). Price indexation maintains the absolute purchasing power of the pension, while wage indexation maintains its value

[6] In these figures, it is assumed that the retirement age for women has been raised to 60 by 2010, and the increase in retirement age depicted takes place at the rate of 4 months per year, starting in 2011, for both men and women. The benefit rate is held constant at 60% in Figure 1 and starts at 60% in Figure 2. The break-even contribution rate, of course, changes over time. In Figure 2, the contribution rate is held constant in the year 2050 and in Figure 1 we report the changes that occur in 2050, at which time all the effects of the raised retirement age should be observed.

relative to the average wage in the economy. If real wages were growing slowly, say at 1% annually, as in many OECD countries, the savings from price indexation would be much smaller (compare rows 2 and 6). China, with its expected high growth rate, is well positioned to achieve substantial cost saving from price rather than wage indexation.

However, the cost of this saving is the deteriorating position of retirees relative to workers: if the real wage growth rate is 5.5% and price indexation is used, the retiree who started with a benefit that was 80% of the average wage gets only 40% of the new average wage after 13 years, and only 21% after 25 years. In contrast, under 50% real wage indexation, the relative pension deteriorates much slower--to 41% of the average wage after 25 years--but this indexation method costs more, as we saw above (Figure 3).

For a given cost, China faces a key trade-off between the relative well-being of young versus old retirees, through the selection of indexation method. For example, holding the (2050) contribution rate constant, China could choose an 80% benefit rate combined with price indexation, or a 69% benefit rate combined with 50% real wage indexation. This trade-off is depicted in Figure 4, which shows that pensions are initially higher with price indexation, but the very old are better off with real wage indexation. The best choice for China and other countries depends on how much pensioners value income in their early years of retirement relative to that in their later years, and whether they care mainly about the absolute value of their purchasing power or their position relative to workers[7].

Financial market reform. Currently interest rates are controlled and, for domestic savers, are very low (even negative in real terms) in China. In addition, types of financial instruments available are limited. Financial market reform which would include increased diversification in instruments, greater freedom for private financial institutions, and liberalized interest rates, is important for China's continued development.

---

[7] The actual system in China is somewhat different from either pure price or wage indexation, in many cities. After an aggregate inflation adjustment amount is determined, usually based on nominal wage increases, this is often distributed on a flat basis to all pensioners, rather than being prorated according to their pensions. Recent retirees with relatively high wages and pensions may thus get less than price indexation would dictate while older cohorts may get more--another way to reduce disparities in relative well-being among cohorts.

Here we simply test the impact of interest rate reform on the financial sustainability of the pension system. In general, the interest rate has no effect on the annual break-even contribution rates in a PAYG system, since revenues and expenditures, by definition, balance every year and do not earn an investment return. But once partial funding is introduced, the interest rate can make a difference.

It turns out that speeding up financial reform, so that the real interest rate is 3% instead of 0 between 1996 and 2010, has only a small effect, reducing the uniform contribution rate by less than 1 percentage point (row 7). Pension reserves are very small at this point, so the interest rate is relatively unimportant. (See Table 8 and discussion below). On the other hand, delaying the financial market reform and depressing interest rates beyond 2011, when reserves have become larger, raises the required contribution rate substantially (row 8). Thus, China has a breathing spell, but if it does not act within this period, its problems will grow.

Combined reforms and coverage expansion. These combined reforms--an increase in the interest rate, a decrease in the benefit rate to 60% and the replacement rate to 55%, an increase of the retirement age to 65 and a shift to price indexation--do indeed reduce expenditures substantially. Both annual break-even rates and the uniform contribution rate eventually fall to half their initial (unreformed) values. Nevertheless, population aging causes the annual break-even contribution rate to exceed 20% by 2030; it reaches 27% and is still rising in 2100 (row 9).

One method that many countries have used to keep their PAYG systems afloat is to gradually expand coverage, together with broader pooling to unify rates. This method is especially tempting in China, where only 20% of the total labor force is now covered and where pension expenditures are less than 2% of GDP (as compared with 10-15% in most European countries).

Rural workers will increasingly move to the cities as mobility restrictions are lifted, most of these will enter the nonstate sector, and those remaining in the countryside will move out of agriculture into TVE's and private companies where enforcement of contributions to a formal mandatory system is more feasible. The pros and cons of covering these groups are discussed in Part III. Here we simply assess the impact on system costs. As young workers from newly covered

groups enter the system, this reduces the dependency rate and break-even payroll tax rate initially, because these groups are contributing but do not yet have eligible retirees. However eventually, as coverage expansion comes to an end and the newly covered workers receive pensions, the required contribution rate rises sharply.

This process is demonstrated in row 10, which assumes that migration of rural workers to the cities and coverage of rural workers is expanded (as detailed in Table 2). Reduced replacement rates, price indexation, increased retirement age and financial market reform are also assumed, enabling comparison with row 9. We see that coverage expansion does indeed depress the break-even contribution rate still further, but its effect is concentrated in the early years. Once coverage expansion slows down, annual break-even contribution rates rise steeply and almost converge with those for the system without coverage expansion. Only pre-funding, a move to a more uniform contribution rate, can stop this process.

Thus coverage expansion as a solution to the problem of population aging is deceptive and dangerous if the PAYG system is retained because it may lull countries into complacency, but the problem eventually reappears, in a more intractable and socially divisive form. That is, the pension debt, which is relatively small at present, expands together with coverage, limiting the choices that will be open to China later on. The transition to a partially funded system is much more feasible for China at present, before coverage expansion has taken place.

IV. Partial Funding in a Multi-Pillar System

China is interested in shifting to a partially funded system to eliminate the negative effects of the high future tax rates that would be implied by a pure PAYG system. A partially funded system also has a positive advantage: it helps to build up a stock of retirement savings that can be used to develop financial markets and can be channelled through these markets to finance long term investments--both of which will enhance China's economic growth. Whether these results will be achieved depends in large part on how the funds are managed and allocated. The first part of this section discusses this issue.

While recognizing the advantages of prefunding, most Chinese municipalities have been unable to achieve it so far, because of the heavy burden of current pension obligations. The second part of this section describes how a transition to a partially funded multi-pillar system can be made, using a combination of borrowing, taxes, sale of SOE assets, and coverage extension.

The Rationale for a Multi-Pillar System

The simplest way to achieve partial funding and smooth contribution rates over time is to maintain the defined benefit structure and simply build up a reserve fund to meet future needs. Many countries have attempted to use this method, but few have succeeded. The results of this method, if it worked well, have been shown in Table 4. Rows 9 and 10 seem to imply that if China reformed its system by design changes, using the proceeds to build a reserve, it could live with a contribution rate of less than 20% well into the twenty first century. Unfortunately, in other countries partially funded defined benefit systems, with the reserves centrally managed, have not worked well, because of upward pressures on expenditures and downward pressures on returns from investments and growth. For the calculations in Table 4 pension benefits, investment returns and wage growth were taken as exogenously given, but evidence from other countries indicates that choice of system impacts the ability to constrain benefits and expand revenues.

One problem that frequently develops in partially funded defined benefit systems is the likelihood of continued pressure to raise the promised benefit level, if a reserve fund does develop. Even if design reforms such as a reduced replacement rate are put in place initially, they may not last if politicians cannot withstand these pressures. In particular, policy-makers may find it difficult to raise the retirement age as longevity increases, if reserves have accumulated; this could potentially be a problem in China. So in the end the funds disappear.

A more central problem is that under the present structure government control over the investments of the funds would be needed, since ultimately governments (in China's case, local governments) have the obligation to pay the defined benefits. But the experience of many countries suggests that publicly managed funds are likely to pursue political rather than economic objectives and therefore do not maximize the returns to the funds or the productivity of

capital. For example, during the 1980's centrally managed pension funds in many countries lost money because they were required to invest primarily in government bonds or in loans to failing state enterprises, at low nominal interest rates that became negative when inflation rose (World Bank 1994).

We observe a similar phenomenon in China today. Currently those pension reserves that do accumulate are managed by municipal authorities, although the central government requires them to invest mainly in government bonds and short term bank deposits. Interest rates are controlled by the central government and in recent years the rate of return has been negative--less than the rate of inflation and far below the rate of wage growth. It is unclear whether local authorities actually follow these rules; monitoring is difficult and incomplete. But other problems arise with those funds that are invested at the discretion of the municipal authorities: they are all retained locally, sometimes lent to failing SOE's. Not only is international diversification prohibited, even investments beyond the municipality are unlikely to be chosen. And no competitive mechanism exists to encourage capital mobility that would maximize returns and social productivity, or to diminish the role of those municipalities that are doing a poor job.

Closely related are other dangers that could arise when governments have exclusive access to publicly managed pension funds. The nontransparency of this arrangement may induce them to spend wastefully or to use excessive deficit finance. If part of the funds are invested in private securities, this raises the specter of back-door nationalization, as the government may be in a position to influence corporate decisions and the access of different enterprises to financial resources via its control over investable funds. These potential problems, which were ignored in the simulations presented in Table 4, increase exponentially as pension reserves grow and become a large share of the total capital in the economy.

