A Perfect Marriage:

Child-related Pensions and Public Education

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Abstract

In the present paper the effects of different pay-as-you-go pension systems on fertility decisions of a representative household are examined. Thereby, the analysis focuses especially on the interplay of parental quantity and quality decisions, introduced by Becker (1960). As it will be shown, a traditional pay-as-you-go system in either case distorts decisions of parents leading to an erosion of the financial basis of the system. In contrast, the assessment of a child-related pay-as-you-go system is ambiguous. If parents are solely responsible for expenditures on the quality of children, it is inefficient, too. However, if it is combined with a device like public education, optimality can be restored.

JEL classifications: D10, I20, H55

Key words: Pay-as-you-go, child-related pension, quantity and quality of children

A.   Introduction

All European pay-as-you-go systems (PAYGO) are on the verge of collapse. As birth rates decline and life-expectancies steadily rise the burden on the forthcoming generations reaches a level which is unsustainable for various reasons. Among economists it is, therefore, common sense that the dominance of unfunded systems has to be reduced by a larger share of funding. Yet, there is a lively debate in Germany as well as in other European countries about how pension entitlements should be capped. In general, two possibilities have been proposed: On the one hand one can lower entitlements equally for all members of a generation. This proposal is widespread among economists and was very recently advanced by a commission on the long-term sustainability of the German social-security system (Kommission zur Nachhaltigkeit der Finanzierung der sozialen Sicherungssysteme 2003). On the other hand, a group of economists, recently Sinn (2000), proposes to

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differentiate entitlements according to the generative contribution. Thus, the latter group aims at introducing a child-related pay-as-you-go pension system (CPAYGO) in which pensions are predominantly determined by the number of children.

Even at first glance, the advantages of such a system seem to be compelling. First of all, a child-related pension system prevents a social dilemma which can occur in a traditional PAYGO. According to the social security hypothesis a PAYGO system diminishes fertility rates because of growing opportunity costs of children.[1] As costs have to be borne by parents but revenues (pensions) are distributed collectively, parents adjust their decisions and bear fewer children. This is inefficient as the pension system still relies on population growth.[2] This inefficiency can be overcome by granting pensions only to parents. Secondly, and this is an extension to the previous idea, a CPAYGO is stable even if the demography changes. In such a pension system those who do not have children are forced to save individually in order to secure their old-age income. Hence, as soon as fertility changes, e. g. because of changed preferences, individual savings will adjust. On a macroeconomic level the combination of human capital, here meant as future contribution payers, and real capital is always sufficient to secure a fixed level of pensions for the elder generation.

In spite of these advantages the support for a CPAYGO is only minor. One major problem of this scheme is referred to as the quality-quantity trade-off. It is feared that a CPAYGO may negatively affect the quality of child-rearing, as Cigno (1993) and Folbre (1994) pointed out. With reference to Becker (1960) the quality of children involves investments in the well-being of children. Expenditures on the education or health care of children are the most prominent examples for those kinds of investments. As it is assumed that a higher level of quality will increase the probability of higher income and hence higher contributions to the pension system, a CPAYGO might cause a new social dilemma if quality is substituted by quantity (i. e. the number of children). Thus, a new inefficiency would occur. Besides, poverty and inequality might increase in future generations.

This paper is aimed at examining this trade-off in greater detail. Using a simple microeconomic model in the tradition of Becker (1960) the decisions of a representative household concerning the quality and quantity of children under a traditional PAYGO and a CPAYGO are highlighted. Moreover, the analysis will be expanded by introducing a public education system. It will be demonstrated that the combination of such an institution and a CPAYGO is a means to restore optimality. Thus, these two institutions constitute a perfect marriage. Finally, the main conclusions are summarised.

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[1] For empirical work suited to back this view see for example Cigno and Rosati (1996) or Cigno, Casalaro and Rosati (2003).

[2] For a formal treatment see Prinz (1990), Bental (1990), Kolmar (1997) or Ehrlich and Lui (1998).

