POLITICAL EQUILIBRIUM SOCIAL SECURITY WITH MIGRATION

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We analyze the consequences on social security of immigration in a micro founded parliamentary democracy. The underlying economic model is an overlapping-generations economy, where individuals differ in preferences over a public good (as well as in age). Social security, as well as the public good is funded by labour- and capital taxes. We find that in an economy with positive population growth, immigration increases the social security payment (per old). On the contrary, an economy with (small) population decline will experience a decline in social security if immigration is large enough. The reason is that immigration in the latter case alters the political majority.

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1. INTRODUCTION

Common demographic transitions in OECD countries have caused falls in both birthrates and deathrates, in turn implying a higher ratio of old to young (an "ageing" population). Recent debate has centred on the consequences for pay-as-you-go pension systems. As these systems rely on taxing the young and transfer to the old, they are only sustainable if there is population growth. It has been argued in the policy debate, as well as in academic papers, such as Blake and Mayhew (2006), that immigration may be one solution. Immigration of young workers alters the ratio of old to young and works as a (temporary) increase in the population growth rate.

This argument relies on the assumption that the social security tax remains the same. However, one would not expect the social security tax to be invariant with respect to the demographic structure. On one hand, and increase in the size of the young brings a resource gain, as the young bring a labour endowment that can be taxed and redistributed. This resource gain can, at least partially, be redistributed to the old in form of increased social security. On the other hand, an increase in the size of the young may shift the political powers to the young and since the young have no interest in social security (as long as they are young) the political-equilibrium level of social security may be reduced.

Razin and Sand (2007) examine political equilibrium social security in an overlapping generations model. Their decisive voter is either young or old, implying corners in equilibrium. When the decisive voter is old, society pays the maximum amount of social security, and when the decisive voter is young there is no social security.

Gonzalez-Eiras and Niepelt (2007) use a probabilistic voting model, implying a government objective equivalent to a social welfare function. This formulation avoids the corners of no or maximum social security. Their result is that an increase in immigration raises social security payments. The reason is that a utilitarian social welfare function attains

a higher value when the resource gain from immigration is spread across both young and old (and not just the young).

The previous literature has only looked at the situation when the tax on the young can only be used for social security. Since the government can spend on other things, like public goods, there is the possibility that the resource gain from immigration may be diverted from social security. Furthermore, the political framework may matter.

In this paper we analyse the consequences of migration on political-equilibrium social security under parliamentary democracy. We allow for a sufficiently rich tax and spending structure to capture the possibility that spending may be diverted away from social security. In particular, we allow for a labour income tax, a capital income tax, social security, and a public good. The economic model is an overlapping generations economy where individuals, apart from age, also differ in preferences over the public good.[1]

Our underlying institution is a parliament, where party entry, parliamentary composition, coalition formation, and bargaining are all endogenous [see Renström (2002), Marsiliani and Renström (2004, 2007)]. The model consists of several stages. In the first stage individuals can enter as parties (or strategically abstain). In the second stage the electorate vote, rationally anticipating the coalition to form, the bargaining outcome, and policy. The number of seats a party obtains is proportionate to the number of votes. In the third stage, the largest party is chosen as formateur (as in Austen-Smith and Banks (1988)) and has to pick coalition partner(s), rationally anticipating the bargaining outcome. In the fourth stage, bargaining in the coalition takes place. In the final stage, the policy proposal has to pass a majority vote in parliament (which it will do, if the coalition has more than 50%

[1] If the individuals differed only in age, the political equilibrium would be a corner for most political institutions. If young were in majority, there would be no social security, and if the old were in majority the social security would be at the maximum possible (as in Razin and Sand (2007)).

representation). The key to the model is that policy is linked to party size in parliament (through a simple bargaining game[2]), and rational voters in turn pin down the relative party sizes.[3]

When population growth is positive, necessary for existence of social security is that there is a coalition equilibrium, where no single party has a majority of the seats in parliament. We therefore focus our analysis on coalition equilibria (which will exist if preferences are enough disperse, see Renström (2002)).