In contrast to publicly managed funds, privately managed pension funds fared very well during the 1980's, because they were insulated from political control and able to take full advantage of the high yields that were available through a diversified portfolio of bonds, equities, real estate and foreign assets. This empirical experience, and the behavior that lies behind it, suggests that competitive decentralized management of funds is likely to earn a higher

return for the pension system and for the economy as a whole, a major reason for choosing a multi-pillar system in which the funds are concentrated in the private pillar. This will also help to develop financial markets, an essential prerequisite for economic growth at the stage where China is now. In order to achieve these benefits, Singapore and Malaysia, which until recently featured central control over their pension funds, are now decentralizing, allowing greater diversification of investments and giving workers greater control over the investment strategy.

Besides the advantage of competitive management of pension reserves, there is also an advantage to having part of the pension system set up as defined contribution rather than defined benefit. The hidden, sometimes perverse redistributions that are inherent in defined benefit plans are thereby avoided. The close link between benefits and contributions, both en toto and at the margin, means that workers are more likely to regard the required contribution as their own saving, rather than a tax, hence it is less likely to reduce employment or induce evasion. And the evasion that remains does not undermine the financial viability of the system, as it would in a PAYG defined benefit plan. This paper does not quantify the reduction in evasion but it does quantify the financial improvement for the system when the evading individual bears the cost.

In addition, defined contribution plans automatically avoid higher costs as longevity increases, without the politically difficult decision to raise the retirement age periodically. Instead, either the retirement age shifts upward or the annual benefit shifts downward automatically when the worker's accumulation is converted into an annuity upon retirement, as life expectancy rises. Similarly, policy-makers need not make a universal choice between wage and price indexation as real wages rise, since each worker can choose a different time profile of consumption. Those who want their living standards to keep pace with wages will have to forego withdrawals at the beginning of retirement rather than placing a financial burden on the over-all system. (See World Bank 1994 for a fuller description of and rationale for this multi-pillar system).

For all these reasons, the uniform contribution rates given in Table 4--which are based on a partial equilibrium model with many variables treated as exogenous that are in fact endogenous--underestimate the real values that would be needed in a single-pillar partially funded defined benefit publicly managed

system. This paper explores the situation in which partial funding is implemented through a multi-pillar system in which the funded and unfunded parts (or pillars) are separated, each mandatory and each having different objectives and managerial arrangements.

The unfunded or tax-financed pillar provides a defined benefit, has the object of providing a social safety net, and is controlled by the government, which has the power to redistribute. Having a straightforward poverty-prevention goal, this pillar is more likely to achieve it than under current single-pillar systems, where poverty-alleviation is but one of several competing goals, many kinds of redistributions go on, and they are difficult to observe and measure (see World Bank 1994 for empirical evidence on the experience of single-pillar systems).

The funded part, in contrast, is privately managed and set up as a defined contribution plan. The investment managers may be chosen by workers (Chile and Argentina), employers (Switzerland) or joint union-employer boards (Australia). Given the absence of independent unions, the fact that many employers are state enterprises, and the importance of facilitating labor mobility, the former is probably the best course in China today. This pillar is ideally suited for maximizing the rate of return on peoples' retirement saving.

Specifically, these two pillars take the following forms in this paper:

1) a basic benefit (25% of the local average wage)--designed to keep the old out of poverty, and financed out of broad payroll or general tax revenues (Pillar I); and

2) a defined contribution (8.5% of wages) that goes into individual accounts--fully funded, invested competitively by managers who are chosen by the workers themselves, and eventually turned into an annuity or gradual withdrawals upon the worker's retirement (Pillar II).[8]

One of the biggest risks of pension reform in China is the probable resistance from local and central governments toward private competitive management of pension funds--in which case many of the supposed benefits may be lost.

Risk in the Single-Pillar and Multi-Pillar Systems

---

[8] The flat benefit might be pro-rated by years of covered service, at the rate of, say, .6% per year. Prorating would not change the results of these simulations, so long as the average benefit remained 25% of the local average wage. The organization and regulation of the investment management of the defined contribution pillar are discussed generically in World Bank 1994.

Pillar I, by definition, provides a basic benefit that is 25% of the local average wage or 23% of the final wage of the average member of the retiring cohort. Under the real wage growth and interest rate conditions assumed in this paper, Pillar II will yield a 32% replacement rate of final year's salary for an individual who retires after 45 years of contributions, has an expected retirement duration of 19 years, and chooses a price-indexed annuity (see Table 5). Thus, under these conditions, the expected pension for the average worker from the two pillars together, in the long run, is 60% of the economy-wide average wage or 55% of final year salary, the same as the reformed replacement rate in the PAYG system analyzed in Part II.[9]

But the variance of the benefit in the multi-pillar system differs from that of the defined benefit in the PAYG system in at least two important respects. First, the provision of a basic benefit that depends on local average wage rather than the worker's own wage means that the replacement rate from the first pillar varies among workers from, say, 46% for a low income worker who earns half the average wage, to 11% for a high income worker who earns twice the average wage, and this means that the total replacement rate varies from 78% to 43%. Thus, a worker does not know ahead of time what his own replacement rate will be. This variance in the replacement rate increases uncertainty in one respect, but it simultaneously reduces the risk of poverty for low wage workers. A basic benefit of this sort could be build into the defined benefit formula, but often it is not and the non-transparency of the formula makes it difficult to calculate the true distributional effects.

Second, the interest rate plays an important role in the funded individual accounts that it did not play in the PAYG system--if it falls so too will the replacement rate and if it does not exceed the growth rate of wages the system is unlikely to produce an acceptable pension benefit. For example, if the financial market reform were delayed so that the interest rate after 2010 was 1% instead of 4%, the replacement rate for the average worker from the defined

---

[9] The replacement rate would be less for a worker who enters the system before 2010 because during 1996-2010 the interest rate is assumed to be less than the wage growth rate. For instance, a worker who enters in 1995 and retires in 2040 only gets a 53% replacement rate and therefore a lower rate of return. If the lower interest rate continues for longer, so too would the lower replacement rate. This is an example of the fact that both the wage growth rate and the interest rate determine the pension in a defined contribution account, and the worker is therefore subject to interest rate risk.

contribution pillar would be 13% instead of 32%. To bring the replacement rate back to 32% would require a contribution rate to Pillar II of 20% instead of 8.5%. Interest rate risk is inherent in funded defined contribution systems, underscoring the importance of using financial institutions and instruments that produce high returns.

In a pure funded defined contribution plan, the worker is subject to capital market volatility and in a pure PAYG defined benefit plan the worker is subject to political risk--the possibility that the government will be unable to keep its pension promises. Compared with a single-pillar plan, the multi-pillar system has the advantage of diversification and consequent risk minimization, since the total pension depends on a combination of sources--partly on payroll taxes and partly on income from capital, partly on private sector capacity and partly on public sector credibility, partly on domestic economic developments and partly on the broader international situation (through investments abroad). If one basket breaks, hopefully some eggs will still be left in the other basket.

The Cost of the Multi-Pillar System; And How to Finance the Transition

Although a shift from the current PAYG defined benefit system to a partially funded multi-pillar system may be desirable for all the reasons given above, it involves transition costs, because the old pension debt must be paid off (i.e. existing pensioners and new retirees must continue to receive their benefits), while at the same time workers are contributing enough to build up their own individual accounts. The payments to existing pensioners can be financed by payroll, income or consumption taxes, by cuts in other government expenditures, by proceeds from the assets of privatized state enterprises, or by borrowing. How these transition costs are covered determines the time pattern of required contribution rates under the new system, as well as its efficiency and equity effects.

The "double" costs that appear to be involved during the transition have been a major stumbling block to reform in many countries--they appear to impose a huge tax burden (or service cut) on the current generation of workers. However, this concentrated double cost for the transition generation turns out to be an illusion, since the possibility exists of borrowing and spreading the burden of repayment over several generations, at a low cost to each. In this section we

compare the costs of the new system, including the transition, with and without borrowing, under the assumptions that:

- In 1995, China shifted to the multi-pillar system just described, i.e. new entrants to the covered labor force simply receive the basic benefit and the annuity from their own accounts.
- The pay-off of the pension debt is financed through a transition account. Current pensioners continue receiving their stated benefits and "middlemen," i.e., current workers, will receive a compensatory annuity that is 1% of their final year's salary for each year of service under the old system (in addition to the basic benefit and an annuity from their individual accounts).
- To reduce program costs, retirement age will gradually be raised to 65 and price indexation will be used, as in the reform scenarios discussed in part II.
- In the baseline scenario coverage does not expand but in later scenarios it does.

Transition costs paid by present worker cohorts. In this scenario there is no borrowing and no coverage expansion. Instead, current workers pay the costs of the new system (which includes their own prefunded accounts) and also cover the obligations to pensioners and middlemen under the old system (Table 6, row 1). The latter requires a payroll tax of 20% initially, but this declines to 3% by 2030 and 1% by 2050 because most of the middlemen have died and the remaining few get compensation for only a small number of years under the old system. Comparing the total cost of this reformed multi-pillar system with a continued but reformed PAYG system (Table 3, row 9), we see that initially required contribution rates are 8.5 percentage points higher under the multi-pillar system than under PAYG--but by 2100 the former is 7.5 percentage points lower. While payroll taxes rise through time under PAYG, they fall under a multi-pillar system if the current generation finances the transition. Neither model provides tax smoothing over time. Nor is the high initial rate under prefunding likely to be economically desirable or politically acceptable.