B.   The Model

The following microeconomic model highlights the effects on the quantity-quality decision of households under a PAYGO and a CPAYGO. There will be no attempt to close the model by introducing a production sector. Thus, the following ideas can be considered as partial analysis or as the decisions of a household in a small country where prices are fixed.

We assume a representative household that lives for three periods (childhood, adulthood and retirement). Following the literature we restrict our analysis to two periods of life, adulthood and retirement, because children do not make economic decisions. The household derives utility from the consumption of goods and from the quantity and quality of children. Hence, the household is not altruistic towards its children but it regards children and their well-being (quality) as consumption goods.

The utility function of the representative household is therefore defined as follows:

$$U = U(c_t^1, c_{t+1}^2, e_t, q_t) \tag{1}$$

where

$$N_t * e_t = N_{t+1} \tag{2}$$

c_t^1 : Consumption while working in period t

c_{t+1}^2 : Consumption while being retired in period t+1

e_t : Number of children of the household

q_t : Expenditures for the quality of children in period t

N_t : Size of generation t in period t

The utility function $U(\cdot)$ is assumed to be strictly monotonically increasing and strictly quasi-concave. Thus, consumption, children and the quality of children are regarded as normal goods. The household receives a fixed labour income $\bar{w}_t$ in period t which it can use for raising and educating children, consumption and saving (s_t). The horizontal line above the variable for labour income indicates that the decision about its level was taken by the previous generation. We assume that labour income depends on investments in quality received while being a child. This is a quite common expectation: The better children are educated and the healthier they stay, the greater should be their income prospects, at least on average. As a consequence of this structure the individual labour income is exogenous for the worker but endogenous for his offspring. We assume $w_{t+1}(q_t)$ to be twice differentiable

with $\dfrac{\partial w_{t+1}(q_t)}{\partial q_t} > 0$ and $\dfrac{\partial^2 w_{t+1}(q_t)}{\partial q_t^2} < 0$. Furthermore, the household faces a PAYGO system

with a contribution rate of $0 < a < 1$ and a promised pension of $p_{t+1} > 0$.

The representative household, thus, maximises its utility function which is subject to the following restriction:

$$\bar{w}_t * (1 - a) = c_t^1 + s_t + e_t * (z_t^e + q_t * z_t^q) \tag{3}$$

and

$$c_{t+1}^2 = (1 + r) * s_t + p_{t+1} \tag{4}$$

z_t^e : Fixed cost per child, $z_t^e > 0$.

z_t^q : Price of one unit of quality, $z_t^q > 0$.

In a first step we want to derive an optimal solution for the described decision problem. Such a solution could be regarded as the decision of an altruistic social planner with perfect foresight. Alternatively, this can be interpreted as the common maximisation of the utility of all individuals in the society. In such an optimal solution it would be taken into account how a PAYGO system is financed. As it is common, the sum of contributions has to equal the sum of pensions in each period. Therefore, we obtain

$$N_t * p_{t+1} = w_{t+1}(q_t) * a * N_{t+1} \tag{5}$$

Dividing (5) by N_t yields to

$$p_{t+1} = w_{t+1}(q_t) * a * e_t \tag{6}$$

Equation (6) clearly displays the well-known fact that the amount of payments a representative pensioner receives from a PAYGO system depends on her decisions while working. If households do not bear, rear and educate children, their pension entitlements have to be capped, provided that the contribution rate is fixed. Hence, as in a fully funded system, workers have to take precautions in order to receive a pension. Children and their quality are thus not only consumption but investment goods.