Our results are that an increase in the size of the young through immigration increases the social security payment if there is population growth initially. If there is a (small) population decline initially, immigration equivalent to cause population growth will reduce the social security payment. This is because the identity of the pivotal voter switches from old to young, and will give more power to the young party in parliament. For this reason, social security is larger under a (small) population decline than under a (small) population growth. Therefore, for economies with small population growth would accomplish a higher social security payment through emigration rather than immigration.

The paper is structured as follows. In section 2 we specify the overlapping-generations model, and we solve for the economic equilibrium. We present the political rules in section 3 and solve for the political-economic equilibria. In section 4 we analyse the consequences on social security. We analyse the dynamic properties of the model in section 5 and conclude in section 6.

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[2] This is similar to *legislative bargaining* in Baron and Ferejohn (1989), with the difference that we use a recognition rule that the largest party makes the first offer (like Austen-Smith and Banks (1988)). In Baron and Ferejohn the recognition rule is a random draw. Also, they allow counter proposals from the entire legislature, while we limit the counter proposals to within the coalition.

[3] See Austen-Smith and Banks (1988), Baron and Diermeier (2001), and Baron, Diermeier, and Fong (2006) for other ways of linking representation to policy proposals.

2. THE ECONOMY

Individuals live for two periods, consuming both as young and as old, but work only when young.[4] They also differ in their preferences over the public good. We define the *after-tax* factor returns as $P_t \equiv (1-\tau_t^k)R_t$ and $\omega_t \equiv (1-\tau_t^l)w_t$ for capital and labour respectively, where τ_t^l and τ_t^k denote the wage- and the capital-income tax rates. The individual consumes c_t^{it} when young, and saves k^{it}_{t+1} for the next period. In period two she receives after-tax return on her savings and social security s_{t+1}, all of which is spent on consumption c^{it}_{t+1}. The period-one and two per-capita consumption of the public good (equal for all individuals) are denoted g_t and g_{t+1} respectively. The government uses the tax receipts for public goods provision as well as social security.

2.1 Assumptions

A1 Population

The size of a generation, N_t, and grows (declines) at a constant rate n >(<) 0. Individuals differ in taste over the public good: low taste, ε^l, or high taste, ε^h.

A2 Individual Preferences

For tractability the utility function is assumed to be of the form

$$U^{it}(\cdot) = c_t^{it}\left(c_{t+1}^{it}\right)^{\beta}\left(g_t\right)^{\varepsilon^i}\left(g_{t+1}\right)^{\beta\varepsilon^i} \qquad (1)$$

where β and ε^i are positive.

[4] We assume that labour is inelastically supplied. This is not a crucial assumption, though. The reason is that for the Cobb-Douglas preferences we are going specify, andy leisure chosen would just become a constant.

A3 Individuals' Constraints

The young and old budget constraints are

$$c_t^{it} + k_{t+1}^{it} = \omega_t \qquad (2) \qquad\qquad c_{t+1}^{it} = P_{t+1} k_{t+1}^{it} + s_{t+1} \qquad (3)$$

A4 Production

For simplicity we assume that technology is Cobb-Douglas:

$$Y_t = A K_t^{\alpha} L_t^{1-\alpha} \qquad (4)$$

a function of capital K_t and labour L_t,

A5 Government's Constraint

The tax receipts at each date are fully used for provision of social security and of the public good

$$G_t + N_{t-1} s_t = Y_t - P_t K_t - \omega_t L_t \qquad (5)$$

2.2 Economic Equilibrium

In this section the individual and aggregate economic behaviour are solved for, given any arbitrary sequences of tax rates and public expenditure.