Transition costs spread over many generations through borrowing. Alternatively, a uniform contribution rate over time can be charged that will just cover the debt of the old system as well as the costs of the new system until 2100 (Table 7). Without extended coverage, this rate turns out to be almost 20%. This can be decomposed into 1) a 3.7% payroll tax that pays off the pension

debt, 2) an 7.5% payroll tax that equates the present value of revenues to the present value of expenditures for the basic benefit (Pillar I), and 3) an 8.5% defined contribution to the individual accounts in Pillar II.

Initially transitional expenditures are much greater than the 3.7% uniform payroll tax so money must be borrowed to cover some of the payouts to existing pensioners. But transition costs disappear shortly after 2050 as payments to middlemen decline, and the loans are fully repaid by 2100, out of the continuing payroll tax. Thus, the combined uniform rate (with borrowing) is lower than the year-to-year rate on row 1 (no borrowing) at first, but slightly higher later on.

The loans to the transition account would come first from the surplus in Pillar I and second from the financial markets more broadly. One possible source of loans is Pillar II, which would make the pension system as a whole self-sustaining. While Pillar II remains autonomous and competitive, so it is not required to lend for this purpose, lending to the government to finance the transition is a logical investment strategy at the start given the limited number of financial instruments available. These loans would be explicit, with a specified redemption date and a positive market interest rate (unlike the notional individual accounts discussed in the Appendix). They could be guaranteed by the government and/or collateralized by future earmarked payroll taxes or proceeds from SOE assets (see below). A plan for repaying the loans is important if part of the object of the pension reform is to increase national saving. This financing method, based on borrowing and eventual repayment, implies that the burden of the transition is spread over 105 years of cohorts, instead of being borne heavily by the first 30 years of cohorts.

Extended coverage and broader pooling. The temporary gains from coverage expansion to the nonstate sector in urban and rural areas can ideally be used to finance the transition to a partially funded system, whose costs are also temporary. If we expand coverage, the constant contribution rate needed to finance the new system plus the transition falls to 17.4% (Table 7, row 4). This again can be decomposed into three parts: 1.6 percentage points needed to pay off the pension debt (the transition account), 7.3 percentage points used to pay the on-going costs of the basic benefit (Pillar I), and 8.5 percentage points for the

individual accounts (Pillar II). (Alternatively, the pension debt can be paid off by 2050 with a 2.8% contribution rate).[10]

The gains from coverage expansion are concentrated in the first three decades, exactly when the transition costs are at their highest (Figure 5). The contributions of newly covered workers to Pillar I in effect are used as a timely loan to the transition account in the early years when it is running a deficit, and the repayment of the loan when it has a surplus is used to cover their benefits from Pillar I later on (Table 8, row 4). This reduces the loans that would be required from elsewhere in the economy.

Without coverage extension the transition account plus Pillar I, combined, run a large debt until 2050 and the balance does not become zero until 2100 even though a higher contribution rate is charged (Table 8, rows 2 and 3). The debt must be covered by continued borrowing from Pillar II or other lenders, thereby using up financial resources that could be invested productively elsewhere. In contrast, when coverage is expanded the larger base of contributors augments revenues long before it increases expenditures of Pillar I, so that the combined debt is eliminated by 2015 and becomes small even earlier (rows 5 and 6). Thus, the entire balance in Pillar II can be used to increase the productive capacity of the economy. And this balance in Pillar II becomes mauch larger with increased coverage.

To achieve these financial gains from coverage expansion, it must go hand-in-hand with broader pooling for paying the transitional costs and the basic benefit, to ensure that the newly covered groups are not in their own separate pools. (Pillar II, in contrast, should remain decentralized and competitive). For example, pooling might take place at the provincial rather than the municipal level. The current system of local pooling is due in part to administrative factors such as the localization of tax collection facilities and the payment of benefits in cash (since checks do not exist and electronic transfers are only just beginning in China). From the viewpoint of economic efficiency, one would

---

[10] If a decision is made to pay off the pension debt by 2050 and to balance the system separately for the periods before and after 2050, this would require a 17% contribution rate before 2050 (3% for the transition account, 5.5% for Pillar I and 8.5% for Pillar II) and 19% (10.5% for Pillar I, 8.5% for Pillar II) after. The higher cost of the basic benefit in the latter period due to system maturation and the increased dependency rate offsets the concentrated transition cost in the first period, so the contribution rate turns out to be very similar for the two periods.

expect the locus of the pool to expand, and eventually to become national in scope, as the benefit-disbursement, tax-collecting and record-keeping capacities of the provinces and the central government improve. Besides facilitating the financing of the system, this will also maximize economies of scale from broader risk-sharing and computerized administration. But the process of centralizing Pillar I may be delayed by political considerations, including the limited capacity of the provinces and central government to secure compliance from localities that wish to control the reserves and those with low dependency ratios who will lose if forced into a common pool.

Aside from the financial advantage to the pension system and the economy, the newly covered groups also benefit by receiving protection when they grow old, if the family support system has broken down in the interim. But the danger of covering these new enterprises is that they may resist by evading and if they don't evade their labor costs will rise, partially choking off their growth. If the contribution rate is kept low, and in a form that is closely linked to benefits so that workers consider it their own savings rather than a tax (as in a multi-pillar system with a defined contribution component), this negative effect will be minimized.

Comparisons among alternative systems. In summary, Figure 6 contrasts the stream of break-even contribution rates that would be required under the current PAYG system, the reformed PAYG, and the reformed multi-pillar system with coverage expansion but without initial borrowing (lines 1, 2 and 3). The first is obviously much higher than the last two, demonstrating that the design changes are essential whether or not the transition is made to a multi-pillar system. The second is lowest at first because it does not incur transition costs and the third is lowest at the end because it is partially funded.

Figure 6 also contrasts the uniform contribution rates under a partially funded defined benefit versus a multi-pillar system with the transition financed through borrowing (lines 4 and 5). One might expect the required rate to be higher in the multi-pillar, which ends up with a large stock of capital, whereas funds in the single-pillar system are depleted by the end. Nevertheless, it turns out that the contribution rate is one percentage point lower under the multi-pillar system.

How can this be? The main explanation appears to be the high (25%) non-compliance rate, which makes the effective tax rate much lower than it appears, for both systems. When a 20% tax rate is imposed, only 15% of the wage bill is collected. Under the single pillar system as well as Pillar I in the multi-pillar system, people who evade or underreport their income often manage to collect benefits, thereby using up resources that they never contributed. However, in the defined contribution component the evader pays the price--he simply does not have an account or an annuity from it at the end. Evasion costs are not passed on to others, nor do they undermine the financial sustainability of the system. Because contributors are not forced to subsidize evaders, the 8.5% defined contribution rate provides a benefit to them that would have cost much more in the defined benefit system and leaves enough left over to build a large reserve fund at the same time. Part of these retirement savings may simply crowd out other voluntary saving but part are a net increment to national saving, particularly long term saving, and as such augment the country's capital stock and GNP. The accumulation of these large reserves means investment income is generated that keeps payroll taxes low even beyond 2100, while in the partially funded defined benefit system the reserves are depleted by 2050 or 2100 and the contribution rate will have to rise sharply.

In reality, the cost advantage of the multi-pillar system over the partially funded defined benefit scheme is likely to be higher yet, when the feedback effects on economic growth from the superior allocation of capital, financial market development, reduced escape of labor to the informal sector, and the tendency toward later retirement--that were not quantified in the present analysis--are taken into account.

Use of SOE assets. Proceeds from the sale of state owned enterprise (SOE) assets are an additional potential funding source for the transition--in China and in other countries as well. SOE's and their municipalities have substantial assets in the form of plants, equipment, housing and land use rights, in addition to pension and other liabilities. It is tempting to use their assets to offset their pension debt. This could be accomplished through a direct transfer of assets or proceeds from the assets when they are sold, or indirectly by imposing a capital gains tax on asset sales, especially housing and land use sales, and utilizing the revenues to finance the transition. If capital gains that are

realized over the next two decades represent a windfall that is due to rapid changes in the Chinese economy rather than to calculated investment decisions, a modest tax on these gains may be less distortionary and more equitable than an incremental payroll tax.

In the most optimistic scenario the assets would be used to pay off the whole pension debt. The transitional account would borrow initially, but these loans would be fully repaid and replaced by proceeds from the SOE assets as they become available. This strategy, if feasible, would reduce the long-run break-even contribution rate by 1.5 percentage points, to a total of 16.5%.

More modestly, the assets could repay part of the pension debt or enable the loans to be repaid faster, so that lower contribution rates could gradually be phased in. The assets could also be used as collateral for the loans, thereby making the loans more attractive. Some localities in China are already using these assets in a minor way to help cover their pension expenses. For example, in Luoyuan county, Fujian province, land-use transactions are taxed for this purpose. Although rules regarding bankruptcy are not yet completely clear, they are moving toward a situation in which payment of the pension debt will have a high claim on the assets of bankrupt firms.

In the aggregate and in the long run the value of SOE assets far exceeds the pension debt in China. However, many institutional and political impediments make it difficult to count on using these assets for a direct pay-off of the pension debt. Among these obstacles are the ambiguous ownership rights over SOE assets (are the owners the SOE's, the municipalities or the state?) the fact that ownership of assets and liabilities may not coincide, and the wide variance in value and accessibility of SOE assets across municipalities. Ironically, the more SOE's are encouraged to behave as self-sustaining enterprises rather than as arms of the state, the less willing those with substantial good assets will become to give them away to bail out those with few assets and a large debt. Other difficulties stem from the absence of well developed real estate and mortgage markets, the reluctance of long-time tenants to move or to pay market rents, the possibility that the needs of pension policy and housing policy may conflict, and the great uncertainty that surrounds the time at which proceeds from SOE assets will become available.

