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Political viability of intergenerational transfers. An empirical application

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Abstract: Public intergenerational transfers (IGTs) may arise because of the failure of private arrangements to provide optimal economic resources for the young and the old. We examine the political sustainability of the system of public IGTs by asking what the outcome would be if the decision per se to reallocate economic resources between generations was put to the vote. By exploiting the particular nature of National Transfer Accounts data – transfers for pensions and education and total public transfers – and the political economy application proposed by Rangel (2003) we show that most developed countries would vote in favor of a joint public education and pension system. Moreover, our results indicate that a system of total public IGTs to the young and elderly would attract substantial political support and, hence, would be politically viable for most countries in the sample.

JEL Codes: D70, H50, J10, P16.

Keywords: Intergenerational Transfers, Population Ageing, Pay-As-You-Go Financing, National Transfer Accounts, Political Economy.

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1 Introduction

Why should we care about future generations? Why should the generations care about each other? The answer to both questions lies in the fact that the generations are interconnected by nature. Biologically speaking there are two periods in our life cycle when we find ourselves in a state of dependence. Infants and young children are unproductive and become fully productive only as they mature physically and intellectually (UN, 2013). Likewise, with ageing the ability to produce is affected dramatically. It is these biological forces that produce the inverted U-shaped pattern that characterizes labor productivity and which generate the economic life cycle illustrated in Figure 1.

As Figure 1 demonstrates the life-cycle pattern of consumption and income leads to a mismatch between needs and means. On the one hand, age groups like the young and elderly consume more than they produce while, on the other, working-age cohorts consume less than they produce. As such, there is a need for a mechanism to reallocate economic resources between age groups, that is, market or private and/or public intergenerational transfers, henceforth, IGTs.[1] In this paper, we opt to focus solely on public IGTs.

The literature on public IGTs is large but fragmented. It dates back to initial studies that sought to determine the golden rule of capital accumulation in the standard overlapping-generations (OLG) framework (Diamond, 1965). In this setting, abstracting from altruism and the consideration of young dependents, the failure of the competitive economy to meet the golden rule creates a key role for public IGTs financed via capitalization (pay-as-you-go) when there is under (over) accumulation.

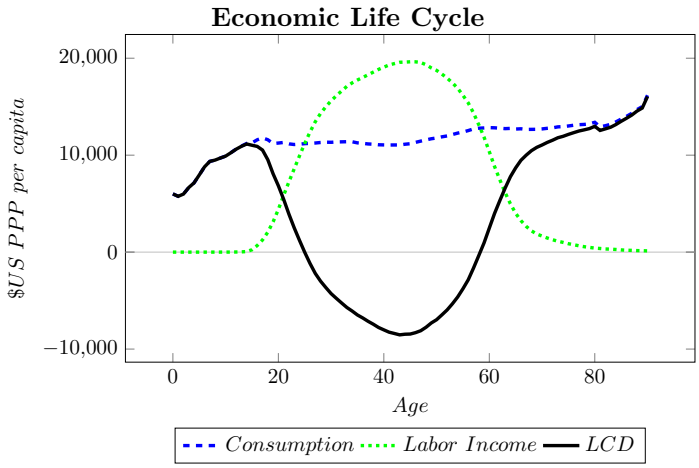
After various decades, probably as a result of the demographic transition, this literature struck out again but in a number of different directions. Some authors highlight the fact that besides the elderly, children are also dependent.[2] Thus, in accounting for the dependence of both age groups, the need for government intervention might derive from the fact that the markets and intra-family reallocations are failing to achieve certain important social goals by providing non-optimal investments in human capital for the young and pensions for the old (Becker and Murphy, 1988). But, if the government only finances public pensions and public education, this may not be sufficient to achieve economic efficiency (Boldrin and Montes, 2005). One way of solving this problem is to create a link between public education and pensions, providing generations with appropriate incentives to reallocate public funds. A social contract of this type - where public pensions are properly linked to earlier investments in education – allows a complete market allocation to be obtained (Boldrin and Montes, 2009).

Thus, the connection between the transfer to children and the transfer to the elderly (already present in the family) has emerged also in the public sphere. Various scholars have argued in favor of the link between forward and backward public IGTs as they seek to answer the question as to why selfish generations might choose to transfer resources to future generations. Pogue and Sgontz (1977) argue that the design of the pay-as-you-go (PAYG) pension system creates the ap-

[1] Figure 4 in the Appendix shows the IGTs and the life cycle deficit for all the countries in our sample. It highlights the different patterns of public and private transfers in countries with different economic structures and different levels of economic development.

[2] Peters (1995) and Boldrin and Montes (2005) investigate a similar policy when parents take decisions regarding their children's human capital, while Bental (1989) and Abio et al. (2004) consider fertility to be endogenous.

Figure 1: *Average patterns of consumption, labor income and life-cycle deficit for 18 NTA countries. The young and elderly obviously consume more than they produce, a fact that is highlighted by the line taken by the life-cycle deficit (consumption minus labor income). The opposite scenario is presented by the working-age cohorts. All the values are calculated converting currencies to US dollars (per capita) based on purchasing power parity (PPP) ratios in a particular year for each country.*



propriate incentives to invest in public education, because it enhances the income of the future working generation. In a similar vein, Konrad (1995) claims that, even in the absence of altruism, the working-class generations are only willing to pay for public education if they can "reap" gains by taxing the results of higher productivity in the future. Another incentive for the working-age generation to transfer economic resources towards the young one could be the higher returns on savings [Boldrin (1992); Boldrin and Rustichini (2000)]. More specifically, the decision to invest in education reflects positively on physical capital productivity because of its complementarity with human capital productivity. This in turn enhances the future return on savings and therefore offers higher future income to the current working age generation.

Kemnitz (2000) considers the link between pensions and education in an OLG setting using the public choice framework, where policy is forged by the relative political power of generations. The level of IGTs is decided by the majority of voters in a context of representative democracy, where governments seek to maximize political support. The main result stemming from this study is that the structure of the PAYG pension system stimulates investments in education that provide future benefits for the current working generation. According to this study, the structure of the PAYG pension system provides incentives to the working-age generation to support educational transfers towards the young even in the absence of altruism. Moreover, the author shows that population ageing achieves a better backward (pensions) and forward (education) redistribution of public funds.

From the perspective afforded by the political economy, a critical aspect of an IGT system is its political sustainability and the actuarial fairness between contributions paid and benefits received.[3]

[3]Regarding the actuarial fairness, Bommier et al. (2010) calculate present values of generations before the introduction of public intergenerational transfers and for a long period after. They try to assess whether the generations have been benefited from the public transfers or not. The results suggest that most generations born after 1930 have been better off from the introduction of social security and public education.

In this regard, Rangel (2003) employing a game theoretical framework of intergenerational exchange, examines the possibility of sustaining a system of public forward and backward intergenerational transfers (hereafter, FITs and BITs, respectively). He uses the concept of a sub-game perfect equilibrium in order to investigate, in the context of selfish generations, the ability of non-market intergenerational arrangements to invest optimally in forward and backward transfers. According to Rangel, for this to happen three conditions must be satisfied: First, the agents should have at least two exchange problems that require simultaneous cooperation; second, the intergenerational program must generate a positive continuation surplus in order to be supported by the middle-aged generation; and, third, the generations must play a game of simple trigger strategies that creates the link between BITs and FITs. The fear of punishment provides incentives to the middle-aged generation to choose the right amount to invest in BITs and FITs.

