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# The emergence of redistributive pensions in the developing world

Achim Kemmerling\* and Michael Neugart†

October 17, 2014

## Abstract

Pension schemes that redistribute money to the elderly have seen a remarkable surge in developing countries. To explain this phenomenon we build a political economy model of a Beveridgean pay-as-you-go social security system which incorporates family transfers driven by costs of non-compliance to a social norm. For appropriately chosen weights of a political support function a government will choose to increase pensions if the share of the urban population increases, productivity differentials between urban and rural workers widen, or if the social norm erodes.

*Keywords:* pensions, developing countries, political economy, family transfers, crowding out, electoral support

*JEL-classification:* H55, D72, O18

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# 1 Introduction

Pension schemes that redistribute money to the elderly have seen a remarkable surge in developing countries. This trend goes against the general impression that social protection in less developed countries has only slowly improved over the last decades and that there are still large parts of the population who do not have any form of official old-age security (Pallares-Miralles et al., 2012).

In this article we offer an explanation for the increase in the scope of pensions in the less developed world. Empirical evidence suggests that the size of pension systems is strongly correlated with the share of urban population in developing countries. In these countries we also typically observe high productivity differentials between the urban and the rural population. Moreover, family transfers have played a prominent role in providing support for the elderly which seems to be crowded out as public pension schemes are introduced. Motivated by this empirical evidence we build a political economy model of a social security system of the pay-as-you-go type. We show that for appropriately chosen weights of an electoral support function governments will be willing to increase the size of pension systems as the share of the urban population increases, urban to rural productivity differentials are higher, or the social norm driving family transfers to the elderly is eroding.

Supposedly, governments are more inclined to increase the scope of a public pension scheme if such a policy reform finds electoral support. Increasing taxes on the income of the working population in order to provide a more generous old-age security may affect societal groups differently. In our approach, we focus on four groups in society that, from our point of view, seem to be important for these kind of policy reforms in developing countries. Generally speaking, there occurs to be a divide between urban and rural citizens with significantly higher wages being earned in urban areas. Furthermore, this divide of a (young) working population seems to be mirrored in the well-being of the older population which in developing countries still depends to a large degree on transfers being paid by younger family members. As the public pension schemes that have been introduced or enlarged more recently do not only transfer between generations but also redistribute within the younger generation a conflict of interest on the size of such a public program arises between those living in high paying urban areas and the rural population. Moreover, if public pension schemes crowd out private transfers to the elderly also the interest of the old population are not aligned. We show that a process of urbanization reflected not only in an increase in the urban population share but also in higher urban-rural wage differentials, and an erosion of a social norm driving the transfers to the old population

may explain more generous public pensions. In particular, if those groups of society that actually gain from such a policy reform have been seen by the reforming governments as those providing the relevant electoral support, we can explain more generous public pension schemes as they are observed empirically.

In the following section 2 we give a rather extended review of the existing literature linking our contribution to the previous work in related areas and also explaining where we deviate. In section 3 we empirically motivate the economic mechanisms which will be driving the results of the political economy model introduced in section 4 and analyzed in section 5. Section 6 summarizes our results.

## 2 Literature review

Reviewing the political-economy literature on pension systems we see that the overwhelming majority talks about old-age security systems of developed countries. There are, of course, many studies on pension systems of developing countries, but most of these are based on different disciplinary approaches. Among analysts of public policy Holzmann et al. (2009), for example, connect the recent resurgence of redistributive pension systems in developing countries with benevolent governments seeking to find an efficient solution for old-age security of the poor. From a sociological point of view Leisering and Barrientos (2013) argue that the recent rise of redistributive pensions is mainly a consequence of the international diffusion of social-policy innovations. Political science approaches focus on the insecurity of the informal sector and the rising demand for social protection of people who face huge income and employment risks (see, e.g., Carnes and Mares, 2014). Economists have also talked about this resurgence, but often from an efficiency point of view. Jung and Tran (2012) for instance, model a general-equilibrium model that shows the efficiency and welfare effects of larger coverage in pension systems of poor countries.

Among those relatively few studies, directly dealing with political economy considerations are Leroux and Pestieau (2014) on developing countries, or Tabellini (2000) on both advanced and developing economies (for a survey see Galasso and Profeta (2002)). Related to these models, we propose an approach for the political economy of pension systems in developing countries that integrates crucial context factors typical for such countries. Our explanation of the rise of social pensions also draws on the accompanying intra- and intergenerational redistribution. Young households have different income levels depending on whether they live in an urban or rural environ-

ment. As pensions are not earnings related but financed via a wage tax they are redistributive. In addition, we model within the context of a publicly provided pension scheme family transfers paid by the young generation to the old generation. The young pay those transfers because of a costs of non-compliance to a social norm. As a result, we have four groups of voters who have differing preferences on the size of the social pension system. The distinct preferences arise from the heterogeneity of wage incomes of the young generation and from the crowding out of family transfers to the old that comes with the introduction of the public pension system. An effect which differs for the elderly depending on whether they are supported by a high or low income earner. Moreover, we borrow from the literature on the role of political institutions for explaining social security systems. We assume that the policy rate is chosen in accordance with a government that seeks to maximize electoral support of the societal groups which are weighted according to their importance for the policymaker. Thus, our approach builds on three strands in the literature: first, the political economy of pension systems mainly theorized for economically advanced democracies; second, the literature on social norms and intra-family transfers; third, the literature on crowding out between public and private transfers.

Starting with the first, our contribution is most closely related to the literature on the political economy of social security systems as surveyed by Breyer (1994), Galasso and Profeta (2002), or De Walque (2005) addressing the question why there is electoral support for a redistributive system in which the contributors outnumber the recipients and where contributors possibly have superior savings devices at hand. Various explanations have been put forward to why this may happen including approaches which stress primarily economic factors and others focusing on the role of political institutions.

In one of the first contributions on the political economy of social security systems Browning (1975) argued that the size of such a system can be explained via conflicts between generations. Voters in this model only differ with respect to age and the median voter is a middle-aged household which prefers an excessive size of the social security system. This is due to the fact that this household does not fully internalize the costs of a social security system for the young generation.

