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Fertility impact of social transfers in Sub-Saharan Africa

– What about pensions?

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Abstract

The potential link between child-related cash transfers and increased fertility is often raised as an issue of concern when debating their use. Old-age pension is a form of cash transfer where theory would suggest the opposite impact, i.e. pensions equal decreasing fertility. A handful of Sub-Saharan African countries have introduced non-contributory social pensions that cover the great majority of the older population. It makes them into a distinct group in relation to the rest of the region where public old-age security arrangements, if existing at all, are largely reserved for the formal sector. This paper attempts to trace any impact these high-coverage pension schemes may have had on fertility. Findings suggest that there has been such an impact, in the range of 0,5 to 1,5 children less per woman depending on model specification.

Keywords: Social protection, social transfers, fertility, old age pension, Sub-Saharan Africa

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1. Introduction

Social protection in the form of cash transfers is high on the development agenda. One recurring concern in the debate on child-related cash transfers is the impact these might have on fertility, given the high dependency ratios in many developing countries. In the case of South Africa, which is one of few Sub-Saharan African countries having introduced a child grant on scale, the potential fertility impact of the grant (particularly on teenagers) has been subject to a heated debate and was used as an argument against its introduction (Lund 2008). The concern over a potential fertility impact is also sometimes reflected in the design of child-related cash transfer schemes, as when household benefits are left unaffected by children born after the family have entered the program, which is the case in some Latin American schemes (Stecklov, Winters, Todd and Regalia, 2007).

Social pensions for the elderly are another form of cash transfers, and like child-related cash transfers, they are part of the 'social protection floor' advocated by the United Nations.[1] A handful of Sub-Saharan African countries have introduced such social pensions for elderly and at present they are also under consideration elsewhere on the continent. However, despite being part of the same package of proposed social protection measures, the impact of pension schemes on fertility seems to be of less interest than that of child grants,

The impact of social transfers on fertility is also an issue of debate in OECD-countries, but here the interest is rather driven by an opposite concern about fertility being too low. However, among OECD countries both child-related social transfers and pensions have been subject to close scrutiny when it comes to their potential fertility impact. A number of empirical studies of fertility development in advanced economies have pointed out old-age pensions as one contributing factor, among others. A theoretical assumption underpinning these studies is that children may serve as a parental investment in old age care, and that the existence of public old age pensions reduces that motive. In this context pension systems have sometimes been blamed for causing a reduction of fertility, over time resulting in fewer tax payers to sustain them (Cigno and Werding, 2007).

Does this claimed pension-fertility link also have a bearing in Sub-Saharan Africa? It is sometimes assumed that this should be the case (Kidd 2009). Is it something that can be tested empirically? Most Sub-Saharan African countries have some kind of public pension system for their public sector employees, sometimes also extended to segments of the formal sector. However, as the vast majority of Africans are active either in the rural or the informal urban sector, these pension systems could hardly be assumed to have a substantial impact on aggregate fertility rates. However, there are exceptions. A few Sub-Saharan African countries have introduced non-contributory pension schemes that benefit the great majority of the elderly: South Africa, Mauritius, Seychelles, Namibia, Botswana, Lesotho and Swaziland. They were introduced at different points in time, with South Africa and Mauritius having the oldest systems dating more than 50 years back while Lesotho and Swaziland are the most recent examples, with systems introduced in 2004 and 2006 respectively. If the theory of a pension fertility link holds also in Africa, it is in these countries we possibly could detect a fertility impact. That is the hypothesis which is to be tested here.

Some caveats should be pointed out right from the start: There are severe data limitations when it comes to African historical indicators on expenditures and coverage of pensions as well as on

[1] UN initiative launched in April 2009: http://www.socialsecurityextension.org/gimi/gess/ShowTheme.do?tid=1321

other fertility determinants. All usual reservations when it comes to the limitations of cross-country econometric analysis also apply. Some indications that such an effect exists is to be expected from this exercise, rather than exact estimates.

2. Results from the pension-fertility literature

The 'theory' of a link between old-age security and fertility dates back at least to the 1950s (Leibenstein, 1957). Since then there have been a large number of contributions from demographers, economists and sociologist. Economists have developed formal models in which rational and utility maximizing agents choose their desired family size influenced by old age security considerations and where children are assumed to support elderly parents. The models differ in complexity, involving interaction with a range of other variables such as savings, growth, capital market imperfections, properties of the tax and social security system etc. All of these models predict that a pension-fertility link is to be expected; a prediction that has been tested repeatedly by use of econometrics on macro-data. Table 1 below reports the results of a handful of such recent econometric studies (not claiming to be exhaustive). Given the purposes of this paper, key findings may be summarized as follows:

- This literature appears to be consistent in reaching the conclusion that pensions lower fertility. This result has been reached in studies based on different model specifications and samples, single-country as well as cross-country studies, and confirmed after the inclusion of a wide range of control variables and econometric tests.