We conduct an empirical exercise that exploits the novel data approach of the National Transfer Accounts (henceforth, NTA) and the political economy framework of Rangel's (2003) application. To the best of our knowledge, no empirical work has yet to assess in this way whether a joint system of public pensions and education or a system of total public IGTs – directed towards the elderly and young – can be politically sustained. This is what we attempt here, and is what can be considered as the value added to the existing literature. Our main findings suggest that a system of total public transfers towards the elderly and young would receive significantly more political support than a joint system of pensions and education. This outcome is probably driven by the fact that total public transfers appeal more to a broader group of voters than is the case of a system of pensions and education. In addition, we find that population ageing has a positive effect on the political viability of both systems of IGTs.

The remainder of the paper proceeds as follows. Section 2 presents the data and the methodology. In section 3 we provide the results of our empirical exercise on pensions and education as well as on total public IGTS. The last section contains concluding remarks and some insights on what we learn from this exercise, the potential policy implications and future lines of research.

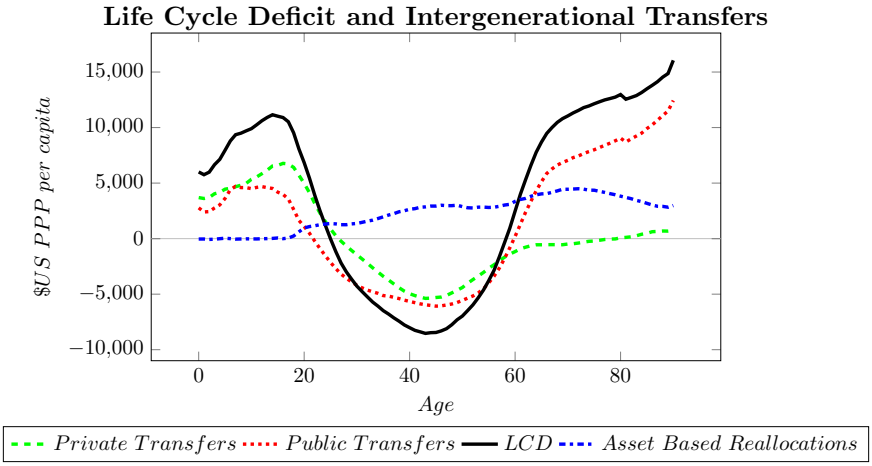
2 Data & Methodology

2.1 National Transfer Accounts (NTA) Data

Conventional economic accounts do not lend themselves to analyses of the way people behave at different stages of the economic life cycle. More specifically, such methods usually report annual flows of public benefits and taxes as a share of GDP. Although this is useful information, it does not capture the age direction of public transfers and, therefore, fails to provide crucial information about who pays and who receives. Furthermore, private transfers occurring outside the market are ignored. By way of alternative, here, we exploit the specific structure of the National Transfer Accounts (NTA) data, which provide us with a complete, systematic and coherent accounting of economic flows from one age group to another.[4]

[4]The NTA data is taken from Lee and Mason (2011) and http://www.ntaccounts.org/web/nta/show/Country%20Summaries. The NTA manual presents the concepts, methods and estimation procedures to measure these flows over the life-cycle (UN, 2013).

Figure 2: *Average life-cycle deficit (LCD), and public (TG) and private transfers (TF) for 18 countries. The higher the LCD, the greater is the need for IGTs. LCD, TG and TF values are calculated by converting currencies to US dollars (per capita) based on purchasing power parity (PPP) ratios in a particular year for each country. See detailed country graphs in the Appendix, Figure 4.*



Starting from the national accounting identity, this method employs public administrative data and micro data surveys to measure, first, the age reallocations made by the public sector, and, second, the private transfers within the family. Figure 2 plots the age profile of the life-cycle deficit (LCD) for eighteen countries and how this is financed via private (TF) and public transfers (TG). The part of LCD not covered by transfers is funded resorting to the asset market (asset income and dissaving). These NTA age profiles are consistently upgraded in the National Accounts. The transfer profiles (TG and TF) are net. In the case of public transfers, the NTA method assigns an aggregate amount of taxes to each category of public expenditure and we use the age profile of explicit earmarked taxes, that is, social contributions, in the case of pensions, or general taxes in all other cases. The balance is set to zero and the eventual surplus/deficit is recorded as public savings/dissaving.

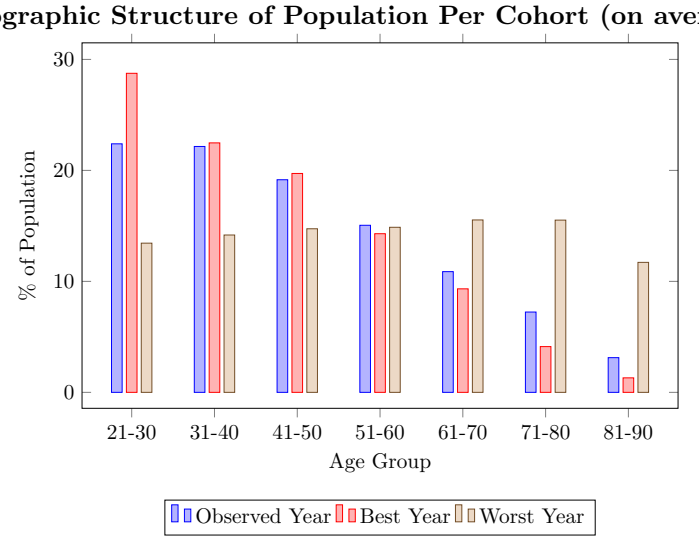
We employ the NTA estimates that provide us with measures of total public transfer inflows (benefits) and outflows (taxes and public asset-based flows) by single years of age.[5] We use cross-sectional data for a specific year in each of 18 countries.[6] Likewise, when available, we use the same type of public transfer data disaggregated between pensions and education.[7] These data provide us with the net transfers (net of taxes and/or contributions) received by individuals at each stage of the life cycle, thus enabling us to gauge their willingness to vote. In this way, we are able to assess the political sustainability of the IGT system, i.e. of pensions and education. Moreover, we use data for the current demographic structure of each country as well as for that projected in the future to compute the size of the voting cohorts. Figure 3 illustrates the demographic transition showing

[5]Public transfers comprise public education, health, pensions, and other in-kind and in-cash transfers. Each of these categories includes the inflows and outflows that people receive and pay during each year of their life.

[6]Austria (2000), Brazil (1996), Costa Rica (2004), Finland (2004), Germany (2003), Hungary (2005), India (2004), Indonesia (2005), Japan (2004), Mexico (2004), Philippines (1999), Slovenia (2004), S. Korea (2000), Spain (2000), Sweden (2003), Taiwan (1998), Thailand (2004), US (2003).

[7]Such data are not available for either Indonesia or the Philippines.

Figure 3: *Observation year is the year that each country in the sample is observed. The "best" and "worst" years are identified using the old-age dependency ratio. Hence the "best" ("worst") year is the year with the lowest (highest) old-age dependency ratio. As can be seen, population ageing has a substantial impact on the demographic structure of the voting cohorts. Details on the demographic structure of each country are provided in Figure 5, in the Appendix.*



the current population age structure compared to the "best" and "worst" years defined in terms of old-age dependency. The old-age dependency ratio is the percentage of people over 65 in the working age population (15-64). Hence the "best" ("worst") year is the year with the lowest (highest) old-age dependency ratio. Similarly, as we discuss below, an essential element in our empirical exercise is the interest rate. We use data on the real interest rate, drawn from the World Bank database.[8]

2.2 Methodology

The empirical exercise that we conduct in this section is based on the political economy application proposed by Rangel (2003). In his stylized model, individuals of different generations interact to decide on the size of IGTs. Intergenerational altruism does not exist, so every decision is driven by selfish preferences. Rangel argues that it is possible to have a sustained IGT system with positive BITs and FITs even with "egoistic" generations. As discussed in the introduction, for this to happen, three conditions must be satisfied: first, the agents should have at least two exchange problems that require simultaneous cooperation; second, the intergenerational program must generate a positive continuation value for working cohorts for them to back it; and third, the generation should be engaged in a game of simple trigger strategies, where the fear of punishment creates a link between FITs and BITs, i.e., an incentive for the middle aged to invest sufficiently in transfers to the old and young to avoid the punishment for not cooperating.