If SOE's sell their housing and other assets, from an economic viewpoint the proceeds should be used in a way that maximizes the return. In some cases, a pay-off of the pension debt may satisfy this criterion, but in other cases SOE's may be better off financing the pension transition through a stream of payroll taxes, while investing the proceeds from their assets elsewhere (e.g. in up-to-date equipment), to enhance their productive capabilities. This is especially the case in a situation where borrowing facilities are limited. Moreover, it is possible that privatization of SOE's will take place through corporatizing them (issuing stock) or by converting them into joint ventures with foreign firms. In that case, the assets would remain with the new privatized enterprise rather than being sold and liquid funds would not be generated to pay the pension debt. Taxing housing sales, land use transactions and stock sales of corporatized enterprises might still work--so long as the tax rate is kept low to avoid impeding the development of real estate and equity markets.

These various obstacles have proved insuperable in some Eastern European countries, but others (e.g. Hungary and Poland) are indeed using SOE assets to cover the deficits of or partially fund their old pension systems, and Bolivia is using them to fully fund its new pension systems. In China, applying SOE assets to help pay off the pension debt, directly or indirectly through a capital gains tax, remains a promising possibility that should be explored--so long as pension reform is not made contingent on this possibility. As part of such a plan it is essential to identify a default source of revenue in case the revenue from SOE assets does not materialize in a timely manner. As noted above, a small payroll tax is one such default option.

IV. Conclusions and Risks

As one of the most rapidly aging countries in the world, China is evaluating how to reform its old age support system so that it provides protection to the old and does not impede rapid economic growth. The current PAYG defined benefit system will not achieve either goal. It will produce contribution rates of 40% by 2030 and over 50% by 2050, the uneven tax rates across municipalities and enterprises interferes with efficient resource allocation, the fragmentation and lack of funding of the scheme impede labor mobility, later

generations of old and young will lose real income, and the vast majority of workers are not covered at all. Chinese authorities recognize these problems and are experimenting with alternative reforms.

This paper has analyzed the impact of design options such as decreased replacement rates, increased retirement ages and a move toward price rather than wage indexation, as well as more basic changes such as a shift toward a partially funded multi-pillar system. We conclude that:

- The design reforms described above are an essential first step and reduce costs substantially; however, steeply rising contribution rates, inducements to evade and intergenerational transfers remain under PAYG.

- The shift to a partially funded system would cut these tax swings and intergenerational transfers and would help to build up a large stock of long term saving.

- Based on the experience of other countries, private management of these funds seems most likely to maximize their rate of return and a multi-pillar system that includes a funded privately managed defined contribution pillar to manage peoples' savings plus a PAYG publicly managed defined benefit pillar to provide a social safety net seems most likely to achieve the redistributive and replacement rate objectives at minimum costs, and with greatest diversification of risk.

- A system that includes a defined contribution component achieves substantial financial savings compared with the single pillar system, by making the evader bear the cost in terms of foregone benefits. But the biggest advantage of the multi-pillar approach may be its feedback effects on economic growth--by reducing escape to the informal sector and early retirement and by increasing long term saving and financial market development--which, have not been quantified in this study.

- The transition to such a system can be accomplished with a long term contribution rate of under 18%, considerably less than that imposed today in most Chinese cities. Of this total, 1.6 percentage points would be used to pay off the old pension debt, 7.3 percentage points would finance the basic benefit and 8.5 percentage points would go into the individual accounts. Such a time-invariant contribution rate implies borrowing initially to cover deficits, as current pensioners are paid while reserves build up, and repaying these loans with

surplus revenues later on. The costs of paying the pension debt are thus shared by several generations. Some of the loans could be made by the funded pillar as a part of its investment portfolio in the early years of the new system.

•Proceeds or taxes from the sale of SOE assets are another possible source for financing the transition. This could cut the long run tax burden by up to 1.6 percentage points.

•The large potential for expanding coverage together with broader pooling, is partially responsible for these affordable costs. The pay-off of the pension debt is also facilitated by China's high wage growth rate, combined with price rather than wage indexation of benefits, since this expands the tax base while constraining the rise in expenditures. If China's wage rates followed the slow growth scenario, as in OECD countries today, the requisite uniform contribution rate would rise 3 percentage points. China is in a position to convert these short term opportunities into long term gains--an improved, sustainable pension system.

One risk of this scheme is that bringing the nonstate sector into the system might choke off its rapid growth rate, which has been good for the economy as a whole. Minimizing or counteracting this risk is the fact that expanded coverage could be phased in gradually over a period of years, the contribution rate would be considerably below current levels, much of it would go into workers' own defined contribution accounts which might be less distortionary since intra- and inter-generational redistributions are not involved, and including all enterprises creates a level playing field which in itself enhances efficiency.

A second risk is the possibility that many enterprises, especially those in the nonstate sector, might try to evade contributing, and that local authorities might not cooperate fully in enforcing compliance. Because these policies involve extension of coverage to groups that are not now in the system and they alter the pattern of costs and benefits among those in the system, some people may regard themselves as winners and some as losers from the change. In principle it should be possible to make most groups better off if there are true efficiency gains. Some of the gains are: an impediment to continued high growth rates will be removed; all workers will get more secure pensions in the long run; previously covered groups will benefit from lower contribution rates and

especially from lower rates than they would have had to pay in the future; newly covered workers will benefit from pensions when they retire, thereby heading off potentially serious social problems; newly covered employers might pay their share of the contribution rate in lieu of wage increases--particularly feasible in a context where wages are rising rapidly; and workers and/or municipalities will get greater discretion regarding the investment of funds in the individual accounts. Nevertheless, non-compliance may be high because most benefits accrue in the future and are inherently uncertain, while substantial costs, especially for newly covered groups, are incurred in the present. Therefore, improved tax administration and a major public relations effort are needed to convince most groups that they will indeed be better off covered and should comply.

A third risk stems from resistance from local authorities--currently municipal and later on provincial--who may wish to perpetuate their control over the pooled reserves. The more entrenched they become, the more difficult it may be to overcome this institutional resistance and eventually move toward a national system, when this is justified on efficiency grounds. Thus a system that is meant to be temporary could take on a life of its own and become permanent, as a result of institutional interests that develop during a policy of gradualism. A carrot that can be used to overcome this resistance is the fact that broader pools with newly covered enterprises will reduce the required contribution rate in most cities with older plans and pensioners. This is a political argument for moving quickly toward a national pool, while coverage expands.

The biggest risk is the possibility that the Chinese government will be unwilling to relinquish public control over the allocation of pension funds or to pay an interest rate that correctly reflects the high marginal productivity of capital in China today. Under the current circumstances, with local government control, heavy required investment in central government bonds at negative real interest rates, few alternative financial instruments and very limited mobility of capital within the country, the accumulated pension funds are declining rather than increasing in value. They are not being allocated to the highest productivity uses nor will they provide a reasonable replacement rate for workers upon retirement. If China implements a partially funded multi-pillar pension system, it must go hand-in-hand with financial sector reform and

restructured investment procedures that emphasize the "right" mix of competition, diversification and regulation, or the pension reform will ultimately fail.

Appendix: Notional defined contribution plans

In the past, defined contribution plans were fully funded, since money was put into the accounts and invested, interest was earned, and pensions were paid only to the extent that they were covered by these assets. More recently, however, several countries, including Sweden, Italy, Latvia and some cities in China, have begun experimenting with notional defined contribution accounts.

The basic idea behind a notional account is that a worker's account is set up as a book-keeping device, to keep track of contributions plus imputed interest at a rate determined by the government, but funds are never accumulated in these accounts. Instead, the money is used to pay current benefits and the accounts are notional or empty accounts. When the worker reaches retirement age, the notional accumulation in his or her account is converted into an annuity (its size depending on the expected duration of retirement and the interest rate) and paid to the retiree out of contributions that younger workers are making at that time, as they build up their own notional accounts.

A notional defined contribution plan has certain advantages over a defined benefit plan. It produces a close transparent relationship between contributions and benefits, thereby deterring evasion and other distortionary behavior. It eliminates some undesirable redistributions within the same cohort, since all individuals receive the same notional interest rate. It automatically adjusts retirement age up or benefits down as expected lifetimes increase, thereby preventing pension costs from rising as fast as they would otherwise.

However, so long as the accounts remain notional, the system is essentially PAYG. It will not increase long term national saving. Like all PAYG systems, it will produce sharp rises in required contribution rates and large inter-generational transfers as populations age. And because the interest rate paid into the accounts is largely notional rather than determined by actual returns, it is highly subject to political manipulation. For example, it may be lower than the market rate, implying that workers are not getting back the full market value of their contributions, which are thereby being diverted to cross-subsidize other government activities. Or it could be higher than the market rate, implying that

future generations may face a heavier tax burden than expected in the future to pay these obligations.

In a partially funded, partially notional system, a reserve is accumulated to partially back up these accounts. It is possible for the funded part of each account to be managed in a decentralized way--for example, workers or unions and employers could choose the investment manager, who is then given considerable control over the investment strategy. However, because the reserves are only a small part of each account, their management and investment strategy are more likely to be centralized, leading to the capital misallocation and low yield problems discussed in the text. Finally, since the accounts are largely notional from the start, they may never become largely funded even if contributions substantially exceed expenditures at some future point. Instead of regarding the use of funds in the early years as a loan which must be repaid later on when revenues exceed expenditures, governments may simply use any later surplus as part of their general finance. For all these reasons, partially funded notional accounts may quickly degenerate into empty notional accounts, which in turn are very much like unfunded PAYG systems.