- Finalized studies focusing exclusively on Sub-Saharan Africa have not been possible to identify, but some of the cross-country samples include developing countries.[2] Most results are either based on single-country studies in high-income countries or on panel data where low-income countries, and African countries in particular, are less represented due to lack of data. In other words, there seems to be an 'Africa gap' in this literature.

- As a proxy for old-age security, most studies have used some measure of aggregate pension cost in relation to GDP. From a Sub-Saharan perspective this measure is of limited value, first of all because data availability is scarce, but more importantly its variation is likely to reflect the public expenditure generosity towards a small fraction of the population (state and formal sector employees) rather than the extent to which the population in general can count on some form of public old-age security.

- In some of the single-country studies both pensions and child benefits have been combined as explanatory variable (Germany, UK and Hungary). The results in these cases indicate that pensions impact negatively on fertility while child benefits impact positively, and with roughly comparable orders of magnitude.

[2] An exception is an unpublished conference paper by Nhabinde and Schoeman (2007). It is an attempt to replicate the Boldrin 2005-paper using Sub-Saharan retirement benefits/GDP data. No significant impact of these payments on fertility was found. The authors recognize the low coverage rate of the retirement programs as being a main caveat to the results.

Table 1: Impact of pensions on fertility: recent empirical results

Study/year	Sample	Pension indicator	Main control variables (not complete)	Main result of relevance to this paper
Galasso et al. 2008	Panel data, approx 80 countries	Pension spending/GDP (various measures using ILO and WB data), and pension coverage (share of population covered by mandatory systems)	i) GDP, ii) Rural population %, iii) share of population >65, iv) legal origin, v)Female labor participation, vi) Female secondary education, viii) Religion	Pensions impact on fertility. Impact stronger in countries with less developed capital markets.
Gábos et al. 2006	Time series Hungary 1950-2005	Pension expenditure/GDP	i) child benefits, ii) indicators on family policy shifts,	Pensions have significant impact on fertility. 1% increase in pension/GDP rate associated with 0,3% decline in fertility, while 1% increase in child benefit/GDP rate associated with 0,2% increase in fertility.
Ehrlich and Kim 2005	Panel data, 57 countries/32 years	Pension benefits/GDP	i)GDP/cap, ii) survival probability different age groups, iii) Female labour participation, iii) Deviation from 50% female share of population, iv) Female/male schooling years	Pensions highly significant impact on fertility. Larger impact in OECD-countries than non-OECD countries
Boldrin et al. 2005	i)Cross section 104 countries 1997, ii)Panel data 8 developed countries 1960-97	Social security expenditures/GDP (also social security expenditures/labor earnings)	i) GDP/cap, ii) Population share over 65, iii) Infant mortality rate	Social security highly significant impact on fertility. (Increasing social security by 10% of GDP reduces TFR by 0,7-1,6 children per woman)
Zhang and Zhang 2004	Panel data 1960-2000	Social security expenditures/income	i) growth, ii) per capita income, iii) schooling	Social security highly significant impact on fertility.
Cigno et al. 2003	Time series data Germany 1960-95	Total pension benefits/person above 65	i) male and female wage rates, ii) interest rates, iii)child benefits, iv) saving rate v) social security deficit	Pensions decrease fertility. Child benefits found to increase fertility. Magnitude of impact of the same order.
Cigno and Rosati 1996	Time series data UK, US, Germany and Italy, 1950-90	Various indicators of pension benefits (depending on data availability each country)	i) male and female wage rates and disposable income per capita, ii) interest rates, iii)child benefits (in the case of UK), iv) saving rate v) social security deficit	Pensions found to decrease fertility in all countries. Child benefits found to impact positively on fertility in UK (the only country where this variable used)

There is also a large literature focusing exclusively on the impact of family policies, such as child-related social transfers, on fertility in OECD-countries. In general results indicate that family policies have at least some positive impact on fertility, albeit the estimated magnitude vary and is sometimes quite small, see Gauthier (2007) for an overview. The more recent wave of child-related cash transfer schemes in developing countries have also been subject to evaluations when it comes to their impact on fertility. A review of three of the major Latin American conditional cash transfer programs found an impact on fertility in just one of them, a

finding that was attributed to the different designs of these programs when it comes to creating incentives for child bearing (Stecklov et al. 2007).