By way of application, Rangel generates a political economy model where agents live for nine periods $a = 1, ..., 9$ and where each period represents ten years. The individuals are dependent

[8] http://data.worldbank.org/indicator/FR.INR.RINR. The real interest rate is defined as the lending interest rate adjusted for inflation measured by the GDP deflator.

children during the first two periods, working age adults in the following five and retirees in the last two. Only workers receive an income; the rest receive transfers only. Agents can borrow and save at the interest rate, r>0. In addition, every period, society decides the amount it wishes to devote to the system of BITs (i.e. public pensions, health care, other in-cash or other in-kind transfers). The system is financed solely by workers, who have to pay a lump-sum payroll tax T.[9] Finally, there is another lump-sum tax E that is used to finance the FITs (i.e. education, child health care, other in-cash or other in-kind transfers), which is imposed on both workers and retirees.

In the following section, we explain in detail how the continuation value of the system of IGTs is calculated to assess the political viability of such a system.

2.2.1 Continuation Value

The continuation surplus is the value generated from the transition from a state of autarky to one in which IGTs take place. The continuation value of the BITs is measured as the present value of all benefits received minus taxes paid.

In the case of the linked system of pensions and education (Section 3.1), all the benefits received by the voting cohorts are those received during the retirement period ($a \geq 8$); and, all the taxes paid are those paid during the working age period ($a = 3...7$). The continuation value is computed as shown by equations 1 and 2 following the stylized model of Rangel (2003).

In the case of total public transfers (Section 3.2), we consider taxes (benefits) paid (received) by the voting age groups ($a \geq 3$) in order to calculate the continuation value of total public IGTs. In this case, we take into account the present values of all the benefits received less the taxes paid during both working age and retirement as shown in equation 3.[10]

$$CV_a = \sum_{i=8}^{9} \frac{PB_i}{(1+r)^{i-a}} - \sum_{i=a}^{7} \frac{PT_i}{(1+r)^{i-a}} \tag{1}$$

where CV_a is the continuation value for working age population ($a \geq 3$), PT are the payroll taxes paid by workers $a \geq 3$ and PB are pension benefits received when retired $a = 8, 9$, and

$$CV_a = \sum_{i=a}^{9} \frac{PB_i}{(1+r)^{i-a}} \tag{2}$$

where CV_a is the continuation value for the retirees $a = 8, 9$.

$$CV_a = \sum_{i=a}^{9} \frac{TPB_i - TT_i}{(1+r)^{i-a}} \tag{3}$$

where TPB are total public benefits and TT are total taxes paid by cohorts ($a \geq 3$) for public IGTs.

[9] This is the baseline version; in the case of the total public transfers below, we also take into account the non-payroll taxes that the elderly pay and the benefits that the working-age agents receive in order to compute their continuation value.

[10] This equation is authors' elaboration on the basis of present value analysis.

2.2.2 Voting

The continuation value measures the value of keeping the current system (i.e. public pensions or total public transfers towards the adults) and, hence, the willingness to vote in favor of it. Furthermore, according to Rangel's model, only if the continuation value is positive for the majority of voters it is possible to invest in education. In each period, voters choose between $(0; T)$ for the BITs and between $(0; E)$ for the FITs. All agents in cohorts above the second cast a vote. This means that if we have a representative voter for each cohort (decade), there is a total of seven votes.[11]

First, what is needed for a viable BITs (i.e. PAYG pension) system is to hold a majority, that is, to obtain at least four votes in favor of such a system. Bearing in mind that retirees always vote in favor of the current system – because they receive positive net transfers – the decision to retain the current system depends entirely on the middle-aged cohorts. More specifically, cohorts $a = 3, 4, 5, 6, 7$ are the final decision makers. That is, to sustain the system in a representative voting scenario, at least two out of these five votes are needed to ensure a simple majority. This means that as long as the continuation values of at least two out of five middle-aged cohorts are positive, the majority votes for BITs. Note that the middle-aged cohorts vote for BITs not because they care about current retirees, but because they believe, quite rightly, that otherwise they will not receive any benefits when retired.

However, to sustain a system of bilateral intergenerational transfers (BITs and FITs) besides choosing the amount deemed sufficient to invest in BITs, it is also needed to invest optimally in FITs.[12] Thus, if inequality 4 holds for, at least, four of the age cohorts $a = 3, 4, 5, 6, 7, 8$, the majority is willing to vote for education, because the system – that links BITs and FITs – generates a continuation value that is bigger than the FITs (i.e. education) tax that they have to pay.[13]

$$CV_a \geq EP_a \tag{4}$$

where P_a is the relative size of each age cohort. Therefore, in short, there could be a sustained path of BITs and FITs – and hence a system of IGTs would be politically viable – if three conditions are satisfied: First, if and only if the continuation value of choosing BITs is positive for the majority of voters (1, 2 or 3); second, if and only if the continuation value of BITs is greater than the amount invested in FITs (inequality 4); and, third, age cohorts play voting strategies that link BITs to FITs.

The next section shows the results, which we expect to be driven by the age shape of the public transfers profile plus the demographic structure of each country. In addition, the usual discount effect should also be noted, that is, where taxes paid and benefits received at earlier stages in the life cycle are discounted to a lesser extent.

[11] In more realistic case, as shown below, we weight the votes by the size of each cohort using the demographic structure as a proxy for the electorate size of each cohort.

[12] This is a direct consequence of generations adopting simple trigger strategies. In fear of being punished and receiving no benefits, current working cohorts are forced to transfer and invest optimal (sufficient) amounts in BITs and FITs, respectively.

[13] Note that cohort 9 always votes against FITs because they are not alive during the next period. The amount invested in FITs is paid proportionally in accordance with the size of each cohort.

3 Results

3.1 Pensions and Education

In this section we conduct our exercise for a linked IGT system of pensions and education.[14] These transfers have been linked in the previous literature and are the main public policies devoted to the two dependent sides of the economic life cycle (i.e. children and the elderly).[15]

First, we compute the continuation values for the pension systems in our sample of countries. Second, by deducting tax E to finance education, we obtain the continuation value for the system of linked pensions and education. Finally, we assess whether such a system is viable during a particular year for each sample country, and also when using alternative demographic scenarios.

Thus, first, using equations 1, 2 and the real interest rate -for each country in a particular year- we calculate the continuation value of each voting cohort. As can be seen from Table 1, the continuation values for age groups $a = 3, 4$ are negative for the vast majority of the selected countries.[16] The results confirm the theoretical predictions made by Rangel (2003). The interpretation is quite straightforward. Under dynamic efficiency, young workers aged 21 to 40 (age groups 3 and 4) are unwilling to support the system of IGTs, because given the present values the taxes they pay are higher than the benefits they receive. At the same time, it is clear that retirees fully support the system, because they enjoy retirement benefits without having to pay any more taxes. With two groups against and two in favor of the system, the final outcome of the voting procedure depends on age groups $a = 5, 6, 7$. As is derived from the results, the CVs of groups six and seven are positive for all countries except South Korea, Taiwan and Thailand. Therefore, as Table 2 shows, the rest of the countries (i.e. 13 out of 16 countries – see column 2) obtain a majority with at least four votes in favor of the pensions. To obtain this result, we weight all cohorts equally (adopting a representative agent view) and ignoring the demographic structure of the population. In contrast, when we weight the age groups – using the real demographic structure to compute number of votes – the voting outcomes are considerably different. Only half the countries – most of which are developed – vote in favor of pensions (column 3).