Maximisation of (1) subject to (2)-(3) gives the individuals' decision rules

$$c_t^{it} = \frac{\omega_t + s_{t+1}/P_{t+1}}{1+\beta} \qquad (6) \qquad k_{t+1}^{it} = \frac{\beta \omega_t - s_{t+1}/P_{t+1}}{1+\beta} \qquad (7) \qquad\qquad c_{t+1}^{it} = \frac{\beta P_{t+1} \omega_t + s_{t+1}}{1+\beta} \qquad (8)$$

and indirect utility (up to a multiplicative constant)

$$V_t^{it} = \left(\omega_t + s_{t+1}/P_{t+1}\right)^{1+\beta} \left(P_{t+1}\right)^{\beta} \left(g_t\right)^{\varepsilon^i} \left(g_{t+1}\right)^{\beta \varepsilon^i} \qquad (9)$$

An old individual's indirect utility is

$$V_t^{j^{t-1}} = \left(\pi_t k_t + s_{t+1}\right)^{\beta} \left(g_t\right)^{\beta\epsilon^j} \tag{10}$$

Finally, the government's budget constraint in per-capita form may be written as

$$\omega_t = y_t - \frac{c_t^{t-1}}{1+n_t} - \frac{2+n_t}{1+n_t} g_t \tag{11}$$

3 PARLIAMENTARY DEMOCRACY

3.1 Political Rules

We use a microfounded model of parliamentary democracy (Renström 2002, Marsiliani and Renström 2007). The sequence of events is as follows:

1. Entry of parties (individuals can register parties containing members of their own type only).

2. Electorate vote (each individual casting one vote on a party of her choice), and parties are represented proportionally to the number of votes.

3. Coalition formation in parliament (largest party chooses coalition partner, rationally anticipating the bargaining outcome). Coalition partner can only be chosen once.

4. Bargaining in the coalition takes place (with threat points of parliament dissolving for one period).

5. Tax and spending policy chosen by the majority coalition is implemented.

That only one party (the largest) is allowed to choose coalition partner (and only once) is to some extent crucial. If no such rule was there, one can run into a situation of cycles. That is, for any coalition, one of the partners can do better by forming a coalition with another party. Forming a coalition once, is not a strong assumption. It could be relaxed as long as the party gets a finite number of tries.

Once individuals have been elected for parliament, they have to form a group and present a policy proposal supported by more than one half of the elected members. Contrary to the legislative bargaining literature, were a chosen legislator makes a take-it-or-leave-it proposal, we assume that both sides have a say. We model this as a simple bargaining game. The largest party can make a policy proposal. If not accepted by the coalition partner, a person in the coalition is chosen randomly to make a final policy proposal. If accepted it is implemented, otherwise no more offers can be made. This simple bargaining game brings a link between relative size in the coalition (the number of seats in parliament) and the equilibrium policy proposal. The larger a party is, the higher is the probability that it would be chosen in the final stage to give the final offer. This lowers smaller party's expected utility of continuing into the second stage. Therefore it would accept a (to them) less favourable proposal than otherwise. Consequently a larger party gets a policy proposal (accepted in the first stage) closer to its ideal point (obviously the time horizon of the game can be made arbitrarily large, but finite, without altering this property).

We define our political equilibrium as follows:

(i) Given any voting outcome, and thereby given any composition of parties in parliament, the largest party must find the choice of coalition partner(s) optimal, rationally anticipating the equilibrium to the bargaining game, for each possible coalition that contains a majority of members of parliament.

(ii) Given the parties that have chosen to run for election, and rationally anticipating the coalition to form, an individual must (collectively) find her choice of party to vote for optimal, given everybody else's vote, knowing that she marginally affect the bargaining

outcome by marginally changing the size of the parties.[5]

(iii) Members of a party (that is a group of people of the same type) must find the entry decision (that is run or not to run for election) optimal, given the other three parties entry decisions.[6,7]

(i), (ii), and (iii) must be mutually consistent.

The equilibrium concept tells us how to solve for the political equilibria. First we characterise the bargaining outcome between various parties. Next we examine which coalitions can form. Given each possible coalition we check whether it is consistent with a Nash equilibrium in the voting game, where voters anticipate the coalition to form. Finally we check whether the entry decisions constitute a Nash equilibrium in the entry game.