Another branch of models focuses on intragenerational redistribution generating electoral support for a social security system. The size of the social security system is explained through conflicts between agents that belong to the same generation but have different characteristics in addition to age. In Casamatta et al. (2000), Tabellini (2000), Ignacio Conde-Ruiz and Profeta (2007), or Koethenbueger et al. (2008) agents differ with respect to their in-

come. A characterizing feature of these explanations is that contributions to the social security system are earmarked to wage income, whereas the pension payments are not. Thus, the social security system does not only redistribute between the young and old generation but also redistributes from the high income to the low income households. Electoral support for a social security system arises now as not only the elderly support the redistributive system but also young households with lower income for whom the pension system becomes an attractive old-age savings device. A social security system may also redistribute within a generation if households differ in longevity. Then those who live longer will profit more from a social security system and are, therefore, more likely to support it (see, e.g., Hindriks and De Donder, 2003; Borck, 2007; Leroux, 2010). Leroux et al. (2011) add to longevity marital status and gender differences showing that the size of the pension system depends on the relative share of those groups each having distinct preferences on the optimal size of the social security system. Finally, in Cooley and Soares (1999) or Boldrin and Rustichini (2000) the intragenerational redistribution takes place between those who own capital and those who do not. It is argued that a social security system may emerge with the help of capital owners as the return on their capital holdings may increase with the crowding out of private savings as a public pension scheme is introduced.

Typically, in political economy models the median voter approach is employed to study the size of the social security system. What the median voter model, however, does not take into account is that in the political process some societal groups may be favored by the government or that special interest groups take action to influence the decision of the policymaker. A government may cater more likely to a group of society the more it can expect that it can provide for the government's survival. The support of a group of society may be a function of the political system that controls the relative access of competing interest groups, the likelihood that a voter in that group turns out at the ballot, or the group's economic power. Examples of political economy models on the social security system that stress those political institutions and where the pension policy is derived via a government support function include Verhoeven and Verbon (1991), Verbon and Verhoeven (1992), Grossman and Helpman (1998), or Kemmerling and Neugart (2009).

The second type of literature our paper uses deals with social norms and income transfers between generations (Arrondel and Masson, 2006; LaFerrere and Wolff, 2006). It is well documented that old age security is an important motive for having (large) families (see, e.g., Nugent, 1985) and that there is a strong obligation, especially in less developed countries, for children to provide assistance to elderly parents (Kagitcibasi, 1982). In some African countries, for instance, more than 90 percent of the elderly popula-

tion receives direct help from their children (World Bank, 1994). The actual motives for intra-family transfers seem to be a mix of altruism and indirect exchange (Altonji et al., 1996), but they clearly constitute some type of a social norm binding younger generations.

One important stylized fact in this literature is that the nexus between old age security and intra-family transfers is much weaker in advanced economies (World Bank, 1994). Many authors explain this by some sort of modernization, and especially the transformation from rural to urban societies with a high degree of mobility (World Bank, 1994; Folbre and Wolf, 2013). Closely related to our paper, Leroux and Pestieau (2014) build a model explaining the choice of the pension system as a function of intra-family transfers. Their model predicts that as family solidarity crumbles, people prefer redistributive pension systems. In contrast to our model theirs is one of a funded pension system and, moreover, parents choose to invest in the human capital of their children expecting to receive some old age benefits from them.

The third strand of literature we integrate into our analysis deals with the the question whether formal systems of old-age security crowd out intra-family transfers (for a survey see Fafchamps and Cox, 2008). The majority of studies do find crowding-out effects, albeit sometimes only small ones. Cross-sectional studies tend to find strong correlates in public opinion surveys between social security systems and intra-family transfers (World Bank, 1994; Cox et al., 2006), but the causal effects are hard to identify. In one of the first studies Cox and Jimenez (1992) find a substantial reduction in intra-family transfers for those families covered by formal pension plans in Peru. There is also some evidence coming from rural Ethiopia showing crowding out of informal insurance being linked to food aid programmes (Dercon and Krishnan, 2003). Using the introduction of a large social security program in Taiwan as a natural experiment, Gerardi and Tsai (2014) also find evidence of crowding out of private transfers. Another piece of evidence is provided by Heemskerk et al. (2004). They compare informal risk-sharing among members of an ethnic group living in Suriname which is a country with a poorly developed welfare system with adjacent French Guiana that has a strong welfare system finding some evidence for replacement. Our model relates to this literature as the choice of the young generation on the transfers for the elderly will be a function of the scope of the public pension system and their own income.

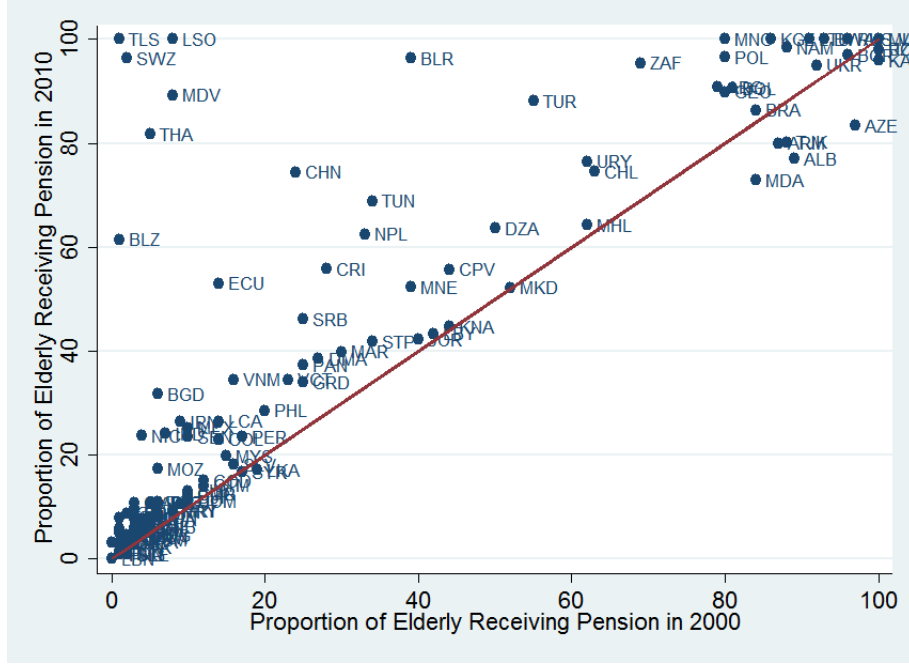


Figure 1: Increasing Coverage Rates; Data source: ILO (2014).

### 3 Empirical motivation

Public pension systems of less developed countries are growing in size (Pallares-Miralles et al., 2012; ILO, 2014). One indication are rising coverage rates, defined as the share of those above the statutory retirement age who receive a public pension. Figure 1 shows this increase in coverage rates between 2000 and 2010. It is evident that with few exceptions - mainly in the transition economies - coverage rates have increased, in some cases dramatically.

To a large extent, this resurgence of pension systems is due to the rise of so-called social pension schemes (Leisering and Barrientos, 2013). Social pensions are non-contributory pension schemes, financed by taxation, and (usually) targeted to poor people above the retirement age. Although the invention of these social pensions dates back at least one century, until the 1980s only very few countries in the developing world ran such a system. However, in the last three decades the number of countries with what the World Bank calls a zero-pillar pension scheme has almost quadrupled (Holzmann et al., 2009; ILO, 2014).