The multi-pillar system is less susceptible to these dangers because it is more likely to be competitively managed with diversified portfolios and with lending to the government at a market-determined rate, with an explicit obligation to repay.

Table 1. Population Aging in China

	1995	2000	2030	2050	2100
Proportion of population over age 60	9	10	22	26	30
Demographic dependency rate[a]	17	18	43	53	63
System dependency rate[b]	21	24	42	55	71
Reformed system dependency rate[c]	21	15	25	33	46
Average age of population	30	31	38	40	42
Expected duration of retirement with current retirement age	19	20	23	25	26[e]
Expected duration retirement-if retirement age increases	19	19	19	19	19[e]
% Workers who are urban-if no urban in-migration[d]	26	26	25	25	24
% Workers who are urban-with urban in-migration[d]	26	28	39	46	49
% Workers who are urban+TVE (rural industry)	47	54	82	84	85

Source: World Bank Population projections and simulations by authors.

[a] Population over age 60/ population aged 20-59

[b] Pensioners/covered workers, based on simulations with unchanged retirement age, rural/urban division and coverage

[c] Pensioners/covered workers, based on simulations with increased retirement age, rural/urban migration and expanded coverage. See Table 2 for rate of increase in retirement age, rate of urban in-migration and coverage expansion assumed.

[d] By "urban" is meant existing cities. As population and industry grows in "rural" areas they too will become "urbanized", but they are not considered "urban" in this table.

[e] These numbers apply to 2065, not 2100

Table 2. Baseline and Alternative Assumptions

	1995-2010	2011-2050	2051-2100
Real wage growth-baseline[a]	5.5%	3.0%	3.0%
Slow growth	1.0%	1.0%	1.0%
Real interest rate-baseline	0.0%	4.0%	4.0%
Fast reform	3.0%	4.0%	4.0%
Slow reform and slow growth	0	1.0	1.0
Noncompliance + exemption rate	25%	25%	25%
Benefit rate (average pension/ave. age)			
baseline	80%	80%	80%
Reform	60%	60%	60%
Replacement rate of final year wage			
baseline	73%	73%	73%
Reform	55%	55%	55%
Retirement age - M	60	60	60
- F	55	55	55
Reform (at end of period) - M	60	65	65
- F	60	65	65
Rate of increase per year in reform	4 months	2 months	2 months
Indexation to real wage-baseline	50%	50%	50%
Reform (price indexation)	0	0	0
Coverage rate - urban	72%	72%	72%
Increased urbanization-baseline	0	0	0
In-migration rate [b]	1.5%	1.0%	0
TVE + private share of rural labor (at beginning of period)	28%	50%	70%
TVE + rural private coverage	0	0	0
Alternative-at beginning of period[c]	30%	54%	80%
Increase per year in TVE labor share & coverage rate (percentage points)	1.5%	1.5%	0
Ratio--rural to urban wage	70%	70%	70%

[a] In addition to this rate of economy-wide wage growth, which applies to all cohorts, workers are assumed to receive a 1% per year wage increase for experience during their first thirty years of employment. This generally does not affect the average wage growth in the economy or the ratio of average pension to average wage (the benefit rate) but it does affect ratio of pension to final year's wage for the average retiree (the replacement rate).

[b] Only applies to population under age 35. Gives % increase in urban share of total population in each group under 35. (eg. if the urban share was 30% in 1995 it becomes 30.45% in 1996)

[c] Covered TVE workers are eligible for pensions beginning with those who retire in 2011.

Table 3. Break Even Contribution Rates for Reformed PAYG Defined Benefit System (percentage of wage bill)

		1995	2000	2010	2020	2030	2050	2100
(1)	Current system -- baseline[a]	20	22	21	27	37	49	60
(2)	Current system - slow growth	20	23	25	30	40	54	68
(3)	Reduced replacement ratio	20	20	17	21	28	36	45
(4)	Increased retirement age[b]	20	21	20	24	29	33	42
(5)	Price indexation	20	19	17	23	32	42	50
(6)	Price indexation - slow growth	20	22	24	29	38	50	63
(7)	Rapid interest rate reform	20	22	21	27	37	49	60
(8)	Delegated interest rate reform	20	22	21	27	37	49	60
(9)	Combined reforms[c]	20	17	13	15	19	21	27
(10)	Combined reforms with coverage expansion	20	12	7	12	16	20	26

[a] Current system means 80% replacement rate; retirement age 55 for women, 60 for men; 50% real wage indexation. See Table 2 for baseline and reform assumptions.

[b] Retirement age for women raised to 60 by 2010. Retirement age for men and women raised to 65 by 2040.

[c] Combined reforms mean 60% replacement rate, retirement age raised to 65 for men and women by 2040, price indexation, rapid interest rate reform.

[d] See Table 2 for increased rate of migration to urban areas and coverage expansion in rural areas.

Table 4. Uniform Contribution Rates for Partially Funded Defined Benefit System (percentage of wage bill)

		1995-2100	1995-2050	2051-2100
(1)	Current system -- baseline[a]	41.1	32.1	54.7
(2)	Current system - slow growth	48.7	36.0	61.6
(3)	Reduced replacement ratio	31.3	24.9	41.0
(4)	Increased retirement age[b]	30.5	26.0	37.3
(5)	Price indexation	34.9	27.5	46.3
(6)	Price indexation - slow growth	45.8	34.3	57.5
(7)	Rapid interest rate reforms	40.5	31.6	54.7
(8)	Delegated interest rate reform	50.6	35.9	56.0
(9)	Combined reform	19.8	17.2	23.8
(10)	Combined reforms with coverage	18.3	14.6	23.1

* Column 1 gives uniform contribution rate through time that will equate the present value of revenues and expenditures from 1995-2100. Columns 2 and 3 give the uniform contribution rates for 1995-2050 and 2051-2100 if the system is balanced separately for these two period. See Table 3 for other definitions.

Table 5. Replacement Rates Under Multi-Pillar System for 19 Years of Expected Retirement

Year of Retirement	No. years work Old System[a]	No. years work New System[a]	Transitional +Basic Benefit[b]	D C Pension[b]	Total Replacement Rate
2000	37	5	60	3	63
2020	19	25	42	15	57
2030	10	35	33	22	55
2040	0	45	23	30	53
2050	0	45	23	32	55
2060-2100	0	45	23	32	55

[a] Expected working period increases as retirement age increases, but this is partially offset by schooling increase.

[b] This gives replacement rate of final year's wage for average member of retiring cohort. Formulas for transitional and basic benefits are given in text. Pension from DC individual accounts is based on baseline wage growth and interest rate assumptions in Table 2. Retirement age is reformed option in Table 2.
Expected period of retirement is 19 throughout. Increased longevity is offset by increased retirement age.
Price indexation of pension is assumed.

Contribution rate to DC pension is 8.5%, of which .3% goes toward administrative expenses.
For contribution rates to transitional + basic benefit seet Table 6.

Table 6. Annual Contribution Rate needed for Multi-Pillar System, Including Transition Costs

	1995	2000	2010	2020	2030	2050	2100
No Expanded Coverage							
(1) Total (incl. 8.5% D.C.)	28.5	25.5	20.5	19.5	19.5	17.5	19.5
(2) Transition cost	20	15	8	5	3	1	0
(3) Basic Benefit	0	2	4	6	8	8	11
Expanded Coverage							
(4) Total (incl. D.C)	28.5	20.5	15.5	15.5	16.5	16.5	19.5
(5) Transition cost	20	10	4	3	2	0	0
(6) Basic Benefit	0	2	3	4	6	8	11

This table assumes that the 8.5% DC contribution began in 1995.

Table 7. Uniform Contribution Rate needed for Multi-Pillar System, With Borrowing to cover Transition Costs*

	1995-2100	1995-2050	2051-2100
No Expanded Coverage			
(1) Total (incl. 8.5% D.C.)	19.7	20.4	18.5
(2) Transition cost	3.7	6.0	0
(3) Basic Benefit	7.5	5.9	10.0
Expanded Coverage			
(4) Total (incl. D.C)	17.4	16.8	18.2
(5) Transition cost	1.6	2.8	0
(6) Basic Benefit	7.3	5.5	9.7