As equations 1 and 2 make apparent, the value of the interest rate plays a key role in the calculation of the continuation value for workers and for retirees, respectively. So next, we examine how the outcomes would be modified if all countries were to "play under the same rules". Thus, we seek to determine the changes generated when assuming the same interest rate for each country in the sample. In this way, we control for the fact that the interest rate might be affecting our results. As is evident from column 4 in Table 2 the results do not vary significantly from that of the baseline scenario (column 3) for most of the countries in the sample except of Brazil.[17]

[14] Data for Indonesia and the Philippines are not available for this section.

[15] The size of public pensions and education in OECD countries in 2013 was on average 8.2% and 4.8% of GDP, respectively. Data on public pensions and education are taken from https://data.oecd.org/socialexp/pension-spending.htm and https://data.oecd.org/eduresource/public-spending-on-education.htm, respectively.

[16] This result is in line with Bohn (1999), who calculates the continuation value of PAYG social security in the US. He shows that it is negative for the young voters, but strictly positive for voters above the median voter age.

[17] This outcome is due to the high real interest rate in Brazil for the particular year and hence higher discount for the future retirement benefits.

Table 1: Continuation values for public pensions

Country	CV_3	CV_4	CV_5	CV_6	CV_7	CV_8	CV_9
Austria	-45.049	22.627	115.223	219.421	312.111	374.165	206.664
Brazil	-20.797	-20.480	-10.319	12.260	40.298	80.584	44.210
Costa Rica	-13.956	-6.155	5.360	19.203	33.398	44.577	20.414
Finland	-73.976	-20.978	57.938	144.292	216.533	242.355	121.095
Germany	-43.184	-7.935	60.574	147.478	232.267	288.043	143.717
Hungary	-56.584	-27.156	22.544	76.746	116.893	124.785	64.183
India	-2.909	-1.755	-137	1.698	3.852	6.098	3.238
Japan	-47.645	-20.595	19.732	72.614	129.101	164.056	65.588
Mexico	-20.890	-14.223	-4.591	6.011	13.144	17.234	7.940
Slovenia	-67.928	-30.221	31.077	90.867	133.616	158.028	77.067
South Korea	-30.272	-24.535	-15.987	-6.373	2.824	9.815	1.888
Spain	-59.423	-26.995	28.131	92.044	142.951	167.603	81.416
Sweden	-90.612	-17.526	87.126	205.319	328.886	411.976	202.918
Taiwan	-37.026	-31.258	-21.991	-11.503	-2.850	2.139	1.127
Thailand	-15.950	-13.912	-10.998	-7.115	-3.125	113	57
US	-63.071	-37.726	15.610	81.181	148.336	195.378	101.788

Note: *CV_a is the continuation value and the subscript indicates the cohort. For example, CV_3 and CV_9 are the continuation values for cohort 3 (21-30 year-olds) and cohort 9 (81-90 year olds), respectively. The negative/positive values denote the willingness/reluctance of a particular cohort to support pensions, respectively. Continuation values are calculated converting currencies to US dollars (per capita) based on purchasing power parity (PPP) ratios in a particular year for each country.*

Table 2: Voting scenarios for pension and education transfers

	Voting on Pensions					**Voting on Pensions & Education**				
Country	VR	VDS	VSIR	BY	WY	VR	VDS	VSIR	BY	WY
Austria	85,71	83,12	83,12	79,24	86,76	57,14	56,16	78,69	77,53	75,23
Brazil	57,14	25,83	100	21,59	58,49	42,86	24,26	98,42	20,99	45,66
Costa Rica	71,43	46,14	46,14	40,58	73,78	57,14	44,22	44,22	38,81	60,48
Finland	71,43	65,85	65,85	51,48	69,87	57,14	61,49	61,49	50,24	58,08
Germany	71,43	64,33	85,28	60,92	74,93	57,14	59,94	80,90	59,46	64,15
Hungary	71,43	61,74	61,74	54,30	70,71	57,14	58,02	58,02	52,94	60,63
India	57,14	24,26	24,26	21,85	55,37	42,86	23,40	23,40	21,13	46,62
Japan	71,43	65,47	65,47	46,22	75,38	57,14	60,46	60,46	45,38	61,40
Mexico	57,14	24,80	24,80	23,26	57,95	42,86	23,18	23,18	22,40	45,55
Slovenia	71,43	61,75	61,75	54,41	73,04	57,14	58,60	58,60	52,76	61,93
S. Korea	42,86	15,01	15,01	10,06	46,27	28,57	13,77	13,77	9,21	16,31
Spain	71,43	57,97	57,97	49,91	73,92	57,14	53,65	53,65	48,25	61,79
Sweden	71,43	64,74	64,74	56,99	70,01	57,14	58,55	58,55	54,82	58,30
Taiwan	28,57	6,53	6,53	-	-	14,29	5,20	5,20	-	-
Thailand	28,57	6,54	6,54	3,56	26,24	0	0	0	0	0
US	71,43	59,95	59,95	52,07	68,71	42,86	34,17	34,17	31,96	42,71

Note: *VR: percentage of votes of a cohort-representative agent. VDS: vote percentage taking into account the demographic structure of the voting cohorts. VSIR: vote percentage when part of the imposed real demographic structure, CVs are gauged with same interest rate for all countries (4,2%). BY: Best year, the year of the lowest old-age dependency ratio. WY: Worst year, the year with the highest old-age dependency ratio. Country (best year, worst year): Austria (1950, 2060), Brazil (1950, 2085), Costa Rica (1980, 2085), Finland (1950, 2100), Germany (1950, 2040), Hungary (1950, 2059), India (1950, 2100), Japan (1950, 2051), Mexico (1955, 2095), Slovenia (1950, 2055), South Korea (1950, 2064), Spain (1950, 2050), Sweden (1950, 2095), Taiwan (not available), Thailand (1950, 2075), US (1950, 2100). The old dependency ratio in assessed in the period between 1950 and 2100.*

Table 3: Political sustainability

Country	VR	VDS	VSIR	BY	WY
Austria	Sustained	Sustained	Sustained	Sustained	Sustained
Brazil	Not	Not	Sustained	Not	Not
Costa Rica	Sustained	Not	Not	Not	Sustained
Finland	Sustained	Sustained	Sustained	Sustained	Sustained
Germany	Sustained	Sustained	Sustained	Sustained	Sustained
Hungary	Sustained	Sustained	Sustained	Sustained	Sustained
India	Not	Not	Not	Not	Not
Japan	Sustained	Sustained	Sustained	Not	Sustained
Mexico	Not	Not	Not	Not	Not
Slovenia	Sustained	Sustained	Sustained	Sustained	Sustained
South Korea	Not	Not	Not	Not	Not
Spain	Sustained	Sustained	Sustained	Not	Sustained
Sweden	Sustained	Sustained	Sustained	Sustained	Sustained
Taiwan	Not	Not	Not	-	-
Thailand	Not	Not	Not	Not	Not
US	Not	Not	Not	Not	Not