If we now substitute (6) into (4), rearrange and optimise the utility function we receive the following results:

$$\partial U / \partial c_t^1 = \boldsymbol{l} \tag{7}$$

$$\partial U / \partial c_{t+1}^2 = \boldsymbol{l} / (1 + r) \tag{8}$$

$$\partial U / \partial e_t = \boldsymbol{l} * (z_t^e + z_t^q * q_t - w_{t+1}(q_t) * \boldsymbol{a} / (1 + r)) \tag{9}$$

$$\partial U / \partial q_t = \boldsymbol{l} * (z_t^q * e_t - \partial w_{t+1}(q_t) / \partial q_t * e_t * \boldsymbol{a} / (1 + r)) \tag{10}$$

The term $\boldsymbol{l}$ refers to the shadow price which is common in a Lagrangean. As we are especially interested in parental decisions concerning the number and quality of children, we can focus our analysis on equations (9) and (10). First of all, one should note that z_t^q, e_t and q_t appear in both equations. Hence, the chosen level of e_t directly affects the decision for q_t, and vice versa. Such an outcome is typical for non-linear budget constraints and has an important effect on the considered quality and quantity decision. A shift of relative prices will most probably lead to more than proportional adjustments with respect to the chosen level of e_t and q_t. Therefore, deviations from the optimal conditions can have enormous effects due to the interplay of these two variables.[3] Secondly, it becomes apparent that a social planner would take the costs as well as the revenues of children into account. Equation (9) displays the fact that in equilibrium the marginal utility of e_t has to equal the marginal costs per child, which consist of the fixed cost per child (z_t^e) plus the quality cost per child ($z_t^q * q_t$), minus the revenues per child, which are determined by the future contributions to the pension system per child ($w_{t+1}(q_t) * \boldsymbol{a} / (1 + r)$). Of course, the revenues have to be discounted with the real interest rate (*r>0*) as they refer to the next period of life. The same logic applies to equation (10). The marginal costs of quality are determined by the number of children and the price per unit of quality ($z_t^q * e_t$) whereas the marginal revenues of quality are constituted by the future extra contributions to the pension system that arise from an additional marginal expenditure on quality ($\partial w_{t+1}(q_t) / \partial q_t * e_t * \boldsymbol{a} / (1 + r)$).

Due to the interplay of quality and quantity decisions it is generally difficult to assess how a shift of *r*, $\boldsymbol{a}$ or any other variable will affect the derived solution. However, for the following ideas it is sufficient to know the conditions for the optimal solution, not the solution itself. In the following we will examine how a representative household will adjust her decisions facing different types of PAYGO. As we know that in each PAYGO, either a traditional or a child-related system, pensions have to be financed by the contribution payments of future generations, the just derived optimal conditions must hold in order to guarantee efficiency.

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[3] For further details see Becker (1991), ch. 5 and Razan and Sadkin (1995)

C.   PAYGO vs. CPAYGO

Bearing this in mind we now want to examine the decisions of a representative household. For an individual, p_{t+1} is not endogenous but exogenous because her individual decision does not seem to affect the financial situation of the PAYGO. Especially in large societies which consist of many households, the individual generative contribution seems to become less important (for the pension). Thus, revenues that correspond to bearing and raising children vanish and the pension entitlement becomes a benefit which from the point of view of an individual household cannot be influenced. If this is the case the first-order conditions for $U(\ )$ with respect to e_t and q_t change as follows:

$$\partial U / \partial e_t = \mathbf{1} * (z_t^e + z_t^q * q_t) \qquad (11)$$

$$\partial U / \partial q_t = \mathbf{1} * (z_t^q * e_t) \qquad (12)$$

It is obvious that due to higher opportunity costs of children (i.e. less revenues) the household chooses a lower level of both e_t and q_t. When pensions are perceived as fixed the future contributions of children to the PAYGO system are ignored. Hence, the investment motive for raising children vanishes, probably with severe consequences for the sustainability of the pension system. Concerning the marginal rate of substitution, which can be easily derived if we divide (11) and (12), the direction of change is difficult to assess as we have not specified $w_{t+1}(q_t)$. For the sake of simplicity we assume that the substitution rate remains constant so that the following equation must hold:

$$w_{t+1}(q_t) = \frac{z_t^e + z_t^q * q_t}{z_t^q} * \frac{\partial w_{t+1}(q_t)}{\partial q_t} \qquad (13)$$