One of the standard criticisms against first-pillar pension schemes is that, due to the limited coverage in developing countries, they exclude large parts of the poor population and, in extreme cases, even redistribute money from



the poor to the rich (Lindert et al., 2006; Goni et al., 2011). However, the recent rise in coverage, as well as the expansion of non-contributory systems make it save to argue that the redistributive character of pension systems has increased over time in most countries. A look at table 1 gives some evidence for this claim. The table summarizes some major features of public pension schemes using the World Bank income groups as categories (columns). The exact year of observation changes from country to country, but the modal value is for 2010.

The table shows that running any type of a first-pillar system is the rule in all types of countries. When we move to the existence of social pension schemes we see that these are more prevalent among middle income countries. Social pensions have become particularly popular in middle income countries. So far the poorest countries have found it most challenging to introduce such systems. According to the table coverage rates in the poorest countries rarely go beyond 10 to 15 percent of the population of elderly people. Rates, especially those for social pensions, are much higher in lower middle income countries. Upper middle income countries, finally, have larger coverage rates in first pillar schemes.

Total spending on pension system rises with aggregate income. Lower middle income countries have sizable social pension systems, upper middle income countries also sizable first-pillar systems. In developing countries, higher coverage rates are correlated with more generous and more redistributive pension systems. For instance, we see that net replacement rates at 100% of the average wage rise with aggregate income. At the same time, and contrary to high income countries, higher replacement rates at average wages also go hand in hand with more progressivity in the system. One indicator of this progressivity is the difference between the net replacement rates at high incomes (150% of average wage) and low incomes (50% of average wage). Systems redistributing from rich to the poor have negative differences, i.e. replacement rates for richer people are smaller. Indeed in low and middle income countries the replacement schedule decreases with individual income so that the differences are negative. In the developing world, pension systems occur to be by and large of the Beveridgean type.

The last two rows of the table show another way to measure the redistributive impact of pension systems. Data comes from World Bank (2011) and is measured as the reduction in the Gini coefficient due to the pension system. This indicator compares the Gini coefficient of actual earnings in the economy with the Gini coefficient of simulated pensions for the same group of new entrants in the base year (Pallares-Miralles et al., 2012, p. 54). We see that, on average, countries across all income groups have pension systems that redistribute money from the rich to the poor. As a matter of fact only

Table 1: Characteristics of Pension Systems in Developing Countries in the late 2000s

	Low income	Lower middle	Upper middle
Countries with a pension system			
with any pension scheme (% of all countries in respective income group)	97	88	86
with social pension (% all countries in respective income group)	21	46	53
Coverage Rates (% of elderly)			
of contributory systems	13	27	41
of social pensions	15	46	31
Spending (in % of GDP)			
on all pension systems	1.15	2.51	4.88
on social pensions	0.14	0.72	0.58
Replacement rates (in %)			
Net replacement rate at 100% of average wage	75	79	86
Percentage difference in net replacement rates at 150% and 50% of average wage	0.7	-14	-15
Redistribution (reduction in post-transfer Gini coefficient in %)			
by all old-age security	3.8	8.8	13.7
by social pensions	1.5	0.8	1.1

Notes: see appendix for data sources.

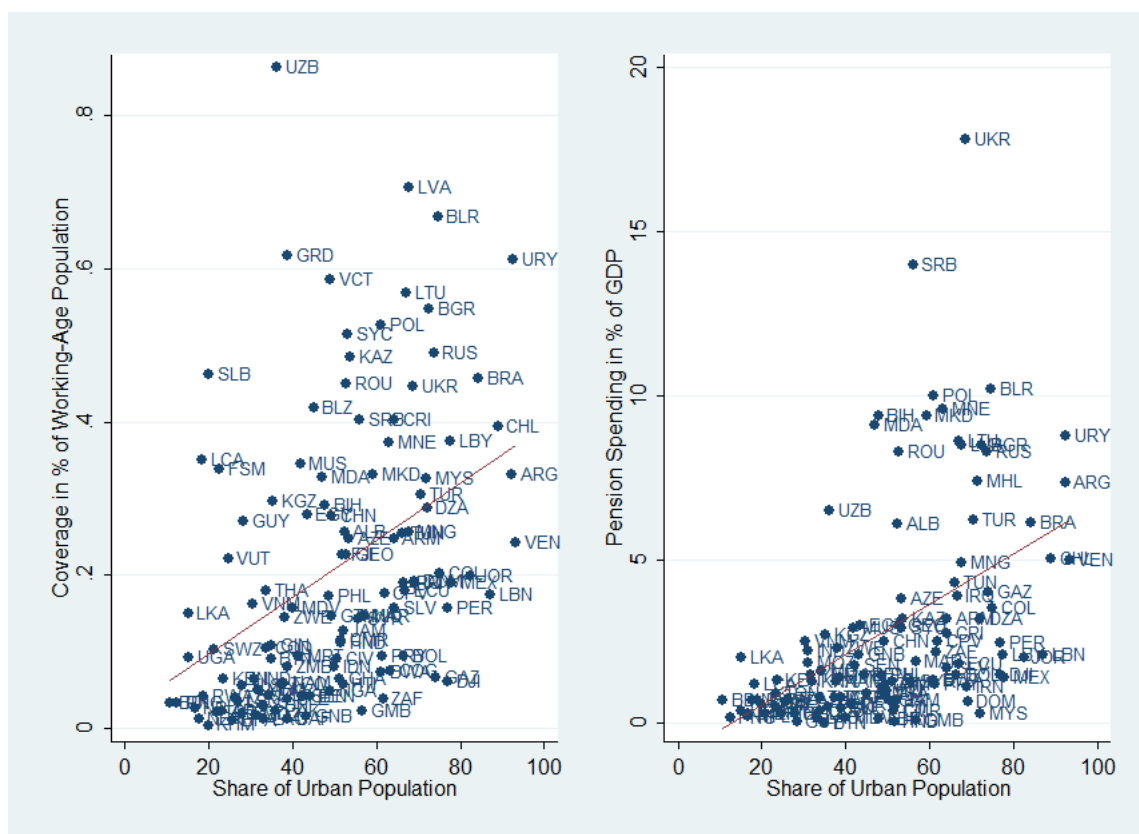
in a handful of cases the World Bank measure is negative, i.e. redistributing regressively. We also see that the redistributive impact rises with aggregate income. The exception here is social pensions where the low income countries, arguably because of the overall very low level of redistribution play a larger role.

All things considered, two important facts are worth repeating. First, pension systems of developing countries do redistribute from the rich to the poor, and arguably redistribute more than one or two decades ago. This is mainly due to the fact that they have increased in coverage, although there is also some evidence that they have become more generous and more progressive. This would imply that these pension systems do not only redistribute between, but also within generations. Such a finding goes against what scholars have found for high income countries (Lindbeck and Persson, 2003). Second, this kind of redistribution seems to rise with aggregate income in developing countries. The latter fact begs the question what might be behind such a stylized relationship.