In the two dimensional model (age and taste heterogeneity) there are two kinds of equilibria (which one occurs depend on the underlying parameter values). One type of equilibrium is when a single party has majority and does not have to form a coalition at all. This happens when the difference in the taste parameter is small so that the model is close to one dimensional (only age heterogeneity becomes relevant). Then if the young (old) are the largest age group, they will also have single majority in parliament. Policy then becomes the ideal point of one individual and effectively collapses to the median-voter model. These equilibria are of less interest for conducting constitutional experiments. We will instead in this paper focus on the coalition equilibria (when no single party has majority). This involves restrictions on the underlying parameters of the model (see Renström 2002).

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[5] An equilibrium to the voting game is a Nash equilibrium, where individuals of the same type act as if they were one large player. No individual has an incentive to deviate from the collectively optimal voting strategy for the group to which she belongs.

[6] An equilibrium to the entry game is a Nash equilibrium.

[7] In explicitly considering an entry stage, we borrow from the citizen-candidate literature (Besley and Coate (1997), Osborne and Slivinski (1996)).

A particular feature of the model is that the only coalitions that can form (consistent with rational voting) is across preferences and across age. We will therefore only examine the bargaining allocations for those coalitions.

A further feature is that the coalitional equilibrium policy is a compromise (on the contract curve between two individuals). The voters of the same types as the coalition partners have a dominant strategy to vote on themselves (to pull the compromise closer the their ideal points). This implies that one of the groups that are not represented in the coalition must, in equilibrium, be indifferent in altering the relative coalition size. We call this group the *pivotal voter*. If the pivotal group was not indifferent, they would vote on their own age group (as everybody else) and the largest age group would have single majority and the coalition would not be formed. It is necessary that one group is indifferent in altering the relative coalition size (and will vote in mixed strategies), i.e. it is necessary that the pivotal voter exist.

We will proceed as follows. First solving for the bargaining allocation as function of the relative coalition size. Then finding the relative coalition size that maximises the utility of the individual group not represented in the coalition (i.e. the pivotal voter). This pins down the equilibrium.

3.2 The Bargaining Game

We will only consider equilibrium coalitions, i.e. those between young and old, and where young and old differ in public-good preferences.

Denote by ε^i and ε^j public-goods preferences of the young and old, respectively, and denote by ρ the relative coalition size of the young. The default options imply zero utility for both (as then the parliament is dissolved and no public good is provided).

A young individual realises that the wage tax affects the savings decision, and

consequently next period's capital stock. The capital stock in the next period is the relevant state variable and will potentially affect the next period's political-equilibrium policies: τ^{k}_{t+1}, g_{t+1}, and s_{t+1}. We treat next period's policy variables as functions of k_{t+1}. We first guess the functional forms, then solve the bargaining game, and lastly verify that the initial guesses were correct. It turns out that the tax rates and the ratios g_{t+1}/y_{t+1} and s_{t+1}/y_{t+1} are independent of the capital stock k_{t+1}. Substituting these policy rules into (9) gives a young individual's indirect utility as

$$V^{it} = (\omega_t)^{1+\alpha\beta(1+\epsilon^i)}(g_t)^{\epsilon^i} \tag{12}$$

up to a multiplicative constant. Using (7) and (8) we may write an old individual's indirect utility as

$$V^{jt-1} = \left(c_t^{t-1}\right)^{\beta}(g_t)^{\beta\epsilon^j} \tag{13}$$

3.2.1 Old the largest party

When the old is the largest party it has the right to make the first offer. The timing is as follows:

1. The old party makes an offer to the young party

2. The young may accept or reject

3. If rejected, the old will make the final proposal with probability 1-ρ, and the young with probability ρ. If the old makes the final proposal, then $\tau_t^l=1$ and $V^{it}=0$. If a young party member makes the final proposal, she maximises (12), with respect to policy. We denote the young's final offer as $\{\hat{c}_t^{t-1}, \hat{\tau}_t^l, \hat{g}\}$, which is solved for in the Appendix. By rejecting the initial offer, the expected utility of the young is the probability of making the final offer times the utility of the final offer. Therefore, the young party will accept an offer that gives utility

at least as great as the discounted expected utility of the final round, i.e. any policy satisfying:

$$(\omega_t)^{1+\alpha\beta(1+\epsilon^t)} g_t^{\epsilon^t} \geq \delta\rho(\hat{\omega}_t)^{1+\alpha\beta(1+\epsilon^t)} \hat{g}_t^{\epsilon^t} \quad (14)$$

The old party chooses a policy proposal by maximising (13) subject to (14).