Note: *VR: percentage of votes of a cohort-representative agent. VDS: vote percentage taking into account the demographic structure of the voting cohorts. VSIR: vote percentage when part of the imposed real demographic structure, CVs are gauged with same interest rate for all countries (4.2%). BY: Best year, the year of the lowest old-age dependency ratio. WY: Worst year, the year with the highest old-age dependency ratio. Sustained: when a linked system of pensions and education transfers would be voted for by the majority. Non-sustained: when not supported by the majority.*

In a second exercise, we consider two different demographic scenarios (Table 2, column 5 and 6). Essentially, we test what would happen to the voting process if instead of using the demographic structure of each country in the year selected for observation, we employ the demographic structure of the "best" and "worst" years as defined above. As can be seen, we obtain better results in terms of votes during the "worst" year than we do during either the "best" year or the observed year for each country.[18] This can be understood in terms of political economy, whereby population ageing makes the median voter older, thus increasing his/her continuation value and making the system politically more popular. This result is in line with the hypothesis of the "political power of the elderly", according to which population ageing makes the median voter older and, hence, more inclined to support greater expenditure on pensions.[19]

The next step is to test whether a positive investment in education is maintained (Table 2, columns 7 to 11) and whether a system of intergenerational transfer – where generations link the education to pensions – is politically tenable (Table 3). To conduct this test, we check whether inequality 4 holds for age cohorts $a = 5, 6, 7, 8$. If inequality 4 holds for these age groups, this means that the majority of voters are willing to support investments in education, because the system – that links education and pensions – generates a continuation value that is higher than the education tax they have to pay. As illustrated in Table 2, inequality 4 holds for the simple majority of voters, in only a few countries. More specifically, only half the countries can support forward IGTs such as

[18] In the Appendix Table 7 in the Appendix, we reproduce the voting scenarios using the ageing demographic structure as projected in the future. Evidently the voting outcomes are better than in the observed year (Table 2).

[19] See the political economy literature on social security (pensions):[Browning (1975); Boadway and Wildasin (1989); Breyer and Craig (1997); Mulligan and Sala-I-Martin (1999); Tabellini (2000); Persson and Tabellini (2000); Disney (2007); Shelton (2008); Tepe and Vanhuysse (2009); Hollanders and Koster (2012);Michailidis et al. (2016)].

Table 4: Continuation values for total public transfers of voting cohorts

Country	CV_3	CV_4	CV_5	CV_6	CV_7	CV_8	CV_9
Austria	116.759	200.851	324.282	462.498	512.525	394.904	224.439
Brazil	-11.290	-6.318	18.047	58.877	78.975	73.906	43.133
Costa Rica	24.491	35.445	55.533	79.842	89.322	74.576	40.300
Finland	72.115	137.836	267.056	406.803	479.540	371.168	224.679
Germany	66.614	101.477	209.753	348.485	456.041	382.131	234.291
Hungary	28.951	59.340	140.305	237.132	283.061	204.029	104.942
India	-1.778	-600	519	1.148	1.635	1.612	1.325
Indonesia	-6.542	-5.040	-2.918	-701	701	847	425
Japan	30.560	63.883	131.474	226.446	317.498	267.527	155.417
Mexico	17.802	24.759	42.105	60.191	62.456	48.344	22.921
Philippines	-9.944	-8.906	-6.676	-3.935	-856	128	-244
Slovenia	71.433	114.753	212.301	302.837	315.782	235.287	126.627
South Korea	-6.245	2.851	23.459	44.863	53.484	37.116	15.704
Spain	-47.451	-20.166	49.278	137.278	195.204	165.904	90.720
Sweden	153.341	226.425	355.452	522.530	687.532	611.277	387.882
Taiwan	-9.096	-3.078	30.420	68.044	84.687	70.803	36.927
Thailand	-19.106	-18.730	-14.879	-8.226	-2.224	393	1.140
US	34.878	49.256	141.447	262.920	381.279	345.935	219.527

Note: *CV_a is the continuation value and the subscript indicates the cohort. For example, CV_3 and CV_9 are the continuation values for cohort 3 (21-30 year-olds) and cohort 9 (81-90 year olds), respectively. The negative/positive values denote the willingness/reluctance of a particular cohort to support pensions, respectively. Continuation values are calculated converting currencies to US dollars (per capita) based on purchasing power parity (PPP) ratios in a particular year for each country.*

education (column 8).

However, a system of IGTs like the one linking education to pensions can only receive political backing, if the majority support both pensions and education transfers. As such, the results of voting on pensions have to be matched by the voting outcomes on education. As is apparent from Table 3, a system of pensions and education would receive the support of the majority of voters in very few countries. Indeed, if the decision was put to the vote, Austria, Finland, Germany, Hungary, Japan, Slovenia, Spain and Sweden would vote in favor of a system of pensions and education in most of the voting scenarios in our exercise.

3.2 Total Public Transfers

In the previous section, we assessed the political sustainability of the common system of pensions and education. In this section, we conduct the same exercise considering instead the total public IGTs for the elderly (BITs) and children (FITs), respectively. Total public transfers consist of public education, public health, public pensions, public transfers, and other in-kind and in-cash transfers. Each of the categories includes the inflows (benefits) and outflows (taxes) received and paid by individuals during each year of their life.

In this case we employ equation 3 to compute the continuation value of the voting age cohorts.[20] As shown in Table 4 when the whole NTA profile is taken into account to compute the continuation

[20]Note that when using equations 1 and 2, we omit taxes paid in dependent ages and benefit received in working ages. This is a minor problem when dealing with retirement pensions and education, but it is of greater importance when referring to all welfare state transfers.

Table 5: Voting Scenarios, BITs and FITs

	Voting on BITs					Voting on BITs & FITs				
Country	VR	VDS	VSIR	BY	WY	VR	VDS	VSIR	BY	WY
Austria	100	100	100	100	100	85,71	95,57	95,57	98,29	88,46
Brazil	71,43	44,06	100	39,52	72,93	57,14	42,49	98,42	38,91	60,10
Costa Rica	100	100	100	100	100	85,71	98,09	98,09	98,22	86,70
Finland	100	100	100	100	100	85,71	95,64	95,64	98,77	88,21
Germany	100	100	100	100	100	85,71	95,62	95,62	98,54	89,22
Hungary	100	100	58,02	52,94	60,63	85,71	96,28	58,02	52,94	60,63
India	71,43	43,52	43,52	40,72	71,09	57,14	42,66	42,66	40	62,34
Indonesia	42,86	12,86	12,86	10,98	40,06	28,57	12,06	12,06	10,22	14,49
Japan	100	100	100	100	100	85,71	94,99	78,22	68,52	86,02
Mexico	100	100	100	100	100	85,71	98,38	67,37	99,14	87,60
Philippines	14,29	2,87	2,87	2,79	13,03	14,29	2,87	2,87	2,79	0
Slovenia	100	100	100	100	100	85,71	96,85	96,85	98,35	88,88
South Korea	85,71	74,90	74,90	67,95	87,61	57,14	47,64	47,64	41,64	60,10
Spain	71,43	57,97	57,97	49,91	73,92	57,14	53,65	53,65	48,25	61,79
Sweden	100	100	100	100	100	85,71	93,81	93,81	97,82	88,30
Taiwan	71,43	47,94	47,94	-	-	57,14	46,61	46,61	-	-
Thailand	28,57	6,54	6,54	3,56	26,24	0	0	0	0	0
US	100	100	100	100	100	71,43	76,36	55,68	73,37	89,41