As the survey of the literature suggested pension systems in less developed countries should depend on two important socio-economic variables. The first one is the share of the urban population. Pension systems should be larger and arguably more redistributive in countries with larger urban populations. Figure 2 shows some evidence for this relationship. On the horizontal axis we plot the share of the urban population for the year 2010. On the vertical axis we plot either coverage rates around 2010 for all pension systems (left panel) or pending on old-age security as percentage of GDP (right panel). In both cases we see a strong and positive bivariate relationship.

The second main dimension that should be related to the size of public pension systems is the extent of intra-family transfers and the social norms causing these transfers. It is very difficult to find systematic and comparable data for intra-family transfers for a large cross-section of developing countries, but there is some data on attitudes for the social norm. Figure 3 shows the results for a response item from the World Value Survey (Wave 5). The question was whether respondents think that it should be a major goal in life to 'make your parents proud'. The figure shows those (strongly) agreeing with the statement as a share of all respondents. The vertical axes are identical to the previous graph. Again, there are strong bivariate relationships. Yet, in this case they are negative as is to be expected if the social norm is related to the importance of informal nets of social security. Based on the cross-sectional analysis, public pension systems and norm-based informal nets indeed seem to be functional substitutes.

Among others, Johnson and Williamson (2006) argue that expanding coverage rates, in particular in social pensions, are an attractive solution for



the poor rural population seeking old age security. Therefore it makes good sense to expect that the expansion of redistributive pensions in developing countries is related to the growing divide between rural and urban areas. Unfortunately, it is difficult to get reliable cross-country data for the differences between income and wage levels of the urban relative to the rural population in a country. The literature often recurs to imperfect proxies such as the productivity gap between agriculture and industry (Bourguignon and Morrisson, 1998; Gollin et al., 2014). Given the paucity of the data in some regions of this world, an alternative consists of using data on night-time luminosity and reconstruct regional income disparities (Henderson et al., 2012; Chen and Nordhaus, 2011). According to this data, regional inequality in many developing countries is on the rise, with agglomerations seemingly outpacing the countryside. Yet, again these are very crude measures of disparities between rural and urban areas. Finally, there is some data only on metropolitan regions in each country, as a proportion of aggregate GDP or income data. Using this source, one can see that disparities between urban and rural seem to be largest in middle income countries. Urban income in these countries typically is more than five times, in extreme cases even more than ten times above the levels of rural income (Florida, 2014).

Given these large and growing disparities between rural and urban sectors, it is very likely that the salience of redistribution in the political agenda of developing countries has increased over time. In the following we will use this insight to build a model that incorporates the major stylized facts of pension systems in the developing world.

## 4 The Model

### 4.1 General outline of model

We consider an overlapping generations model. People live for two periods  $t$  and  $t + 1$ . They work and save when young. The interest rate on savings is  $r$ . Labor supply is exogenous. There are two types of young workers: urban with share  $\beta$  and rural with share  $(1 - \beta)$ , with  $0 < \beta < 1$ . Urban workers earn a fixed wage  $w^u$  and rural workers earn a fixed wage  $w^r$  with  $w^u > w^r$ . There is population growth denoted with  $n$  which we assume to be smaller than the interest rate on savings ( $n < r$ ). Old workers receive a transfer  $T$  from their kids. The transfer is driven by a social norm. Non-compliance to the norm is costly. Finally, the political decision is on the size of a social pension of the pay-as-you-go type.



Figure 3: Size of Pension System and Social Norms; see Appendix for data sources.

## 4.2 Voters

### 4.2.1 Preferences

Utility of a young ( $y$ ) representative household member is over consumption of a private good ( $c$ ) in periods  $t$  and  $t+1$ , and compliance to a social norm:

$$U_t^y = u(c_t^y) - \alpha u(c_t^y/T) + \gamma u(c_{t+1}^y) \quad (1)$$

with current consumption  $c_t^y$  and consumption when being old of the currently young  $c_{t+1}^y$ . Future payoffs are discounted with  $\gamma > 0$ , and costs of the social norm are weighted with  $0 < \alpha < 1$ . It is assumed that utility for the young is lower the smaller their transfers to the old are relative to their own consumption when being young. Such a specification implies a social norm where one should give to the elderly in relation to one's own well-being. Social norms for guaranteeing mutual insurance in general have been attributed a prominent role for countries in the developing world (see, e.g., the survey by Platteau, 2006). More specifically, it has been put forward as a major enforcement mechanism for intergenerational transfers already by Nugent (1990). The decisions of the young generation are on savings  $s$ , the transfer  $T$ , and the size of the social security system, i.e.  $\tau$ .

Utility of a currently old ( $o$ ) household member is

$$U_t^o = u(c_t^o) \quad (2)$$

The decision of an old household member is on the size of the social security system ( $\tau$ ) as these voters already made their savings decisions in the prior period.

### 4.2.2 Budget constraints

Private consumption  $c_t$  in the first period of a voter's life satisfies (without superscripts indicating age for convenience)

$$c_t = w^i(1 - \tau) - s - T. \quad (3)$$

with  $i = u, r$ . Wages net of the contribution  $\tau$  to the social security system minus private savings  $s$  and the transfers  $T$  have to equal consumption  $c_t$ .

Private consumption in the second period when people are old is

$$c_{t+1} = P + s(1 + r) + T \quad (4)$$

i.e. composed of the pension payment  $P$ , the returns on the private savings, and the transfers  $T$ .

### 4.3 Government

The government imposes a tax  $\tau$  on labor income out of which pensions  $P$  are financed. In any period  $t$  we have  $N_t^o$  old members of society and  $N_t^y$  young members of society. Therefore, a balanced government budget for the social pension of the pay-as-you-go type requires

$$\beta N_t^y \tau w^u + (1 - \beta) N_t^y \tau w^r = N_t^o P_t \quad (5)$$

which can be re-written as

$$\beta \frac{N_t^y}{N_t^o} \tau w^u + (1 - \beta) \frac{N_t^y}{N_t^o} \tau w^r = P_t \quad (6)$$

Using the constant growth rate of population  $n$  defined as

$$n = \frac{N_t^y - N_t^o}{N_t^o} \quad (7)$$

and inserting yields the budget constraint as

$$(n + 1) \tau \bar{w} = P_t \quad (8)$$

with  $\bar{w} = \beta w^u + (1 - \beta) w^r$ . Note that this is a Beveridgean pension system. All members receive the same pension but contribute in relation to their wage income. Consequently, the pension system redistributes within a generation from the urban to the rural workers.