3.2.2 Young the largest party

This works as when the old is the largest party. The young party makes the first proposal. If the old party rejects, then the final proposal will be made by the young with probability ρ and the old with prob 1-ρ. If the young makes the final proposal it chooses τ_t^k=1 and old's utility is zero. The proposal of the old in the final stage maximises (13) and is denoted $\{\hat{c}_t^{t-1}, \hat{\tau}_t^l, \hat{g}\}$. The young have to make a proposal that leaves the old with utility at least as great as the discounted expected utility in the last stage, i.e. the policy proposal must satisfy

$$\left(c_t^{t-1}\right)^{\beta} g_t^{\beta\epsilon^l} \geq \delta(1-\rho)\left(c_t^{t-1}\right)^{\beta} \hat{g}_t^{\beta\epsilon^l} \quad (15)$$

The young maximises (12) subject to (15).

The solutions in section 3.2.1-3.2.2 give linear sharing rules (after tax incomes are linear fractions of GDP). This is intuitive because of the Cobb-Douglas utility specification. The share depends on a group's relative size in the bargaining game.

3.3 Pivotal Voter

We will now identify the pivotal voter, i.e. the group outside the coalition that is indifferent (in equilibrium) in altering the relative coalition size. This group is picking their most preferred point on the contract curve between the two coalition partners. If a pivotal voter did not exist, it would imply that agents vote on their own age group, and the largest age group

would have majority without forming the coalition. Thus, the pivotal voter is necessary for a coalitional equilibrium.

Lemma 1 *If one assumes* A1-A5*, and that a group consisting of young i-types form a coalition with a group consisting of old j-types, then individuals with low preference for public goods that are not included in the coalition, vote for the individual in the coalition of their own age group. The pivotal voter is young (old) with high preference for public goods if i-types have low (high) preference, and j-types high (low) preference.*

Proof: An individual with no preference for public goods only has preference over the tax she faces. This individual finds it optimal to support its own age group since this lowers the tax rate. The only group that can be indifferent is the one excluded from the coalition and cares more for the public good. By voting mixed this group is trading off voting for opposite age group to increase public goods provision and voting for own age group to reduce the tax.

QED

If preferences over public goods are distant enough then we have a situation where the young (or old) outside the coalition may or may not favour their own age group in the coalition. For example if ε^h is sufficiently larger than ε^l, then there is an ideal relative coalition size (between young ε^l and old ε^h) preferred by the young ε^h outside the coalition (i.e. the pivotal voter). Thus, if such a coalition were to form the young ε^h have no incentive to try to maximise the size of the young ε^l or of the old ε^h. In fact, there is a relative coalition size which makes the outside group indifferent in altering the relative powers of the partners inside the coalition. Similarly, there is an ideal relative coalition size (between young ε^h and old ε^l)

preferred by the old ε^h (pivotal) outside the coalition.

If ε^h and ε^l are too close, then any individual outside the coalition will prefer to increase the size of their own age group. The political equilibrium then reduces to a median-voter equilibrium, with the largest age group dictating policy (and consequently confiscating from the minority age group). This is plausible since when one dimension of heterogeneity disappears (ε), there is only one dimension left (age), and with one dimensional heterogeneity, logically, the model should collapse to a median-voter model.[8]

3.4 Coalition Equilibrium

Proposition 1 *If one assumes* A1-A5, *and the benchmark constitution, and that population growth is positive, then the unique coalition equilibrium is characterised by a coalition of young* ε^l *and old* ε^h. *Three parties enter*: *young* ε^l, *young* ε^h, *and old* ε^h. *All old individuals vote for old* ε^h. *The pivotal voter is young with* ε^h *and vote in mixed strategies on the three parties, being indifferent altering the relative coalition size*. *Necessary for this equilibrium to exist is that*

$$\varepsilon^h \geq \varepsilon^l + \sqrt{\varepsilon^l(1+\varepsilon^l)} \tag{16}$$

Proof: See the Appendix.