However, even different assumptions would not lead to other results. If the substitution rate remains unchanged, e_t and q_t will be reduced equally. This reduction, in turn, will affect equation (6). If α is fixed, pension entitlements have to be lower compared to the optimal situation. In addition, if fertility and expenditures on quality fall below a certain level, the sum of wages constantly decreases leading to further and further pension cuts.[4] Of course, this effect could be compensated by private funding. Yet, this is not efficient as welfare could be increased if decisions about the number and quality of children are revised. Furthermore, in most countries α is not fixed but p_{t+1}. Possibly because of a guaranteed minimum pension or because of preferences of the median voter (Browning 1975), the contribution rate $\boldsymbol{a}$ will be adjusted in order to finance the promised amount of pensions. Then the disposable income

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[4] This level will be reached if the internal rate of return of the PAYGO becomes negative. Yet, this could also happen if preferences for children and their quality are very weak.

of forthcoming households will decline which reduces overall consumption including less children and less expenditures on quality. As a result, a vicious circle develops which makes all forthcoming generations worse off.

No matter if α or p_{t+1} is affected, the situation can be regarded as a social dilemma. As costs of children have to be borne individually but revenues are distributed collectively, individual costs of children are higher than social costs. Therefore, decisions are suboptimal and there are possibilities for improvement. Of course, if all individuals could bargain in this situation efficiency could be restored, but that solution can be excluded because of transaction costs and a lack of commitment as one can easily comprehend. So a different solution is needed to overcome this problem of institutional externalities[5].

Two possibilities have been advanced. Firstly, the PAYGO system could be abandoned (see for example Feldstein (1996) for this proposal). Secondly, efficiency could be restored by redefining property rights. The first solution is very popular among economists. However, a transition to a fully funded system is difficult to design as the entitlements of the elder generations have to be preserved. Therefore, the current workers have to cope with a double burden which most possibly hampers welfare improvements. In addition and regardless of the double burden, a PAYGO system itself can be a device to reach efficiency. For instance, Radka and Razin (1995) show that, in absence of negative bequests, such an intergenerational transfer system is efficient. Furthermore, the mixture of human capital and real capital might be a more efficient way to secure old age pensions with reference to the portfolio selection theory (see Merton 1984). Moreover, in most western European countries policy makers discuss only a freezing of contribution rates which leads to a diminished size of the PAYGO but not its abolition. This also applies to current proposals in Germany as it was mentioned in the introduction. Hence, the social dilemma will still exist, only the magnitude of the problem is reduced.

Having outlined these arguments shall be sufficient to explain why we are more interested in the second alternative which is referred to as a child-related pay-as-you-go system (CPAYGO). By differentiating pensions according to the number of children such a system is aimed at merging social and individual costs of child bearing. Alternatively, one could say that the property rights with regard to contributions of the working generation are re-defined, i.e. according to the involvement in bearing and educating children.

We assume that the representative household receives a pension b_{t+1} per child. Initially, the total amount of pensions shall not change so that the following equation holds:

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[5] The term "institutional externality" is used as this situation does not result from a market failure but from the institutional framework of a PAYGO.

$$b_{t+1} * e_t = p_{t+1} \tag{14}$$

Then, the budget constraint for second period consumption changes as follows:

$$c_{t+1}^2 = (1+r) * s_t + b_{t+1} * e_t \tag{15}$$

By optimising (1) with respect to (3) and (15) we obtain the following results for e_t and q_t:

$$\partial U / \partial e_t = \boldsymbol{l} * (z_t^e - b_{t+1}/(1+r) + z_t^q * q_t) \tag{16}$$

$$\partial U / \partial q_t = \boldsymbol{l} * (z_t^q * e_t) \tag{17}$$

It is directly obvious that the introduction of a CPAYGO has the same effect as a price – reduction of the fixed costs (z_t^e) per child. Therefore, relative prices will change. As the fixed price per child solely affects the demand for children and not the demand for quality, the direction of change is straightforward. The household will choose more children but will invest less in their quality. Depending on the substitution elasticity this effect might be significant due to the non-linearity of the budget constraint. Most probably, the effect will be more than proportional. In either case, however, the demand for both, quality and quantity, remains positive because they are normal goods.