## 5 Choice of pension system

### 5.1 Voters' policy preferences

Citizens have diverse interests with respect to the social security system. In particular, we have young urban and young rural workers, and voters in the old generation receiving transfers from young family members either earning high urban or relatively low rural wages. In order to derive the preferred social pension system for each of these four societal groups, first, one needs to determine the optimal decisions of the young generation on savings  $s$ , and transfers  $T$  as functions of the contribution rate  $\tau$ . In the next step, we determine the optimal choice on  $\tau$  for each of the four groups. For deriving all these choices we recur to a logarithmic specification of the utility function.



### 5.1.1 The young generation

Using a logarithmic specification for utility (1) and inserting the consumption budget constraints (3), (4) and the government's budget constraint (8), we get for the utility function of the young

$$U_t^y = \ln(w^i(1 - \tau) - s - T) - \alpha \ln\left(\frac{w^i(1 - \tau) - s - T}{T}\right) + \quad (9)$$

$$+ \gamma \ln((n + 1)\tau\bar{w} + s(1 + r) + T).$$

Using the properties of the logarithmic function (9) can also be written as

$$U_t^y = (1 - \alpha)\ln(w^i(1 - \tau) - s - T) + \alpha \ln T + \quad (10)$$

$$+ \gamma \ln((n + 1)\tau\bar{w} + s(1 + r) + T)$$

i.e. a costly deviation from a social norm may also be interpreted in terms of a young worker maximizing utility where private consumption in the first period and the transfer to the older generation are weighted according the social norm parameter  $\alpha$ .

From the first order conditions on savings and transfers ( $\frac{\partial U_t^y}{\partial s} = 0$  and  $\frac{\partial U_t^y}{\partial T} = 0$ ) we derive optimal savings  $\hat{s}$  and transfers  $\hat{T}$  as a function of the tax rate  $\tau$ :<sup>1</sup>

$$\hat{s} = w^i(1 - \tau) \frac{(r\gamma - \alpha)}{r(1 + \gamma)} - (n + 1)\tau\bar{w} \frac{\alpha + r}{(1 + r)r(1 + \gamma)} \quad (11)$$

$$\hat{T} = \frac{\alpha}{r(1 + \gamma)} ((n + 1)\tau\bar{w} + w^i(1 - \tau)(1 + r)) \quad (12)$$

Doing the partial derivatives for the optimal decisions on savings and transfers as voters would face different contributions rates to the social pensions we get

$$\frac{\partial \hat{s}}{\partial \tau} = -w^i \frac{(r\gamma - \alpha)}{r(1 + \gamma)} - (n + 1)\bar{w} \frac{\alpha + r}{(1 + r)r(1 + \gamma)} < 0 \quad (13)$$

$$\frac{\partial \hat{T}}{\partial \tau} = \frac{\alpha}{r(1 + \gamma)} ((n + 1)\bar{w} - w^i(1 + r)) \geq 0 \quad (14)$$

Higher tax rates and thus pensions crowd out private savings of the young generation. The effect of higher tax rates on the within family transfers from the young to the old is ambiguous. For the young urban generation which earns  $w^u > \beta w^u + (1 - \beta)w^r$  higher contributions to the pension system reduce within family transfers  $\hat{T}$ . For the young rural generation, however, higher

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<sup>1</sup>Second order conditions are fulfilled.

tax rates  $\tau$  will increase the contributions they are willing to pay to their old family members. The pension will make them better off when being old so that they are willing to give up some of their savings when being young to transfer them to their old family members. The partial effects on the transfers are, of course, stronger the stronger is the social norm  $\alpha$  that the young should support the old.

Inserting optimal savings  $\hat{s}$  and transfers  $\hat{T}$  in (9) and differentiation with respect to the policy rate  $\tau$  yields after simplifying

$$\frac{\partial U_t^y}{\partial \tau} = -(1 + \gamma) \frac{w^i(1 + r) - (n + 1)\bar{w}}{w^i(1 - \tau)(1 + r) + (n + 1)\tau\bar{w}}. \quad (15)$$

The partial derivative may be positive or negative depending on the wage of the young worker relative to the pension payments. This is due to the intragenerational distribution of the pension system. It is financed by a tax rate proportional to the wage  $w^i$  but pension payments are the same for all old no matter whether they earned the higher urban or the lower rural wage during their working life. Equation (15) actually suggests that the young urban workers will want to have no social pension system at all while the young rural workers would want to tax away as much of the income as possible and put it into the social security system if the return of the pension system is sufficiently high.<sup>2</sup> This will be the case, if the interest rate on the private savings is sufficiently low compared to what the return is of the social security system. The generosity of the pension is a function of the growth rate of the population as always in pay-as-you-go systems and the average wage which increases with the share of the urban population and the wage differential between urban and rural wages.

### 5.1.2 The old generation

Using the logarithmic specification of the utility function, the budget constraint (4) and pension payments (8) utility of the old can be written as

$$U_t^o = \ln((n + 1)\tau\bar{w} + s_{t-1}^o(1 + r) + \hat{T}). \quad (16)$$

When evaluating their best choice on  $\tau$  they will take into account the effect on pensions  $P$  and the transfer of the young  $\hat{T}$ , but not on  $s_{t-1}^o$  as this decision was already taken in the past period. Differentiation with respect to  $\tau$  gives

$$\frac{\partial U_t^o}{\partial \tau} = \frac{(n + 1)\bar{w} + \frac{\partial \hat{T}}{\partial \tau}}{(n + 1)\tau\bar{w} + s_{t-1}^o(1 + r) + \hat{T}}. \quad (17)$$

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<sup>2</sup>The upper bound on the policy rate  $\tau$  is given by the restriction that savings may not turn negative. A sufficient condition for this is derived in the Appendix.

With consumption of the old being positive, the comparison of the marginal effect on pensions and the marginal effect on family transfers decides whether the old want to increase pensions. Inserting the marginal effect on optimal transfers  $\hat{T}$  shows that the sign of the (17) is determined by the inequality

$$(n+1)\bar{w}(r(1+\gamma)+\alpha)-\alpha w^i(1+r) \geq 0. \quad (18)$$

Whether the old generation will want to increase the generosity of the pension system is, among other things, a question of whether the family transfers come from a young urban worker earning a high wage or a young rural worker earning a relatively lower wage, as well as the importance of the social norm because the family transfers may increase or decrease as a response to a more generous pension. For a sufficiently low social norm  $\alpha$  the old will, however, always prefer a larger pension system. For a poorly developed social norm the marginal effect on transfers is low, too, and enlarging the pension system will consequently crowd out transfers only to a sufficiently smaller degree.