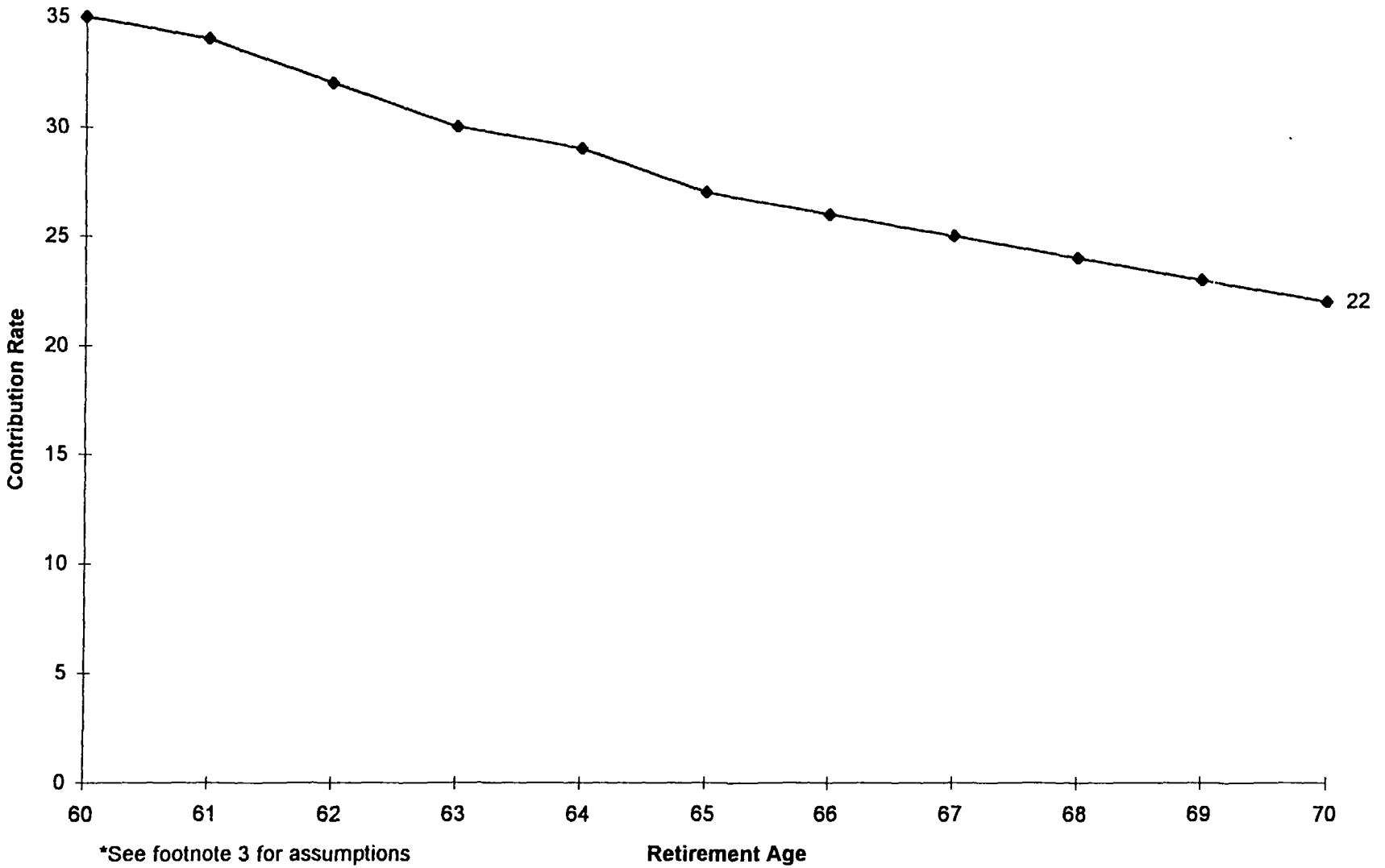
*See Table 6 for definition of uniform contribution rate for basic benefit + transition. Defined contribution (DC) rate = 8.5%.

Table 8. Annual Surplus and Total fund in Transition Account and Pillar I[a]

	1995	2000	2010	2020	2030	2050	2100
Without coverage expansion							
Revenues minus Pension Payments in transition account as % of covered wage bill	(12)	(8)	(8)	(3)	(1)	(2)	(3)
Funds in transition acct+Pillar I as % of current covered wage bill	(6)	(30)	(36)	(38)	(43)	(33)	0
as % of 1995 covered wage bill	(6)	(41)	(96)	(145)	(221)	(318)	0
With coverage expansion							
Revenues minus Pension Payments in transition account as % of covered wage bill	(13)	(6)	(2)	(1)	0	1	1
Debt of transition acct+ Pillar I as % of current covered wage bill	(8)	(19)	(7)	6	13	22	0
as % of 1995 covered wage bill	(8)	(37)	(35)	59	194	634	0

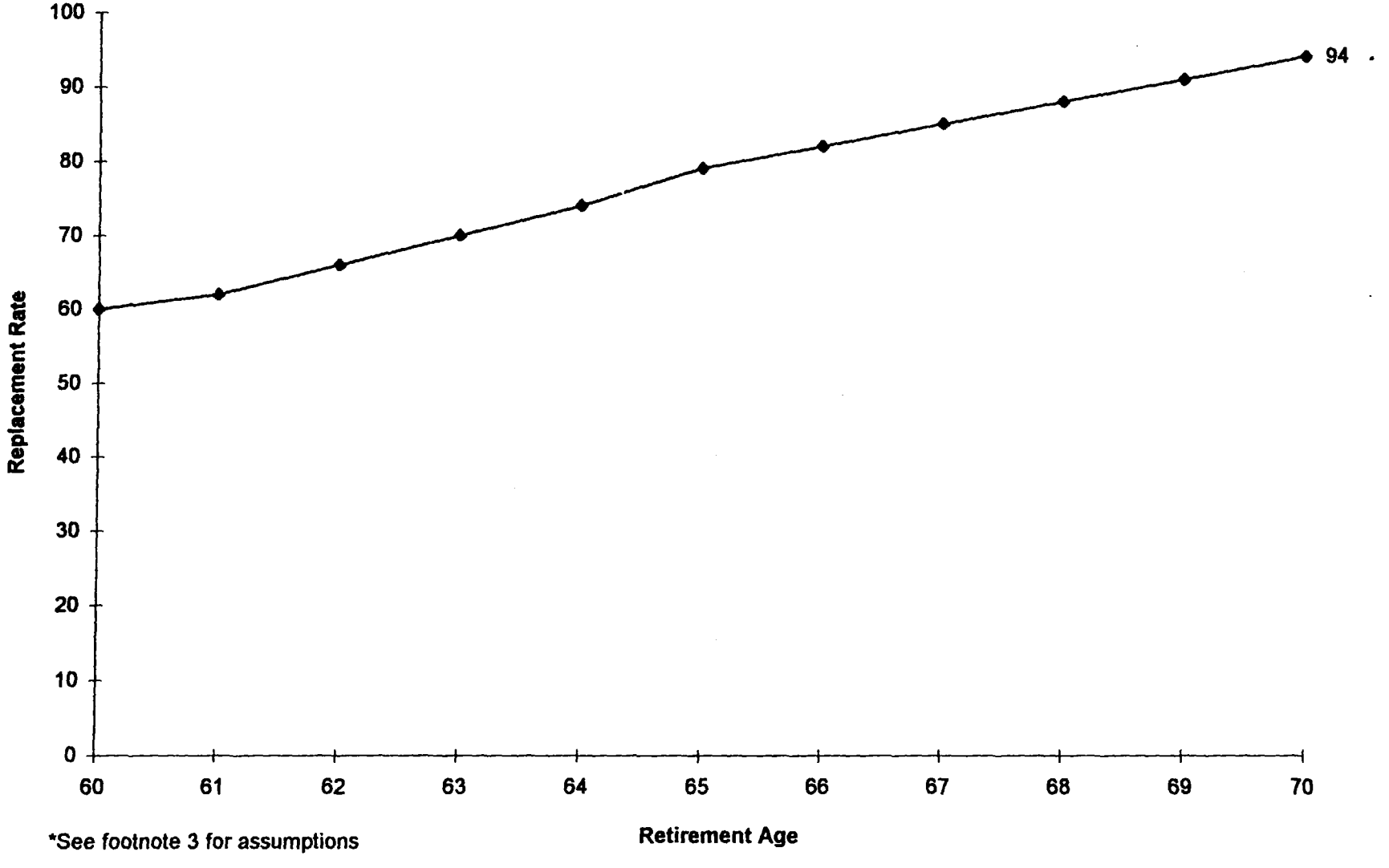
[a] numbers in parentheses are deficits or debt.

Figure1. Trade-Off Between Retirement Age and Contribution Rate*



*See footnote 3 for assumptions

Figure 2. Trade-Off Between Retirement Age and Replacement Rate (Holding Contribution Rate Constant)*



*See footnote 3 for assumptions

Figure 3. Pension Relative to Average Wage under Price and 50% Real Wage Indexation