Note: *VR: percentage of votes of a cohort-representative agent. VDS: vote percentage taking into account the demographic structure of the voting cohorts. VSIR: vote percentage when part of the imposed real demographic structure, CVs are gauged with same interest rate for all countries (4,2%). BY: Best year, the year of the lowest old-age dependency ratio. WY: Worst year, the year with the highest old-age dependency ratio. Country (best year, worst year: Austria (1950, 2060), Brazil (1950, 2085), Costa Rica (1980, 2085), Finland (1950, 2100), Germany (1950, 2040), Hungary (1950, 2059), India (1950, 2100), Indonesia (1965, 2095), Japan (1950, 2051), Mexico (1955, 2095), Philippines (1995, 2100), Slovenia (1950, 2055), South Korea (1950, 2064), Spain (1950, 2050), Sweden (1950, 2095), Taiwan (not available), Thailand (1950, 2075), US (1950, 2100). The old dependency ratio is assessed in the period between 1950 and 2100. .*

value, the results are strikingly different from the corresponding outcomes in Table 1. In contrast with the previous section, more than half the countries have positive continuation values even for the youngest voting cohorts (CV_3 and CV_4). This indicates that the net present value (benefits received minus taxes payed) of the welfare system is positive for voting cohorts. Therefore, they have strong incentives to support such a system of IGTs.

Nevertheless, there are some countries, including India, Indonesia, the Philippines, South Korea, Taiwan, and Thailand, where the voting cohorts present negative current values of the system of welfare transfers.[21] These differences between countries can be explained by the differences in the structure of their NTA profiles. In other words, countries have different patterns for the reallocation of resources and, therefore, different patterns of IGTs. As is evident from Figure 4 (Appendix), the aforementioned countries with negative continuation values present similar patterns of IGTs. For most Asian countries, the overall size of public transfers is small and remains quite concentrated among young dependents. As such, the age groups reallocate their resources primarily via family transfers as opposed to via publicly funded systems of BITs and FITs. This might constitute the main reason why the continuation values of total public transfers are negative for most of the voting cohorts in these countries. In contrast, in European countries, public transfers are greater and seem

[21] Just as before in the case of Brazil, the negative continuation values are mainly driven by the unusually high real interest rate.

Table 6: Political Sustainability of Total Public Transfers

Country	VR	VDS	VSIR	BY	WY
Austria	Sustained	Sustained	Sustained	Sustained	Sustained
Brazil	Sustained	Not	Sustained	Not	Sustained
Costa Rica	Sustained	Sustained	Sustained	Sustained	Sustained
Finland	Sustained	Sustained	Sustained	Sustained	Sustained
Germany	Sustained	Sustained	Sustained	Sustained	Sustained
Hungary	Sustained	Sustained	Sustained	Sustained	Sustained
India	Sustained	Not	Not	Not	Sustained
Indonesia	Not	Not	Not	Not	Not
Japan	Sustained	Sustained	Sustained	Sustained	Sustained
Mexico	Sustained	Sustained	Sustained	Sustained	Sustained
Philippines	Not	Not	Not	Not	Not
Slovenia	Sustained	Sustained	Sustained	Sustained	Sustained
South Korea	Sustained	Not	Not	Not	Sustained
Spain	Sustained	Sustained	Sustained	Not	Sustained
Sweden	Sustained	Sustained	Sustained	Sustained	Sustained
Taiwan	Sustained	Not	Not	-	-
Thailand	Not	Not	Not	Not	Not
US	Sustained	Sustained	Sustained	Sustained	Sustained

Note: *VR: percentage of votes of a cohort-representative agent. VDS: vote percentage taking into account the demographic structure of the voting cohorts. VSIR: vote percentage when part of the imposed real demographic structure, CVs are gauged with same interest rate for all countries (4.2%). BY: Best year, the year of the lowest old-age dependency ratio. WY: Worst year, the year with the highest old-age dependency ratio. Sustained: when a linked system of pensions and education transfers would be voted for by the majority. Non-sustained: when not supported by the majority. .*

to have crowded out private transfers. Similarly, they are quite clustered around the old, which explains the greater support given by voters, despite the discounting effects.

The voting outcomes for the total welfare transfers are shown in Table 5 and 6. Evidently, most of the countries in our sample would have voted in favor of a system of total public IGTs. More specifically, as shown in Table 6, when we consider a representative voter, 15 out of 18 countries would have backed total public transfers (column 2). The number of countries falls to 11 when we take into account the observed population structure and we weight the votes by the size of each cohort (column 3). Controlling for the interest rate does not change the outcomes very much, with the exception of Brazil, where allowing for the same interest rate changes the outcome in favor of public transfers (column 4). Finally, as in the previous section, when considering the demographic transition the outcomes vary considerably, between the "best" year (column 5), the observed year (column 3) and the "worst" year (column 6). Clearly, population ageing increases the political support for total public transfers directed towards the young (FITs) and old (BITs).[22]

At this juncture, we should stress that differences in outcomes between the previous and the current sections are due primarily to the differences in the data used. In this section, we take into account all the public transfers that are made in each country. This means, the continuation value of each cohort is measured including the present value of all benefits received and all taxes paid. In contrast, the continuation value of pensions and education takes into account only those pension

[22]In Table 8 in the Appendix we reproduce the voting scenarios using the ageing demographic structure as projected into the future. Evidently, the outcomes of the voting scenarios are better during the "worst year" than during the observed year (Table 5).

benefits received when retired and those social contributions paid when working. Hence, many of the benefits that young and middle-aged workers ($a = 3, 4, 5, 6, 7$) receive are included in the calculation of the continuation value in this section but not in the previous one. These benefits might include, for example, health care or other in-kind or in-cash transfers that these voting cohorts receive from the welfare state. Thus, in present values middle-aged workers benefit more from a system of total public transfers than they do from a linked system of pensions and education. Thus, by including a broader spectrum of transfers it is plausible to assume that more votes can be attracted from young and middle-aged workers ($a = 3, 4, 5, 6, 7$).

4 Conclusions

The empirical exercise conducted in this paper follows the political economy application made by Rangel (2003) using National Transfer Accounts data. The main goal has been to evaluate the political sustainability of an intergenerational system organized through the linkages between backward and forward public transfers. We have assessed the political viability of this system by computing the continuation value for these backward and forward transfers. We employed two types of data: first, we used pensions and education as backward and forward transfers, respectively; and, second, we employed the total public transfers directed towards the old and the young. We, then, assessed the political sustainability of the system by computing the continuation value – i.e. if the majority of voters receive more than they pay in present values in the observed years – of the system of intergenerational transfers. In those instances that the continuation values for the majority of voters is positive, we assume that they would have supported such a system if the decision had been put to the vote in that particular year for each country.

Our findings suggest that only in about half the countries studied – primarily developed countries – the majority would vote for a system of intergenerational transfers, including only pensions and education. In contrast, when we conducted the same exercise using the total public intergenerational transfers, our results proved to be significantly better. The difference between the respective outcomes could be attributed to differences in the data employed. More specifically, the differences can be associated with the inclusion of a broader spectrum of public transfers (i.e. health care, other in-kind and other in-cash transfers) other than pensions and education. In this way, the young and the middle-aged take into account not only the present values of retirement benefits but also the present values of the benefits that they receive from the aforementioned public transfers. Hence, in the case of total public transfers, it is more plausible to attract votes from the young and middle-aged.