## 5.2 Collective decision

We assume a government choosing for once and all the size of the social security system  $\tau$  by maximizing a political support function

$$\max_{\tau} \quad \Lambda_{y,u}U_t^{y,u} + \Lambda_{y,r}U_t^{y,r} + \Lambda_{o,u}U_t^{o,u} + \Lambda_{o,r}U_t^{o,r} \quad (19)$$

over the payoffs of the four distinct societal groups of young urban and rural workers, and those old who receive a transfer from a young urban worker and the old who receive a transfer from a young rural worker. Such a government objective function can be rationalized with a probabilistic voting model, see Coughlin and Nitzan (1981), Lindbeck and Weibull (1987) or, for a textbook exposition Mueller (2003). Political support functions have been used by Verhoeven and Verbon (1991), Verbon and Verhoeven (1992), Grossman and Helpman (1996, 1998) or Neugart (2009) previously. We choose such an approach because it captures a wider variety of political settings than a median voter or a majority approach. For the moment, we let the weights  $\Lambda$  on the various groups of society be independent of the share of the urban population or the population growth rate. Later on in Section 5.3 we will alleviate this assumption.

In any case, factors in addition to the actual population share of these distinct groups in society determine whether a group weighs strongly in the decision of the government on the scope of the pension or not. An explicit derivation of the weights along a probabilistic voting model would inform that the weights may depend on the ideological dispersion of the voters within

those four groups or whether any of the groups manages to form an interest group that may influence the policymaker (see Persson and Tabellini, 2002).

The first order condition for (19) using the partial derivatives (15) (17) along with the optimal savings and transfers (11), (12) becomes:

$$H = \Lambda_{y,u} \frac{\partial U_t^{y,u}}{\partial \tau} + \Lambda_{y,r} \frac{\partial U_t^{y,r}}{\partial \tau} + \Lambda_{o,u} \frac{\partial U_t^{o,u}}{\partial \tau} + \Lambda_{o,r} \frac{\partial U_t^{o,r}}{\partial \tau} = 0 \quad (20)$$

with

$$\frac{\partial U_t^{y,i}}{\partial \tau} = -(1 + \gamma) \frac{w^i(1 + r) - (n + 1)\bar{w}}{w^i(1 - \tau)(1 + r) + (n + 1)\tau\bar{w}}$$

$$\frac{\partial U_t^{o,i}}{\partial \tau} = \frac{(n + 1)\bar{w}(r(1 + \gamma) + \alpha) - w^i(1 + r)\alpha}{(n + 1)\tau\bar{w}(r(1 + \gamma) + \alpha) + s_{t-1}^o(1 + r)r(1 + \gamma) + w^i(1 - \tau)(1 + r)\alpha}$$

and  $i = u, r$ . The first order condition implicitly defines the tax rate  $0 \leq \tau^* \leq \bar{\tau}$  which maximizes the support for the government.<sup>3</sup>

We summarize our main results with respect to the political economy of the rise of social security systems in the following proposition.

**Proposition:**

1. A higher share of the urban population will always increase the scope of the pension system  $(\tau^*, P^*)$ .
2. Higher urban wages ( $w^u$ ) relative to rural wages will always increase the scope of the pension system  $(\tau^*, P^*)$  if political weights on the rural population are sufficiently large relative to the weights on the urban population.
3. A decrease in the social norm  $\alpha$  will always increase the scope of the pension system  $(\tau^*, P^*)$  if the political weight on the old population receiving transfers from the young urban workers ( $\Lambda_{o,u}$ ) is sufficiently large relative to the weight on the old population receiving transfers from the young rural workers ( $\Lambda_{o,r}$ ).

**Proof:** see Appendix

We already showed that the rural and urban workers as well as the elderly receiving transfers by an urban or rural worker have diverging interests on the size of the pension system. For the young urban workers the pension

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<sup>3</sup>In the Appendix it is shown that the second order condition for a maximum is fulfilled.

system redistributes income away from them. The young rural workers gain from the social security system because their contribution to the pension system is relatively small due to their lower income while the payment they will receive is based on all workers' contributions including those of the high income workers. For the old generation, wanting or not wanting a pension system is mostly a question of how large the reduction in family transfers as their other source of old age income would be as the young reduce their payments when being subject to a higher contribution rate to the public pension system. The lower the social norm (and therefore transfers) are, and the lower the young rural workers income is relative to the pension, the more likely is the support for an increase in the pensions coming from the old. Assuming that some sort of a pension exists, the Proposition answers the question on how the government would change the generosity of pensions to secure maximum electoral support as any of the following changes occur: the share of workers  $\beta$  earning urban wages increases, urban wages  $w^u$  increase, or the social norm  $\alpha$  becomes less important.

How the government responds is basically a question of the effect of these parameter changes on the marginal utility of a tax change on any of these four groups of society and the corresponding weights with which the payoffs are credited by the government. A larger share of the urban population will always increase the scope of the pension system. Although the young urban generation is not in favor of a public pension scheme having more urban workers lessens the burden of a more generous pension scheme as, *ceteris paribus*, more workers contribute who earn high wages. Moreover, as the tax base increases, a marginal increase in the contribution rate will also raise the utility of the young rural workers because the intragenerational distribution of the pension scheme is magnified. Finally, a larger tax base also strengthens the intergenerational redistribution of the pension scheme favoring the elderly so that the government can increase its electoral support by proposing a larger public pension scheme.

A sufficient but not necessary condition for higher urban wages  $w^u$  to increase the size of the pension system is that the young rural and the old supported by them are sufficiently strongly weighted by the government. Those are the groups whose marginal utility of a larger pension scheme increases unambiguously as the wages of the young urban workers rise. Now, the pension scheme redistributes even more within the young generation which makes the young rural workers more in favor of increasing its scope. For the elderly who receive transfers from young urban workers, however, the crowding out of those transfers may be so strong that the effect of a larger pension on their marginal utility may rather be weakened. Consequently, the government has to weigh the fate of the rural population sufficiently strongly so

that it will offer a more generous public pension. This condition is weakened as the crowding out of transfers is not too strong. Then, an increase in urban wages will already lead to higher pensions if the young urban population does not enter the government's decision rule too strongly.

As we look into changes of the social norm, we find that the weights on the young are irrelevant for the government's choice. At the margin a change in the social norm does not alter the marginal effect of a change in the contribution rate on utility because the young internalize the implied change this will have on the old age transfers they would get. Moreover, the marginal effects on young- and old-age consumption, and costs arising from the social norm outweigh each other. What counts for the government's choice on the size of the pension system as the strength of the social norm decreases is only the relative weight it puts on the old receiving transfers from the young urban or the young rural workers. It turns out that a sufficient condition for an increase in pensions as norm-driven behavior becomes less prevalent is that the government puts a sufficiently large weight on the old receiving transfers from the young urban. Intuitively, this group suffers more from a deterioration of the social norm in terms of transfers paid and will, therefore, want the government to compensate by making pensions more generous.