3. Some remarks on fertility in Sub-Saharan Africa

Sub-Saharan Africa is sometimes described as being half-way through its demographic transition, with indicators on mortality and fertility roughly at levels comparable to those of South America in the 1960s or China in the early 1970s (Malmberg, 2008). Average fertility rates for Sub-Saharan Africa started to fall in the 1980s and have since then been reduced by 25 percent to 5,1 children per woman. UN predicts, mainly through extrapolating present trends, that it will take another 35 years before Sub-Saharan Africa fertility reaches the level of 3 children per woman, which is a slower rate of decline than what has been historically observed in South America, India and China (Malmberg, 2008). The population of Africa is projected to approximately double by 2050, reaching close to two billion people or slightly more than a fifth of world population. Assumptions made on the rate of fertility decline are key factors in these projections (UN, 2009).

Fertility is now declining all over Sub-Saharan Africa. However, this is a process with a considerable degree of heterogeneity over the continent. In terms of sub-regions the decline has gone furthest in Southern Africa, least in West Africa while East Africa is in an intermediate position. The total fertility rate ranges from 2-3 children per woman in South Africa, Mauritius and Botswana up to 6-7 children per woman in countries such as Burkina Faso, Mali and Niger. There is a clear rural-urban divide in this development, with fertility starting to decline in some urban areas already in the 1960s but not until the late 1990s in the last rural areas (Garenne, 2008). In terms of simple correlations it is apparent that the African countries with lower fertility rates also tend to be richer in terms of GDP/capita, more urbanized and with better social indicators (Garenne, 2008).

4. High-coverage pension systems in Sub-Saharan Africa

In general Sub-Saharan African countries have some form of mandatory contributory pension system, in most cases with legal origins dating back to the first decades after independence (ISSA, 2009). Comparable data on coverage and expenditures are scarce. In the ILO/Social Security Expenditure database (widely used in the studies presented in Table 1 above) just 15 African countries have data for any year reported on pension expenditure/GDP for the 1990-96 period, most in the range of 0,1 to 0,5 percent. Indicators on contributory pension scheme coverage (contributors/labour force) reveal that, with few exceptions, contributors tend to constitute approximately just 5 percent of the labour force (Barrientos, 2008). The general picture in Sub- Saharan Africa is hence that the vast majority of the population is uncovered by any form of publicly organized old-age security. However, there are exceptions.

For the discussion of a possible pension fertility link in Africa the systems of interest are those that provide old-age security to a majority of the elderly. For the purpose of this study we label them 'high-coverage' systems, disregarding such distinctions as universal/means-tested. It has been possible to identify seven Sub-Saharan African countries with such systems: South Africa, Mauritius, Namibia, Seychelles, Botswana, Lesotho and Swaziland. In a global perspective these African non-contributory, large-scale pension schemes are in fact quite unique; in a social pension database provided by HelpAge just two developing countries outside Africa have social pensions covering more than 50 percent of the elderly (Bolivia and Chile).[3] Some key

[3] http://www.helpage.org/Researchandpolicy/Socialprotection/PensionWatch/Feasibility

information on them is presented in the Table 2 (information gathered on a case by case basis, with estimates to be taken as rough indications rather than as strictly comparable).

Table 2. High-coverage old age pension systems in Sub-Saharan Africa

	Year introduced *1)*	**Means-tested or universal**	**Qualifying age**	**Coverage rate** *(pensioners/age-qualified pop) 2)*	**Pension /GDP per capita**	**Total pension cost/GDP**	**Source**
South Africa	1948	Means-tested	65 (m) 60(f)	87%	29%	1,20%	Willmore 2006
Mauritius	1950	Universal	60	100%	16%	1,70%	Willmore 2006
Namibia	1973	Universal	60	93%	16%	0,80%	Willmore 2006
Seychelles	1979	Universal	63	>80%	25%	2,90%	Campling et al.2009 *4)*
Botswana	1996	Universal	65	96%	10%	0,5	Willmore 2006
Lesotho	2004	Universal	70	*3)* 96%	34%	1,4	Stewart/Yermo 2009 *5)*
Swaziland	2006	Means-tested	60	>80%	7%	n.a.	RHVP 2007