Proposition 2 *If one assumes* A1-A5, *and the benchmark constitution, and that population growth is negative, then the unique coalition equilibrium is characterised by a coalition of young* ε^h *and old* ε^l. *Three parties enter*: *old* ε^l, *old* ε^h, *and young* ε^h. *All young individuals vote for young* ε^h. *The pivotal voter is old with* ε^h *and vote in mixed strategies on the three*

[8] This also happens in a different (multidimensional) model by Banks and Duggan (2001).

parties, being indifferent altering the relative coalition size. Equilibrium policy is

$$\epsilon^h \geq \epsilon^l \frac{1+\alpha\beta}{1-\alpha\beta\epsilon^l} \tag{17}$$

Proof: See the Appendix.

4 SOCIAL SECURITY

We now turn to the consequences for social security.

Proposition 3 *If one assumes* A1-A5, *and that population growth is positive, then necessary for positive social security is the existence of the coalition equilibrium.*

Proof: See the Appendix.

The reason for this result is that if there is no coalition equilibrium and there is population growth, then the party having the majority of the seats in parliament is young, and therefore would set the social security payment to zero.

Proposition 4 *If one assumes* A1-A5, *and* $\alpha \leq \bar{\alpha}$, *then social security is positive in the coalition equilibrium.*

Proof: See the Appendix.

Thus, if capital's share is not too large then social security is a positive amount (as opposed to an old-age poll tax).

Proposition 5 *If one assumes* A1-A5, *and that population growth is positive, then in the coalition equilibrium the following holds*

$$\frac{\partial s_t}{\partial n_t} \geq (1-\alpha)\frac{s_t}{1+n_t} \tag{18}$$

Proof: See the Appendix.

That is, the social security payment is increasing in immigration.

Proposition 6 *If one assumes* A1-A5, *and that the coalition equilibria exist, then if n is close to* 0, $n<0$ *gives a larger social security payment than when* $n>0$.

Proof: See the Appendix.

This result is due to the identity of the pivotal voter. When there is population decline the pivotal voter is old, and when there is population growth the pivotal is young. An old pivotal voter induces more social security than a young.

Corollary 1 *For* $n>0$ *and close to* 0 *reducing the size of the young population* (*through emigration*) *increases the social security payment*.

Proof: See the Appendix.

Corollary 1 implies that for societies with small population growth rate would raise its political equilibrium social security payment through emigration rather than immigration.

5 DYNAMICS

We now turn to the dynamic properties, in particular stability.

Proposition 7 *If one assumes* A1-A5, *and that the coalition equilibria exist, then the economy is globally stable, converging to a steady state in per-capita quantities.*

Proof: See the Appendix.

Proposition 8 *If one assumes* A1-A5, *and that the coalition equilibria exist, then an economy with a higher capital tax rate grows slower (out of steady state) and has a higher social security payment, implying (observationally) a negative relationship between social security and economic growth.*

Proof: See the Appendix.

6 CONCLUSIONS

We have used a careful political economy model (microfounded parliamentary democracy) to analyse consequences of immigration on equilibrium social security. We found that in an economy with positive population growth, if the size of the young population increases (through immigration) in one period, then the social security payment (at individual level) increases in the same period (and only in that period). We also found that for economies with negative population growth (but close to zero) and increase in the size of the young (through immigration) reduces the social security payment. The reason is that the majority in the age dimension switches from old to young. Societies with (small) population growth can achieve an increase in the social security payment through emigration rather than immigration.

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