Nonetheless, this result confirms the point of view of Cigno (1993) and Folbre (1994). A CPAYGO induces a substitution effect which cannot restore efficiency. Comparing equations (9) and (10) with (16) and (17) we can conclude that the household takes into account the future revenues per child (b_{t+1}), but not the marginal revenues of expenditures on quality. As the determinants of future contributions are not considered simultaneously, this pension scheme is not adequate to allow for efficiency.

However, it is not clear at all whether the alternative, a traditional PAYGO, is preferable. The introduction of either pay-as-you-go system involves inefficiencies. While a traditional PAYGO system makes all future individuals worse off because of increasing contribution rates or decreasing pension entitlements, a CPAYGO distorts fertility choices and negatively affects the consumption possibilities of future generations due to lower expenditures on quality investments. Therefore, the overall effect is difficult to judge. Concerning the financial basis of the pension system the effect is ambiguous, too. Presumably the increase in the reproduction rate will offset the quality-related reduction of wages so that the transfers to the elder generation increase but that shall not be examined further. Instead, we want to discuss whether there are ways to prevent this inefficiency. More precisely, we examine if the inefficient substitution effect can be offset by the introduction of a second device. Fortunately, it turns out that an appropriate institutional framework is already in place: A public education

system.

D.   The role of public education

So far we have implicitly assumed that only parents finance expenditures that are related to the quality of children. Yet this is not the case. In almost all modern societies benefits for families are widespread, especially concerning education, health care and child care. For Germany, the advisory council of the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth (Wissenschaftlicher Beirat für Familienfragen 2002) asserts that approximately between 20.8 % and 35.8 % of total expenditures on children (except for opportunity costs) are borne by taxpayers. Similar results apply to the majority of European countries.

Predominantly these benefits aim to improve the well-being of children, hence their quality. As a consequence, transfers in kind outweigh transfers in cash by far. As we will see, such measurements affect the favourability of both pay-as-you-go systems in question considerably. In the following we restrict our analysis to a public education system as an example for such public expenditures. At least three different reasons can be advanced for this restriction. Firstly, public education is common in almost all countries and therefore the most prominent example for public expenditures related to children. Secondly, it is without question that these expenditures directly affect the quality decisions taken by parents. Other benefits, like subsidies for child care (kindergarten), might have other goals depending on the circumstances. For example, publicly financed child care could be regarded as a means to enhance women's employment because it reduces the opportunity costs per child. Thirdly and finally, the rationale for public education is beyond dispute while other means of collective investment in the quality of children, like free health care, are more often questioned.[6] As education involves an externality problem itself a corresponding transfer is a means to enhance economic efficiency. Furthermore, public education is the major device to improve equal opportunities. As Homann and Pies (1996) put it, it guarantees the approval of a social contract. Behind a Rawlsian veil of ignorance, thus, individuals would most probably settle for such an institution. In spite of our focus on public education it should be stressed that the analysis could be applied to other types of benefits as well. Then, however, we would have to discuss guidelines for a rational family policy which is beyond the scope of this paper.

In a first step we want to examine the effect of the introduction of public education while a traditional PAYGO system is in place. From a historical perspective this can be regarded as

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[6] For an overview and assessment of European family policies see for example Werding (2001).

a typical development. We assume that a share τ of all costs related to the education of children is publicly financed. This can denote that parents still have to pay a fee per child towards the school or that additional services have to be borne individually. The provision of the public good shall be financed by an income tax t. Thus, we gain the following condition:

$$\boldsymbol{t} * z_t^q * q_t = t * \overline{w}_t \tag{18}$$

Due to the introduction of public education the optimisation problem of the household with respect to the first period changes as follows:

$$\overline{w}_t * (1 - \boldsymbol{a}) * (1 - t) = c_t^1 + s_t + e_t * (z_t^e + (1 - \boldsymbol{t}) * q_t * z_t^q) \tag{19}$$

If we now rearrange and optimise (1) with respect to (19) and (4), we can derive the marginal rate of substitution of e_t with respect to q_t:

$$\frac{\partial U / \partial e_t}{\partial U / \partial q_t} = \frac{z_t^e + (1 - \boldsymbol{t}) * z_t^q * q_t}{(1 - \boldsymbol{t}) * z_t^q * e_t} \tag{20}$$

Differentiating this expression with respect to τ yields $\dfrac{\partial U / \partial e_t}{\partial U / \partial q_t} / \partial \boldsymbol{t} > 0$.