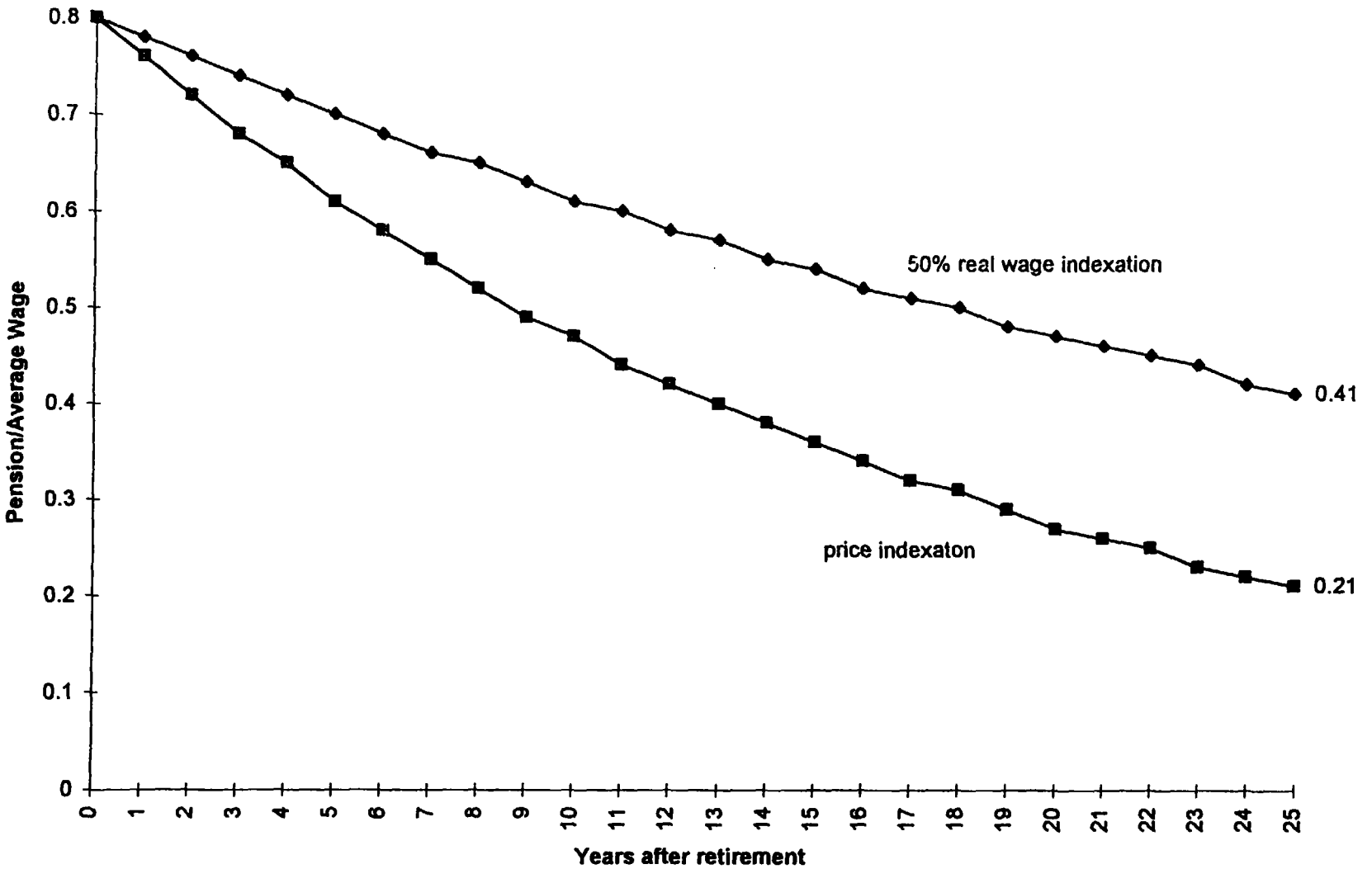


Figure 4. Relative Position of Young, Old and Very Old Under Price and 50% Wage Indexation (Contribution Rate Constant)

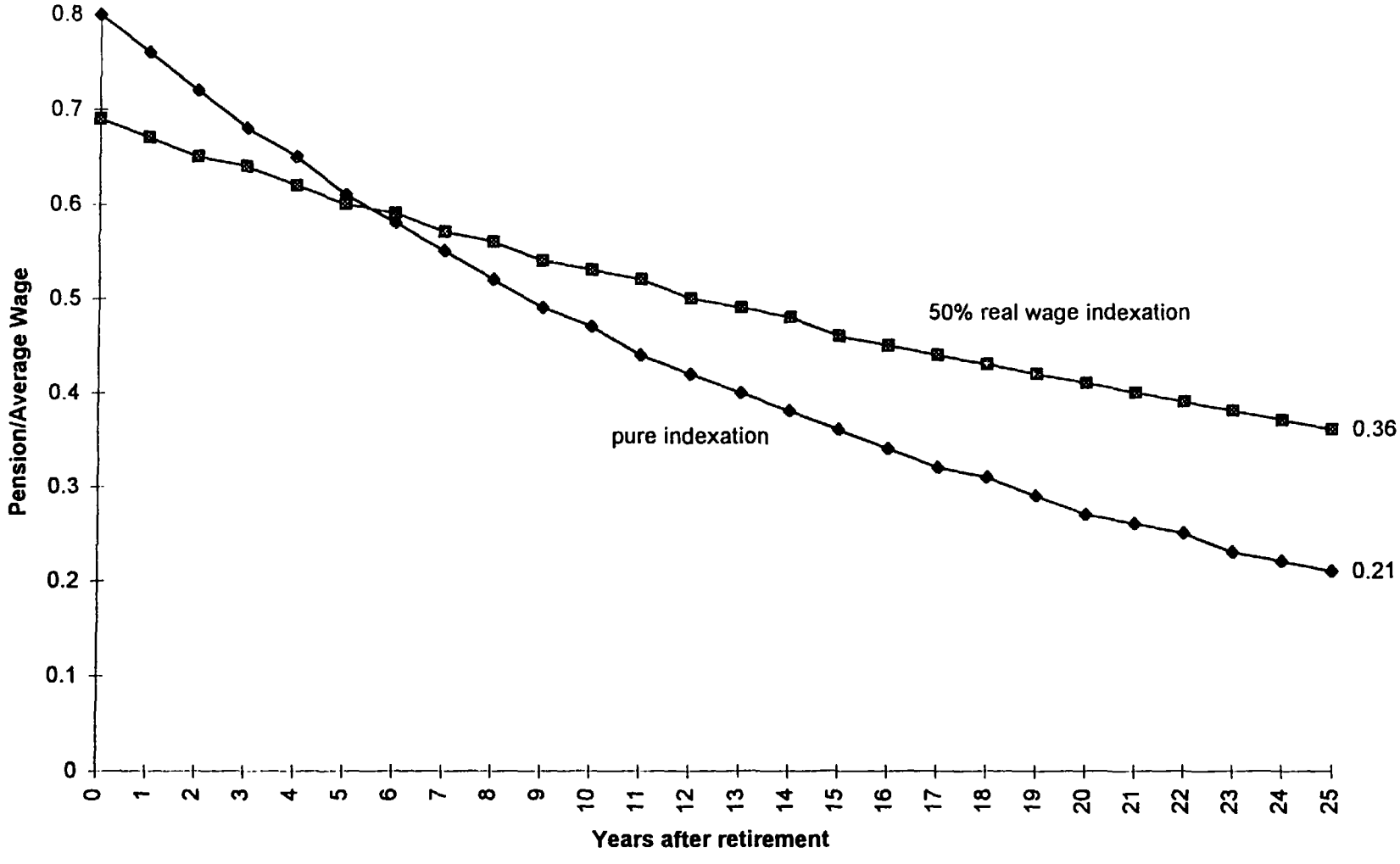
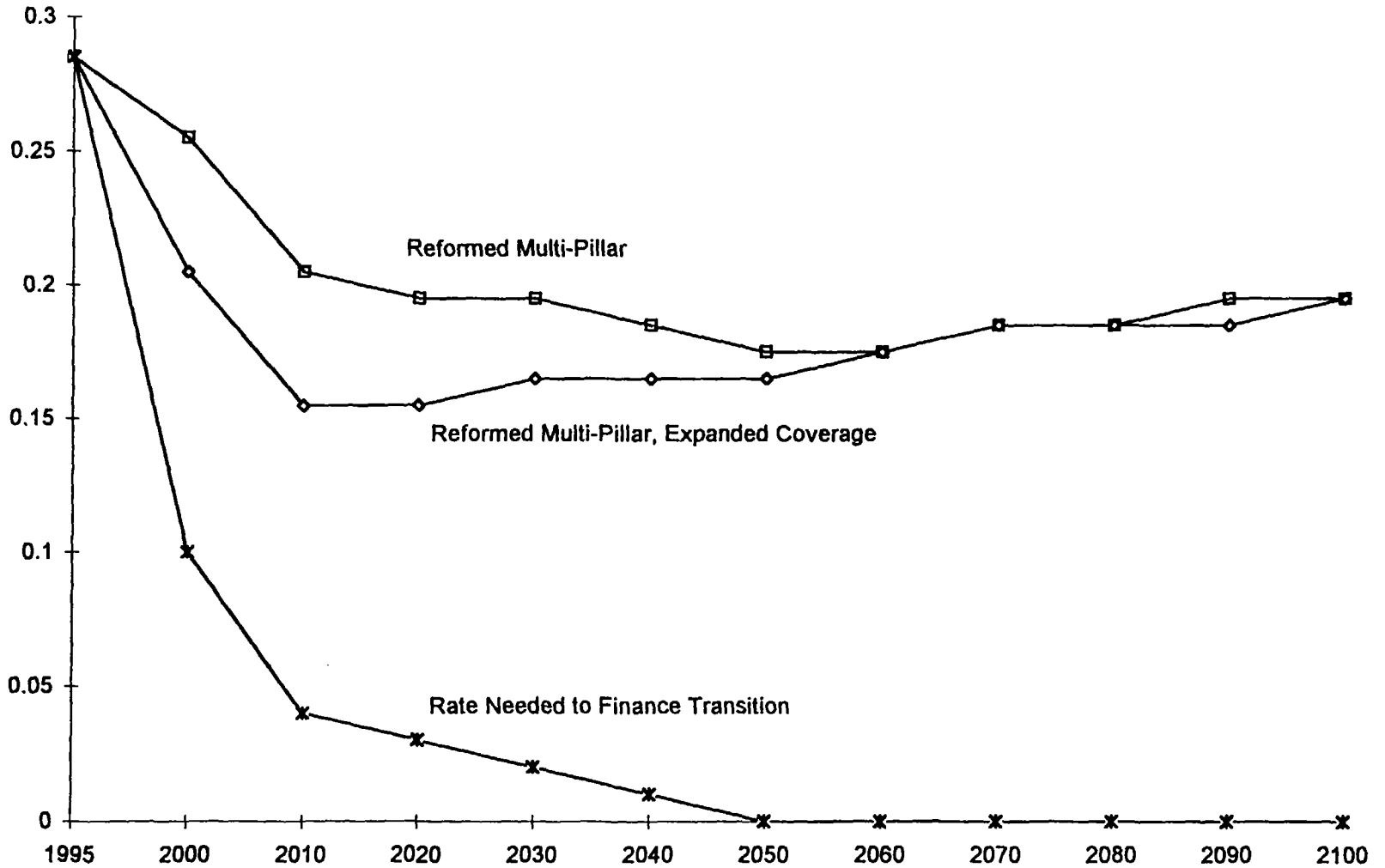
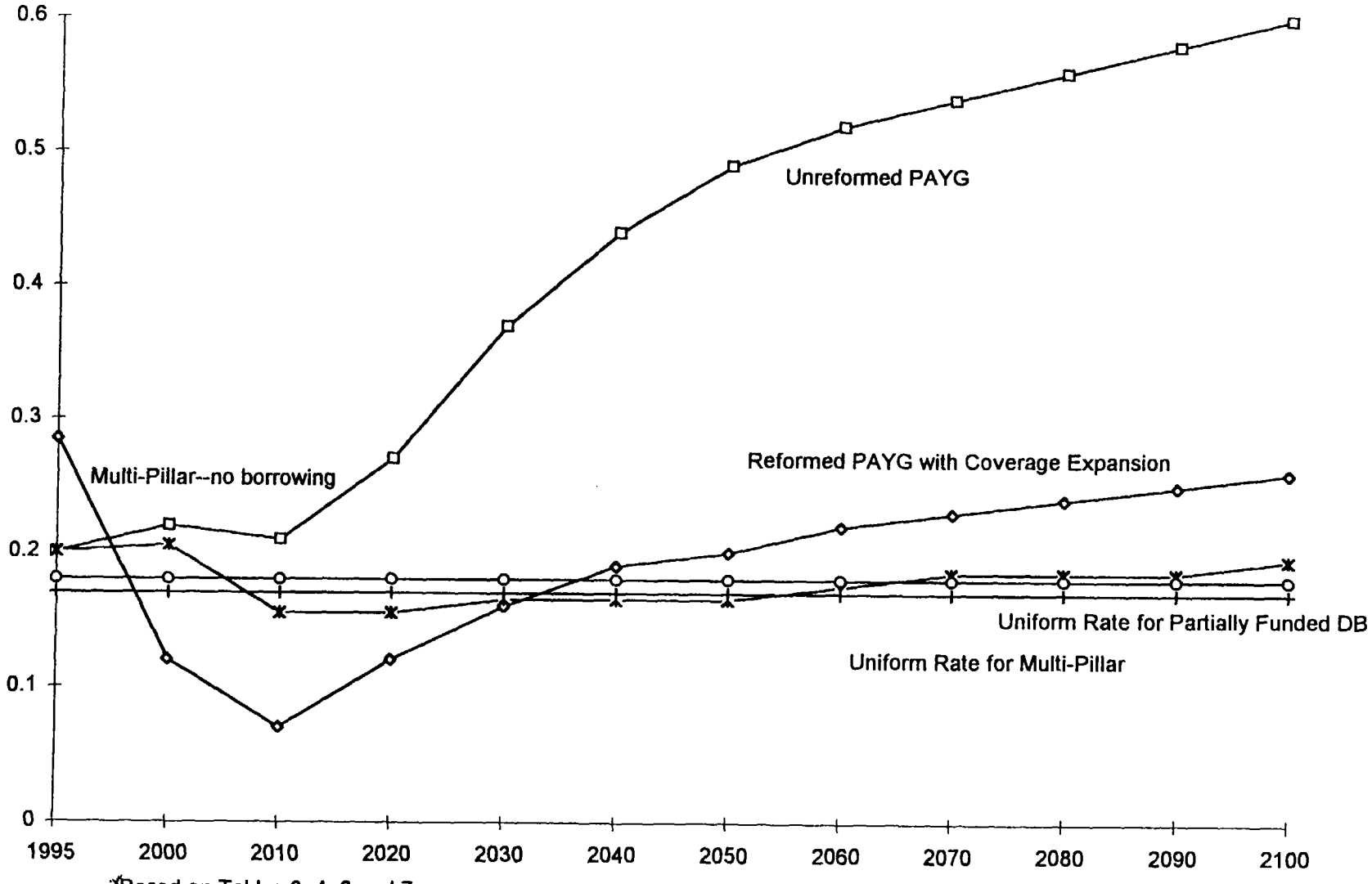