### 5.3 A numerical example

In the analytical discussion of our results we assumed that the weights of the electoral support function are arbitrarily chosen positive numbers. For the numerical example we let weights  $\Lambda$  reflect the relative size of the population. Given an urban share of  $\beta$  and a population growth rate of  $n$  the government support function can be written as

$$G = \beta(1+n)U_t^{y,u}(\tau, \hat{s}, \hat{T}) + (1-\beta)(1+n)U_t^{y,r}(\tau, \hat{s}, \hat{T}) \quad (21)$$

$$+ \beta U_t^{o,u}(\tau, \hat{s}, \hat{T}) + (1-\beta)U_t^{o,r}(\tau, \hat{s}, \hat{T}).$$

We use (21) to evaluate numerically how the optimal policy rate  $\tau^*$  of a government changes as a response to urbanization. We define urbanization as a process of an increasing share of an urban population, higher urban relative to rural wages, or a combination of both. The numerical example illustrates for a specific choice of weights on the four societal groups that reflects the (changing) population weights what has been shown in the previous section for parametrized weights  $\Lambda$ .

In Figure 4 we plot the first order condition on (21) being fulfilled for two different optimal tax rates  $\tau^* = 0.3$  and  $\tau^* = 0.5$  as a function of the share of urban population (horizontal axis) and the urban wage (vertical axis).

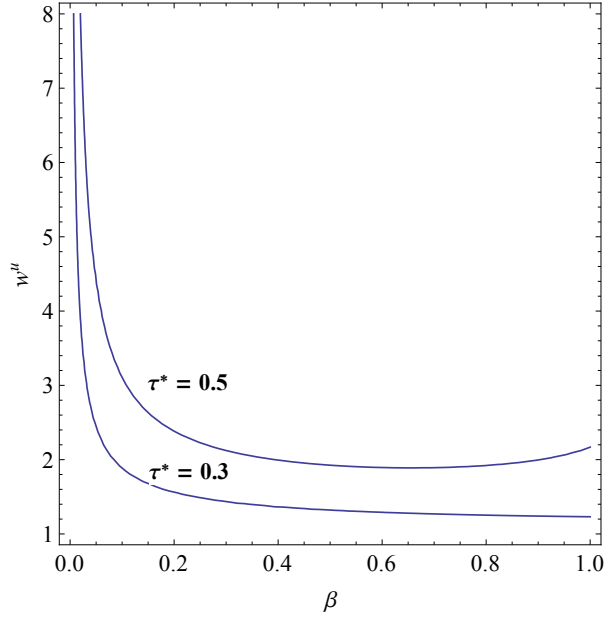


Figure 4: First order condition of government support function; Vertical axis:  $w^u$ ; horizontal axis:  $\beta$ ;  $\tau^* = 0.3$  and  $\tau^* = 0.5$  maximizing governmental support; other parameters:  $\alpha = 0.2$ ,  $\gamma = 0.7$ ,  $n = 0$ ,  $r = 0.6$ ,  $w^r = 1$ ,  $s^o = 0.5$ .

Holding urban wages relative to the rural wage fixed but increasing the share of the urban population makes a government increase the scope of the pension system in order to secure maximum support by the four societal groups. The same government response arises as we hold the share of urban population fixed but increase the urban wage relative to the rural wage. Again, the government will increase the tax and therefore the pension generosity to secure maximum electoral support.

## 6 Conclusions

In the developing world public pension systems are growing in size and the question might be asked why this is so. Empirically we observe that these pension systems are by large of the Beveridgean type not only redistributing between generations but also within generations. Moreover, countries with a larger share of the population residing in urban areas have larger pension schemes. As, in addition, per capita income in urban areas is manifold of what can be earned in rural areas, political support for an increase in a pension system may come about as the share of urban citizens increases, urban

to rural income gaps rise, or the social norm driving transfers to the elderly erodes. Support for a more generous pension system comes from young and low income rural workers to whom the pension system redistributes, and the old generation up to the point where an increase in the public pensions is not overcompensated by a decrease in the norm-driven family transfers. We show that if governments weigh the fate of these societal groups sufficiently strongly the scope of redistributive social security programs increases.

As mentioned above, testing our model econometrically faces serious empirical challenges. Whereas data on urbanization and agglomeration has improved over the last decades even for poor countries, data on productivity and income differentials between rural and urban areas are subject to fundamental problems of availability and quality (Jerven, 2013). However, we are optimistic that such data will be available in the near future (Florida, 2014). Better data would allow us to tease out the role of redistributive conflicts between different groups of the population in developing countries. This data would also allow us then, to compare the predictive power of our model compared to alternative explanations as, for example, those based on the growing importance of the informal sector or those based on the relevance of the demand for insurance.

## Appendix

### Condition on positive savings and consumption of the young

From (11) we know that savings are positive if

$$w^i(1 - \tau)(r\gamma - \alpha)(1 + r) - (n + 1)\tau\bar{w}(\alpha + r) > 0 \quad (22)$$

The left hand side of (22) is decreasing in  $\tau$ . Moreover, it is turning more easily negative for  $w^i = w^r$ . Thus, solving (22) for  $\tau$  an upper bound on the policy rate for savings not turning negative is defined by

$$\frac{w^r(r\gamma - \alpha)(1 + r)}{w^r(r\gamma - \alpha)(1 + r) + (n + 1)\bar{w}(\alpha + r)} = \bar{\tau} > \tau \quad (23)$$

This is a sufficient but not a necessary condition.

Consumption of the young is positive if

$$w^i(1 - \tau) - \hat{s} - \hat{T} = \frac{1 - \alpha}{1 + \gamma} \left( w^i(1 - \tau) + \tau\bar{w}\frac{1 + n}{1 + r} \right) > 0, \quad (24)$$

see (3), (11), and (12). Consumption of the young is always positive for  $\alpha < 1$ .



## Second order condition

For having a maximum, we need to show that

$$\frac{dH}{d\tau} < 0. \quad (25)$$

Doing the derivatives for (20) term by term gives

$$\frac{d}{d\tau} \left( -(1+\gamma) \frac{w^i(1+r) - (n+1)\bar{w}}{w^i(1-\tau)(1+r) + (n+1)\tau\bar{w}} \right) = \quad (26)$$

$$= -(1+\gamma) \frac{(w^i(1+r) - (n+1)\bar{w})^2}{(w^i(1-\tau)(1+r) + (n+1)\tau\bar{w})^2} < 0 \quad (27)$$

Now, let us look into the derivative of

$$\frac{d}{d\tau} \left( \frac{(n+1)\bar{w}(r(1+\gamma) + \alpha) - w^i(1+r)\alpha}{(n+1)\tau\bar{w}(r(1+\gamma) + \alpha) + s_{t-1}^o(1+r)r(1+\gamma) + w^i(1-\tau)(1+r)\alpha} \right) = \quad (28)$$

$$= \frac{-((n+1)\bar{w}(r(1+\gamma) + \alpha) - w^i(1+r)\alpha)^2}{((n+1)\tau\bar{w}(r(1+\gamma) + \alpha) + s_{t-1}^o(1+r)r(1+\gamma) + w^i(1-\tau)(1+r)\alpha)^2} < 0 \quad (29)$$