As the sign of this expression is positive we can conclude that quantity is substituted by quality of children. Hence, the more costs a society bears that refer to the quality of children the fewer children will be born. As the price for one unit of quality decreases (because of τ) households adjust their plans and spend more income on quality investments which directly decrease the demand for the number of children. Due to the changes in the institutional framework it becomes more attractive for households to raise fewer but better educated children. In addition, this substitution effect will be backed by the introduction of an income tax.

With reference to our optimal solution the reproduction rate is far too low. Remember that the introduction of a PAYGO already leads to a suboptimal choice regarding fertility. By adding a system of public education this problem worsens because relative prices are distorted. Likewise the financial stability of the PAYGO deteriorates because the basis of contribution payments erodes. Although income prospects rise due to the increase in quality investments, the reduction in fertility most probably outweighs this effect and, therefore, harms the sustainability of unfunded pension systems even further. Against this background it is not surprising that especially countries which focus on granting benefits to families that aim at improving the well-being of children, like Germany, Italy or Spain, have lower fertility rates than those countries who aim to lower costs for both quantity and quality, like France (see Eurostat 2003).

So far we can conclude that a pure CPAYGO distorts decisions in favour of the number of children while a traditional PAYGO in combination with public education distorts decisions in favour of expenditures on quality. It is, therefore, self-evident to examine whether these cases of sub-optimality can be overcome by settling for both, a system of public education and a child-related pension system.

In order to do so, we combine equations (19) and (15). Hence, there are now two devices, b_{t+1} and τ, which differently affect the quantity and quality decisions of the household. For the corresponding optimisation problem we gain the following solutions:

$$\partial U / \partial e_t = \boldsymbol{l} * (z_t^e - b_{t+1}/(1+r) + (1-\boldsymbol{t}) * z_t^q * q_t) \tag{21}$$

$$\partial U / \partial q_t = \boldsymbol{l} * (1-\boldsymbol{t}) * (z_t^q * e_t) \tag{22}$$

Now we are able to restore optimality as one can act on both conditions simultaneously. By equating (21) and (8) as well as (22) and (9) and solving for b_{t+1} we gain the optimal level for the child-related pension.

$$b_{t+1} = \boldsymbol{a} * w_{t+1}(q_t) - \boldsymbol{a} * \frac{\partial w_{t+1}(q_t)}{\partial q_t} * q_t \tag{22}$$

This result needs a brief explanation. The first term on the right-hand side refers to the total sum of contributions a worker pays for the elder generation. It represents, therefore, the maximum pension which an adult could receive per child. This sum of contributions has to be diminished by the second term. The derivation of $w_{t+1}(q_t)$ with respect to q_t allegorises the rate of return of expenditures on quality. Thus, the last term has to be regarded as the total amount of revenues that were achieved by expenditures on the quality of children. Of course, these revenues have to be multiplied with α as only this share of revenues is distributed among the pensioners. As a result, pension entitlements should not only be granted according to the number of children raised because expenditures on quality have to be rewarded, too.

For τ we obtain the following condition:

$$\boldsymbol{t} = \boldsymbol{a} * \frac{\partial w_{t+1}(q_t)}{\partial q_t} * \frac{1}{(1+r) * z_t^q} \tag{23}$$

Substituting τ in (18) and rearranging we can identify the second motive for obtaining a pension in such an optimal CPAYGO.

$$\overline{w}_t * t = \boldsymbol{a} * \frac{\partial w_{t+1}(q_t)}{\partial q_t} * q_t \frac{1}{(1+r)} \tag{24}$$

In equilibrium the sum of taxes equals the sum of revenues which correspond to the expenditures on the quality of children. As the term on the left refers to period one and the term on the right hand side to period two, the sum of revenues has to be discounted.