Comments Table 2:
Data are from the years 2002-2007 (data from Willmore refer to circa 2003, other sources from 2005-2007).
1) Year of introduction in South Africa and Namibia refer to the year when non-contributory pension system was extended to majority African population.
2) In the case of Seychelles and Swaziland no exact coverage rates available; the estimate '>80%' is based on information in indicated sources combined with population statistics.
3) Persons already receiving government pension are excluded from the universal pension in Lesotho.
4) GDP ratios and coverage rate for Seychelles estimated using Campling et al.and WB/WDI
5) Pension/GDPc estimated using Stewart/Yermo and WB/WDI

One trait these systems have in common, whether universal or means-tested, is the fact that they are non-contributory. It has been noted elsewhere that the non-contributory feature appears to be a necessity if high-coverage is to be reached in countries where the rural and informal sectors dominate (see Barrientos(2008) and Holzmann and Hinz (2005)). The seven systems are also reasonably comparable in various dimensions. This is the case in terms of i) coverage rate (all above 80 percent of age qualified population), ii) pension benefit as share of GDP per capita (mostly in the range of 15-25 percent) and iii) aggregate pension cost in relation to GDP (roughly 1-2 percent).

Reviewing the history of these pension systems it is clear that the social and political context in which they were introduced vary a great deal:

-*South Africa and Namibia, pensions introduced as part of apartheid policies*: In the case of South Africa non-contributory state pensions were introduced for white and coloured in 1928 with inspiration from European welfare policies. Eligibility was extended to urban Africans in 1944 and to rural Africans in 1948. Pension payment rates were differentiated according to race and rural/urban residence (the relation between a white and a native rural pension was 11 to 1 in 1965) and the system was used to forward various aspects of apartheid policies (Devereux (2001) and Pelham (2007)). The number of natives receiving old age pensions are reported to have risen from 197.000 persons in 1947 to 400.000 by 1973 (Devereux, 2001). Even if it has not been possible to identify early indicators on coverage, these figures imply that the system did cover a majority of the elderly population already early on during the apartheid era[4]. Since

[4] In 1973 South Africa had a total population (including white and coloured) above 65 years of approximately 700.000 (World Bank/WDI), to be compared with the reported figure of 400.000 native pensioners.

independence South Africa has a unified, non-contributory and means-tested pension system (the means-test serving to exclude a minority of the rich rather than to identify the poor). Coverage rate has been reported to be 87 percent of age-qualified population with annual pension benefits in the order of 30 percent of GDP/capita (Willmore, 2007).

Initially the South African pension system did not apply to residents of South West Africa (now Namibia). There it was extended to white residents in 1949, to coloured 1965 and to the African population in 1973. Just as in South Africa pensions were initially differentiated by race. After Namibian independence in 1990 a universal pension system, equal for all races, was established. In contrast to South Africa there has not been any means-testing since then. Coverage rates at independence 1990 were in the range of 50 percent, something which the new government made efforts to increase. During the 1990s coverage rates improved, particularly after the privatization of pension delivery and the introduction of mobile cash dispensing machines touring remote areas on monthly basis (Devereux, 2001).

-*Mauritius, an unintended system that survived*: Mauritius introduced a non-contributory pension system in 1950, before independence. It was originally regarded as a temporary measure as the intention was to dismantle it once a proper contributory system could be put in its place. Its introduction has been portrayed as a bit of an historical accident. However, as it became popular and functioned smoothly it was kept in place (Willmore, 2003). Initially it was means-tested but since 1958 the means-tests have been abolished (but with pensions included in taxable income). The system covered the vast majority of the population already the initial years and since 1977 coverage has been close to 100 percent. Over the years the system has become increasingly generous (Willmore, 2003). The non-contributory system operates alongside with a contributory pension scheme, with contributors now constituting close to 60 percent of the labour force (Barrientos, 2008).

-*Seychelles, pensions introduced after a leftist coup*: In 1979 the Social Security Fund of Seychelles was established, extending the pension coverage to the entire population above 64 (later reduced to 63). It was introduced in a context where a leftist government had been installed after a coup in 1977. It has been described as an element in the one-party state's progressive policy ambitions to extend social protection to all citizens. The return to multi-party democracy in Seychelles in 1993 seems to have expanded the scale and scope of the social protection programmes introduced during the previous one-party regime (Campling, Confiance and Purvis, 2009).