Therefore, we have

$$\frac{dH}{d\tau} < 0. \quad (30)$$

## Proof of main result

### Effect of $w^u$ and $\beta$

Let us fix  $\beta$  and ask if an increase in  $w^u/w^r$  raises  $\tau^*$ , i.e.

$$\frac{d\tau^*}{dw^u} = -\frac{\frac{\partial H}{\partial w^u}}{\frac{\partial H}{\partial \tau^*}} > 0 \quad (31)$$

From calculating the second order condition we already know that  $\frac{\partial H}{\partial \tau^*} < 0$ . What remains to be shown is that  $\frac{\partial H}{\partial w^u} > 0$ . Doing it term by term for each of the societal groups gives:

$$\frac{\partial^2 U^{y,u}(\tau, \hat{s}, \hat{T})}{\partial \tau \partial w^u} < 0, \quad (32)$$

$$\frac{\partial^2 U^{y,r}(\tau, \hat{s}, \hat{T})}{\partial \tau \partial w^u} > 0, \quad (33)$$

$$\frac{\partial^2 U_t^{o,u}(\tau, \hat{s}, \hat{T})}{d\tau \partial w^u} \begin{matrix} \leq \\ \geq \end{matrix} 0, \quad (34)$$

and

$$\frac{\partial^2 U_t^{o,r}(\tau, \hat{s}, \hat{T})}{\partial \tau \partial w^u} > 0. \quad (35)$$

The effect of an increase in urban wages on the marginal effect on utility of a larger pension scheme differs between societal groups. For the young rural workers and the old population receiving transfers from rural workers the marginal effect of a larger pension scheme on utility is amplified with higher urban wages. For the old generation receiving transfers from young rural workers the effect is ambiguous, and for the young urban workers the effect is negative, i.e. they dislike an increase in the scope of the pension system even more when their wages are higher.

Now, let us fix  $w^u/w^r$  and ask if an increase in  $\beta$  raises  $\tau^*$ , i.e.

$$\frac{d\tau^*}{d\beta} = -\frac{\frac{\partial H}{\partial \beta}}{\frac{\partial H}{\partial \tau^*}} > 0 \quad (36)$$

Given that  $\frac{\partial H}{\partial \tau^*} < 0$  we need to check if  $\frac{\partial H}{\partial \beta} > 0$ . Again, doing it term by term for each of the societal groups gives:

$$\frac{\partial^2 U^{y,u}(\tau, \hat{s}, \hat{T})}{\partial \tau \partial \beta} > 0, \quad (37)$$

$$\frac{\partial^2 U^{y,r}(\tau, \hat{s}, \hat{T})}{\partial \tau \partial \beta} > 0, \quad (38)$$

$$\frac{\partial^2 U_t^{o,u}(\tau, \hat{s}, \hat{T})}{d\tau \partial \beta} > 0, \quad (39)$$

and

$$\frac{\partial^2 U_t^{o,r}(\tau, \hat{s}, \hat{T})}{\partial \tau \partial \beta} > 0. \quad (40)$$

All cross-derivatives are unambiguously positive.

Table 2: Effects of changes in  $\beta$ ,  $w^u$ , and  $\alpha$  on the marginal effect of a tax increase on the utility of the four societal groups

	Societal group			
	y,u	y,r	o,u	o,r
$w^u$	-	+	+/-	+
$\beta$	+	+	+	+
$\alpha$	0	0	-	+/-

### Effect of $\alpha$

Finally, let us turn to the effect of a change in the social norm  $\alpha$  on  $\tau^*$  and ask if

$$\frac{d\tau^*}{d\alpha} = -\frac{\frac{\partial H}{\partial \alpha}}{\frac{\partial H}{\partial \tau^*}} < 0 \quad (41)$$

Given that  $\frac{\partial H}{\partial \tau^*} < 0$  we need to check if  $\frac{\partial H}{\partial \alpha} < 0$ . Again, looking into the effects on each of the societal groups separately reveals that the cross-derivatives for the young workers are zero because the marginal effects on the utility of the young workers arising from an increase in the scope of the public pension scheme are independent from the social norm. Doing it term by term for the old population gives:

$$\frac{\partial^2 U_t^{o,u}(\tau, \hat{s}, \hat{T})}{d\tau d\alpha} < 0 \quad (42)$$

and

$$\frac{\partial^2 U_t^{o,r}(\tau, \hat{s}, \hat{T})}{d\tau d\alpha} \begin{matrix} \leq \\ \geq \end{matrix} 0 \quad (43)$$

A decrease in the social norm amplifies the positive effect of a marginal tax increase on the utility of the old population receiving transfers from urban workers. while the sign of the other cross-derivative is ambiguous.

### Partial effects on scope of pension system

Collecting all the marginal effects on the four groups of society as shown in Table 2<sup>4</sup> it is straightforward to derive the partial effects on the scope of the social pension system. If the weights on  $\Lambda_{y,r}$  and  $\Lambda_{o,r}$  are sufficiently larger than the weights  $\Lambda_{y,u}$  and  $\Lambda_{o,u}$  the partial effect  $\partial H / \partial w^u > 0$  which implies  $d\tau^* / dw^u > 0$ . The partial effects of  $\beta$  and  $\alpha$  follow from the same reasoning.

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<sup>4</sup>A detailed derivation of the partial effects is available upon request.

## **Data source information**

Table 3 summarizes the data sources used in section 3.

Table 3: Summary Statistics and Sources

Variable	Num. obs.	Mean	St. dev.	Source
Year of introducing social pension	80	1981	31	ILO (2014)
Coverage of social pensions (in % elderly population)	85	33	35	ILO (2014)
Coverage of contributory systems (in % of elderly population) in 2010	154	52	38	ILO (2014)
Coverage of contributory systems (in % of elderly population) in 2000	154	42	39	ILO (2014)
Net replacement rate at 100% of average wage	61	70	26	Pallares-Miralles et al. (2012)
Net replacement rate at 50% of average wage	61	101	174	Pallares-Miralles et al. (2012)
Net replacement rate at 150% of average wage	61	66	26	Pallares-Miralles et al. (2012)
Spending on all Pension Systems in % of GDP	145	3.94	3.88	Pallares-Miralles et al. (2012)
Spending on social pensions in % of GDP	53	0.55	0.71	ILO (2014)
Redistribution all old age (reduction in GINI in %)	36	10	13	World Bank (2011)
Redistribution social pensions (reduction in GINI in %)	16	1	1	World Bank (2011)
Urban population (in % of total population)	201	56	24	UN (2014)
'Make Parents Proud?'	55	81	16	World Value Surveys (2009)

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