The significance of (24) is as follows. Taxpayers gain pension entitlements by investing in the quality of children. Therefore, we obtain a rationale for granting childless households a pension, too. One might ask why individual expenditures on the quality of children are not rewarded in optimum. However, if τ is chosen correctly investment and consumption with respect to q are separated from each other. The share τ of costs represents those expenditures which are aimed to secure old age pensions while the share $(1-\tau)$ refers to consumption by parents. Likewise one might say that the social and individual costs of quality are brought together by subsidising the price per unit of quality.

Bearing this in mind the assessment of the substitution effect has to be revised. It is obvious that a substitution effect will occur if a society which subsidises public education converts a traditional PAYGO system into a CPAYGO. In this case, however, the substitution effect is inevitable in order to enhance welfare. One might argue that due to this effect income prospects of future generations deteriorate because of lower expenditures on quality. Yet this must not be the case. As contribution rates could be lowered the amount of disposable income will increase leading to additional expenditures on the quality of children. Furthermore, one should keep in mind that especially during the last decades the opportunity costs per child have increased dramatically as income prospects of women have been rising. Therefore, one should not expect a far higher reproduction rate due to a child-related pension.

At this point of the discussion one could ask whether it would be more useful to grant the child-related pension while parents actually raise children. For instance, liquidity constraints of parents could back the preference for child allowances. Although this discussion shall not be the topic of this paper at least two arguments can be put forward for restricting the benefit to the retirement age. First, in the real world the average future income of children, and thus the average contribution, is difficult to estimate. Hence, it is even more difficult to achieve optimality. Nevertheless, this would not be the main cause. Second and more important, even with a CPAYGO in place the dominance of unfunded pension systems has to be reduced. When child related pensions are paid out while parents are young they will solely receive a pension that corresponds to investments in the quality of children. As a consequence, the replacement rate would be relatively low so that a pension above the minimum living standard could not be guaranteed. Then even parents have to be obliged to save individually in order to prevent free-riding. As one can see, the child-related pension entitlement disburdens parents from mandatory saving which in turn has the same effect as

an additional transfer while being young. To sum up, only when the minimum standard of living is guaranteed an untimely provision of the child-related pension is an option. For instance, one could allow parents with more than two children to opt for a child allowance for each additional child instead of an additional pension entitlement.

E.   Outlook

This paper dealt with the interplay of fertility decisions and different types of pay-as-you-go systems. Thereby, especially the possibility of undesirable substitution effects accompanying the introduction of a CPAYGO has been examined. As it turned out, a substitution effect is inevitable but optimal provided that a public education system is in place. By acting simultaneously on both variables, quantity and quality of children, inefficiency can be prevented. Therefore, these two institutions ideally supplement each other so that they can be called a perfect marriage. In addition, one major objection against the introduction of a CPAYGO, the fear of an undesirable substitution effect, can be rejected.

Of course, further research, theoretical as well as empirical, would be beneficial. The presented model could be extended in many directions. It would be possible, for example, to introduce bequests into the model without changing the essence of the model. Furthermore, more types of pension systems or a different institutional framework could be considered. On the empirical side, the return on expenditures on quality should be estimated in order to grant pensions adequately.

For forthcoming pension reforms the presented result is, nonetheless, really promising. In most western countries a system of public education is in place so that the transition of the PAYGO system into a CPAYGO is welfare enhancing. In addition, the odds for such a reform are favourable as pension entitlements have to be only partly related to the number of children. Therefore, the transition process is much easier to implement. By combining the CPAYGO with private saving, countries will obtain a pension system that is sustainable and independent of demographic developments. As the peak of demographic crisis is already in sight the first step towards a new pension system should be made right now.

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