We also identify a cluster of Asian countries for which continuation values are negative for most of the voting cohorts and, as such, the voting outcomes indicate a non-sustained system for both pensions and education and for total backward and forward public transfers. We associate these results with the stage of development of intergenerational transfers and, especially, with the fact that public transfers continue to be dominated by private transfers. Hence, there are still few political incentives for voting in favor of public transfers.

In addition, when we conduct our exercise employing the "best" and the "worst" demographic scenarios in terms of the old-age dependency ratio, it is found that population ageing has a positive effect on the political viability of both systems of intergenerational transfers considered here. In

other words, in terms of political economy, ageing makes the median voter older and increases his/her continuation value, thus, boosting the political sustainability of the system. This result is in line with the hypothesis of the "political power of the elderly", according to which population ageing makes the median voter older and, hence, more inclined to support higher expenditure on public transfers towards the elderly. However, this raises the question as to how increasing political viability might interact with decreasing financial feasibility.

Thus, although ageing pressure on the financial health of the PAYG pensions system points to a conflict between financial and political sustainability, our results indicate some positive signs. More specifically, population ageing can be translated into a higher continuation value for the median voter that can be invested in education making the joint system of pensions and education politically more viable (Rangel, 2003). Thus, pensions can foster education. This, in turn, improves the future financial prospects of the PAYG system. Higher investment in education can boost the productivity of future workers and consequently the level of their contributions to social security and revenues from taxing their income. The immediate policy conclusion is that pensions could be pre-funded by increasing education expenditure. Moreover, we can suggest that it might be a useful reform to require legislation to vote on pensions and education as a unique social policy package. This reasoning could also be applied to a broader spectrum of intergenerational transfers directed toward children or the elderly, which also tend to be financed implicitly on a PAYG basis.

Appendix

Table 7: Voting Scenarios on Pensions and Education of the "Worst" Year

	Voting on Pensions			*Voting on Pensions & Education*			*Pensions & Education*		
Country	WY_VR	WY_VDS	WY_VSIR	WY_VR	WY_VDS	WY_VSIR	WY_VR	WY_VDS	WY_VSIR
Austria	85,71	86,76	86,76	71,43	75,23	75,23	Sustained	Sustained	Sustained
Brazil	57,14	58,49	100	42,86	45,66	87,17	Not	Not	Sustained
Costa Rica	71,43	73,78	73,78	57,14	60,48	60,48	Sustained	Sustained	Sustained
Finland	71,43	69,87	69,87	57,14	58,08	58,08	Sustained	Sustained	Sustained
Germany	71,43	74,93	87,55	57,14	64,15	76,78	Sustained	Sustained	Sustained
Hungary	71,43	70,71	70,71	57,14	60,63	60,63	Sustained	Sustained	Sustained
India	57,14	55,37	55,37	42,86	46,62	46,62	Not	Not	Not
Japan	71,43	75,38	75,38	57,14	61,40	61,40	Sustained	Sustained	Sustained
Mexico	57,14	57,95	57,95	42,86	45,55	45,55	Not	Not	Not
Slovenia	71,43	73,04	73,04	57,14	61,93	61,93	Sustained	Sustained	Sustained
South Korea	42,86	46,27	46,27	14,29	16,31	16,31	Not	Not	Not
Spain	71,43	73,92	73,92	57,14	61,79	61,79	Sustained	Sustained	Sustained
Sweden	71,43	70,01	70,01	57,14	58,30	58,30	Sustained	Sustained	Sustained
Thailand	28,57	26,24	26,24	0	0	0	Not	Not	Not
US	71,43	68,71	68,71	42,86	42,71	42,71	Not	Not	Not

Note: *WY: Worst Year. Every voting scenario is calculated using the demographic structure of the "worst year". WY_VR: vote percentage when each cohort has a representative voter. WY_VDS: vote percentage when the demographic structure is taken into account. WY_VSIR: vote percentage when CVs are computed with same interest rate for all countries (4,20%). "Worst" year, the year with the highest old dependency ratio. Country ("worst" year): Austria (2060), Brazil (2085), Costa Rica (2085), Finland (2100), Germany (2040), Hungary (2059), India (2100), Japan (2051), Mexico (2095), Slovenia (2055), South Korea (2064), Spain (2050), Sweden (2095), Taiwan (not available), Thailand (2075), US (2100).*

Table 8: Voting Scenarios on Total BITs and FITs of the "Worst" Year

	Voting on BITs			*Voting on BITs & FITs*			*BITs & FITs*		
Country	WY_VR	WY_VDS	WY_VSIR	WY_VR	WY_VDS	WY_VSIR	WY_VR	WY_VDS	WY_VSIR
Austria	100	100	100	85,71	88,46	88,46	Sustained	Sustained	Sustained
Brazil	71,43	72,93	100	57,14	60,10	87,17	Sustained	Sustained	Sustained
Costa Rica	100	100	100	85,71	86,70	86,70	Sustained	Sustained	Sustained
Finland	100	100	100	85,71	88,21	88,21	Sustained	Sustained	Sustained
Germany	100	100	100	85,71	89,22	89,22	Sustained	Sustained	Sustained
Hungary	100	100	100	85,71	89,93	89,93	Sustained	Sustained	Sustained
India	71,43	71,09	71,09	57,14	62,34	62,34	Sustained	Sustained	Sustained
Indonesia	42,86	40,06	40,06	14,29	14,49	14,49	Not	Not	Not
Japan	100	100	100	85,71	86,02	86,02	Sustained	Sustained	Sustained
Mexico	100	100	100	85,71	87,60	87,60	Sustained	Sustained	Sustained
Philippines	14,29	13,03	13,03	0	0	0	Not	Not	Not
Slovenia	100	100	100	85,71	88,88	88,88	Sustained	Sustained	Sustained
South Korea	85,71	87,61	87,61	57,14	60,10	73,68	Sustained	Sustained	Sustained
Spain	71,43	73,92	73,92	57,14	61,79	61,79	Sustained	Sustained	Sustained
Sweden	100	100	100	85,71	88,30	88,30	Sustained	Sustained	Sustained
Thailand	28,57	26,24	26,24	0	0	0	Not	Not	Not
US	100	100	100	85,71	89,41	58,12	Sustained	Sustained	Sustained

Note: *WY: Worst Year. Every voting scenario is calculated using the demographic structure of the "worst year".WY_VR: vote when each cohort has a representative voter. WY_VDS: vote percentage when the demographic structure is taken into account. WY_VSIR: vote percentage when CVs are computed with same interest rate for all countries (4,02%). Country ("worst" year): Austria (2060), Brazil (2085), Costa Rica (2085), Finland (2100), Germany (2040), Hungary (2059), India (2100), Indonesia (2095), Japan (2051), Mexico (2095), Philippines (2100), Slovenia (2055), South Korea (2064), Spain (2050), Sweden (2095), Taiwan (not available), Thailand (2075), US (2100).*

Figure 4: Intergenerational Transfers Structure and Life Cycle Deficit

LCD: Life cycle deficit. TG: Public transfers. TF: Private transfers. LCD, TG and TF values are calculated converting currencies to US dollars (per capita) based on purchasing power parity (PPP) ratios in a particular year for each country.