Figure 5. Impact of Expanded Coverage on Contribution Rate, and Comparison to Transition Costs*



*Based on rows 1, 2, 4 in Table 6.

Figure 6. Comparison of Alternative Systems*



*Based on Tables 3, 4, 6 and 7

ESTELLE2.XLS

References

Friedman, Barry and Leonard Hausman. Social Protection and Economic Restructuring in China. Manuscript.

World Bank 1994. Averting the Old Age Crisis: Policies to Protect the Old and Promote Growth. (Washington DC and New York: World Bank and Oxford University Press).

1994 Statistical Yearbook of China. (Beijing: State Statistical Bureau).

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS1651	Bank-Led Restructuring in Poland: Bankruptcy and Its Alternatives	Cheryl W. Gray Arnold Holle	September 1996	B. Moore 38526
WPS1652	Intra-Industry Trade, Foreign Direct Investment, and the Reorientation of Eastern European Exports	Bernard Hoekman Simeon Djankov	September 1996	F. Hatab 35853
WPS1653	Grants and Debt Forgiveness in Africa: A Descriptive Analysis	Leonardo Hernández	September 1996	R. Vo 31047
WPS1654	Indonesia's Palm Oil Subsector	Donald F. Larson	September 1996	P. Kokila 33716
WPS1655	Uncertainty and the Price for Crude Oil Reserves	Timothy J. Considine Donald F. Larson	September 1996	P. Kokila 33716
WPS1656	The Investment Decision: A Re-Examination of Competing Theories Using Panel Data	Cherian Samuel	September 1996	C. Samuel 30802
WPS1657	Is There an Optimal Structure for Decentralized Provision of Roads?	Frannie Humplick Azadeh Moini-Araghi	September 1996	J. Williams 82557
WPS1658	Decentralizing Structures for Providing Roads: A Cross-Country Comparison	Frannie Humplick Azadeh Moini-Araghi	September 1996	J. Williams 82557
WPS1659	Unemployment Insurance in Algeria: Implications for a Labor Market in Transition	Elizabeth Ruppert	September 1996	H. Osselyn 36039
WPS1660	Mind Your P's and Q's: The Cost of Public Investment is *Not* the Value of Public Capital	Lant Pritchett	October 1996	S. Fallon 38009
WPS1661	Determinants of Public Expenditure on Infrastructure: Transportation and Communication	Susan Randolph Zeljko Bogetic Dennis Heffley	October 1996	Z. Bogetic 623-7292
WPS1662	From Learning to Partnership: Multinational Research and Development Cooperation in Developing Countries	Giorgio Barba Navaretti Carlo Carraro	October 1996	M. Patena 39515
WPS1663	Internal Finance and Investment: Another Look	Cherian Samuel	October 1996	C. Samuel 30802
WPS1664	Pensions in Germany	Monika Queisser	October 1996	H. Arbi 34663

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS1665	How Important Are Labor Markets to the Welfare of Indonesia's Poor?	Andrew D. Mason Jacqueline Baptist	October 1996	D. Ballantyne 87198
WPS1666	Is Growth in Bangladesh's Rice Production Sustainable?	John Baffes Madhur Gautam	October 1996	P. Kokila 33716
WPS1667	Dealing with Commodity Price Uncertainty	Panos Varangis Don Larson	October 1996	J. Jacobson 33710
WPS1668	Small is Beautiful: Preferential Trade Agreements and the Impact of Country Size, Market Share, Efficiency, and Trade Policy	Maurice Schiff	October 1996	M. Patena 39515
WPS1669	International Capital Flows: Do Short-Term Investment and Direct Investment Differ?	Punam Chuhan Gabriel Perez-Quiros Helen Popper	October 1996	T. Nadora 33925
WPS1670	Assessing the Welfare Impacts of Public Spending	Dominique van de Walle	October 1996	C. Bernardo 31148
WPS1671	Financial Constraints, Uses of Funds, and Firm Growth: An International Comparison	Asli Demirgüç-Kunt Vojislav Maksimovic	October 1996	P. Sintim-Aboagye 37644
WPS1672	Controlling Industrial Pollution: A New Paradigm	Shakeb Afsah Bemoit Laplante David Wheeler	October 1996	
WPS1673	Indonesian Labor Legislation in a Comparative Perspective: A Study of Six APEC Countries	Reema Nayar	October 1996	R. Nayar 33468
WPS1674	How Can China Provide Income Security for Its Rapidly Aging Population?	Barry Friedman Estelle James Cheikh Kane Monika Queisser	October 1996	S. Khan 33651