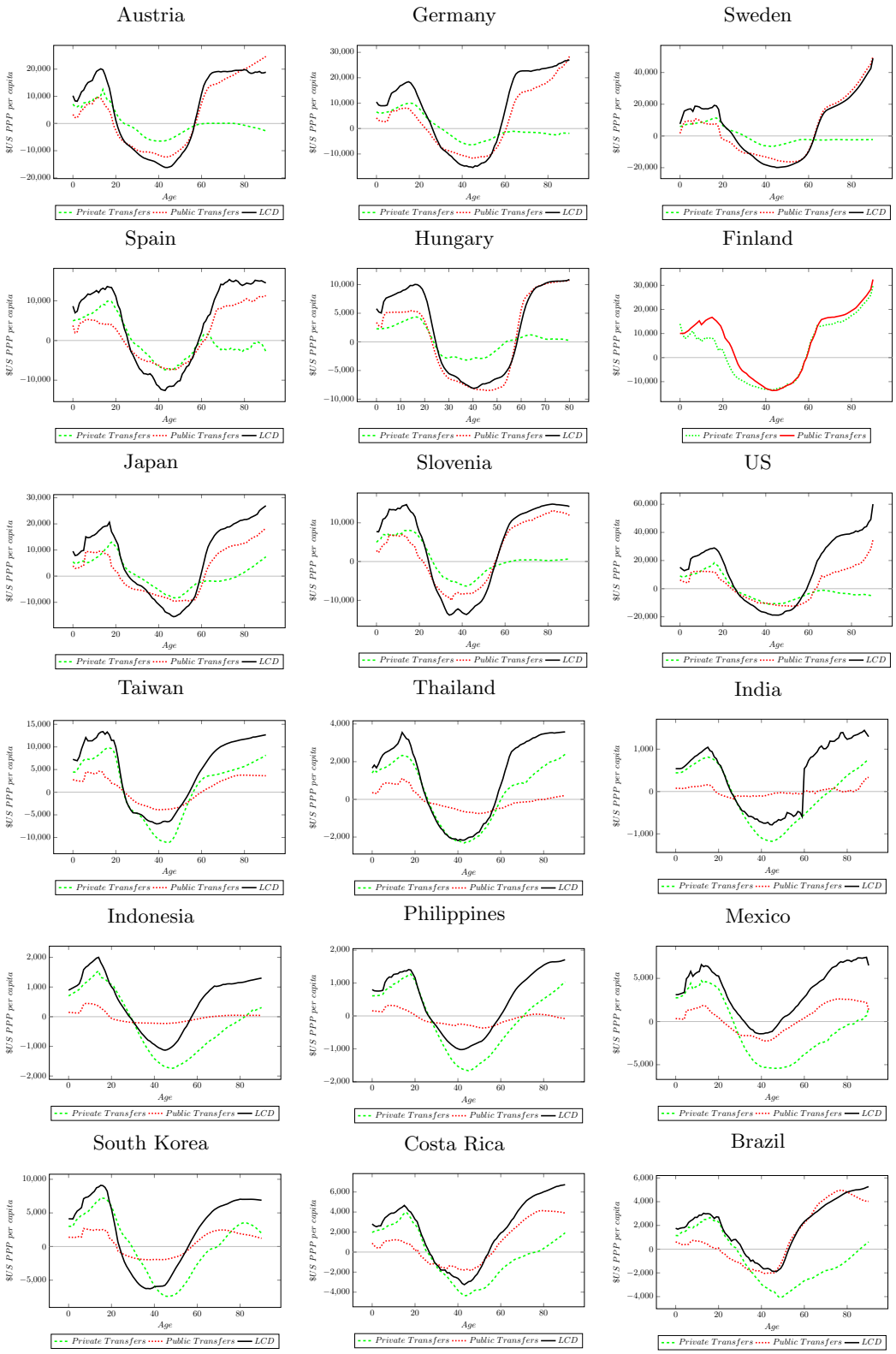
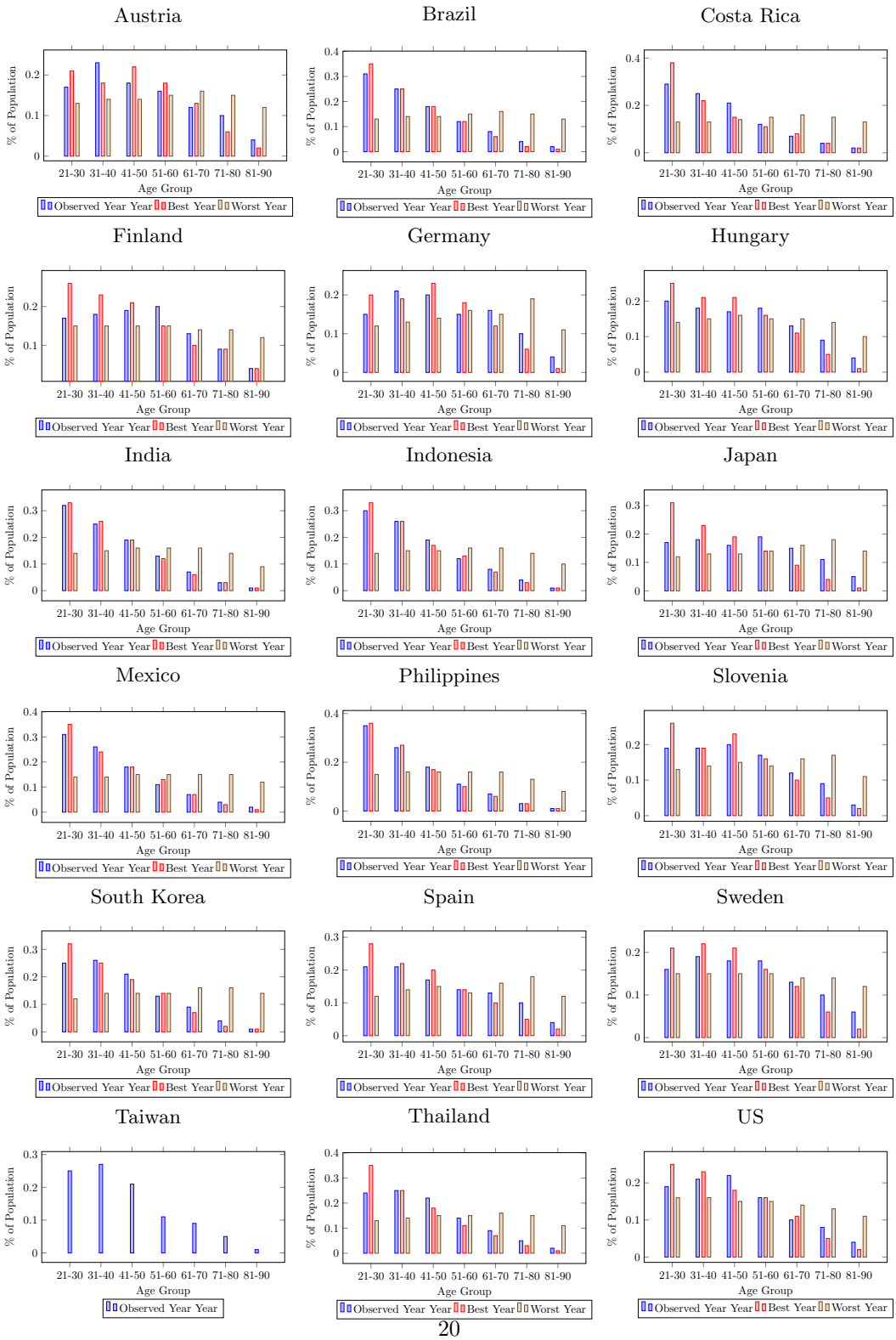


Figure 5: Demographic Transition, Population Ageing per Country

Observation year is the year that each country is observed in the sample. The "best" and "worst" year are identified using the old dependency ratio (not availiable for Taiwan). Hence the "best" ("worst") year is the year with the lowest (highest) old dependency ratio. As we can see population ageing has a substantial impact on the demographic structure of the voting cohorts.



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