-*Botswana, Lesotho and Swaziland, pensions introduced in the context of multi-party politics and by a traditional monarchy:* These are the most recent examples of Sub-Saharan African countries introducing high-coverage pension schemes, with systems put in place during 1996-2006. In contrast to South Africa, Namibia, Mauritius and Seychelles the systems in Lesotho and Botswana have been introduced in the context of a democratic multi-party system. There are at least some indications that electoral politics was a factor contributing to their introduction and also for sustaining them (Pelham, 2007). In the case of Swaziland (traditional monarchy rather than multi-party) the introduction of the system was announced by the king, but has also been heatedly debated in the Swazi parliament after a public out-cry when pensions were temporarily were suspended due to administrative weaknesses during the introductory years (Dlamini, 2007). It is also apparent that international influences have played a role, as these countries are close to, and economically integrated with, South Africa where a pension system has been in place for decades (Pelham, 2007). The three countries are also severely affected by the HIV/AIDS-pandemic and the increasing number of AIDS orphans who are taken care of by the older generation has been an additional motive for these reforms (RHVP (2007) and Pelham (2007)). However, despite the fact that both Lesotho and Swaziland are quite aid dependant, there are no indications that donors have played any role in pushing for or financing these systems. In the case of Lesotho the introduction of the pension system apparently came as a great surprise to the donor community (Pelham, 2007).

Although these systems have been introduced during highly different political and social contexts, they seem to have one thing in common: Once introduced they have remained in

place even though the original political context has radically changed. This seems to illustrate the 'stickiness' or path dependence of a social policy instrument such as pensions. Once introduced the systems shape institutions, values and interests that tend to sustain them.

To summarize, despite this historical heterogeneity, these seven high-coverage pension countries constitute a distinct group clearly separated from the rest of Sub-Saharan Africa where only a small minority of the population is covered by any public old-age security. As revealed by Table 2 the systems are also reasonably comparable in terms coverage and generosity. So, some populations in Sub-Saharan Africa have been subject to a 'pension treatment', whilst the rest have not. This is something that may be exploited, despite the lack of comparable time series data on pension expenditure and coverage, to approach the question: Do pensions in Africa impact on fertility?

5. Theoretical considerations

There are many variations on formal modelling of utility maximizing agents that make fertility decisions influenced by old-age security concerns (see any study mentioned in Table 1). That kind of modelling exercise will not be repeated here. Instead this section is limited to pointing out some of the more basic premises that underpin the hypothesis of a pension-fertility link.

First of all, the hypothesis is built on the assumption that fertility choices are influenced by the costs and benefits of having children. As it is a choice, an underlying assumption is that family size can be chosen, i.e. that there exists a mechanism for birth control. It further assumes that children do provide some form of old-age care to their parents; if not there could be no substitution effect as pensions are introduced. Furthermore it is a link that is assumed to work through peoples' perception. For instance, introducing a pension scheme that people in reproductive ages do not trust will remain in place should not be expected to impact on fertility. This also implies that, to the extent it takes time for a newly introduced pension system to build up in terms of coverage and credibility, the link to fertility would operate with a lag.

These premises do not imply that costs and benefits of having children are necessarily the *only* factors influencing fertility choices.[5] Neither do we have to assume all individuals to be completely rational in the sense that they deliberately calculate economic costs and benefits before taking decisions on having children. Perceptions of costs and benefits of having children may, for instance, operate alongside values, traditions and norms that also influence fertility choices. The costs and benefits of certain behaviours may of course also influence the creation and survival of values, traditions and norms in the long run.

To make the pension-fertility link less theoretical and more down to earth, we may visualize two African villages. In one of the villages, without pensions, young couples see the elderly being taken care of by their adult children, particularly in difficult times when survival is at stake. They may also see elderly with fewer children being more vulnerable to economic shocks and illness, and they might have heard sayings that place a value on large families. In the other village, with pensions, young couples see the elderly surviving on small pensions, and even sharing these small amounts with other household members (which has been shown to be the case when the use of social pensions is followed up in Sub-Saharan Africa). The role children play to guarantee old-age security tends to become less visible in this setting. The young couple in the latter village also less frequently hear sayings that transmit norms in favour of having many children. It is not completely far-fetched to imagine that the pensions available in village two may be a factor, obviously alongside with many other factors, that influences this young couple's choice of family size.

[5] A complex set of factors may explain fertility transitions, with costs and benefits of having children just one group of factors among many (Oppenheim, 1997).

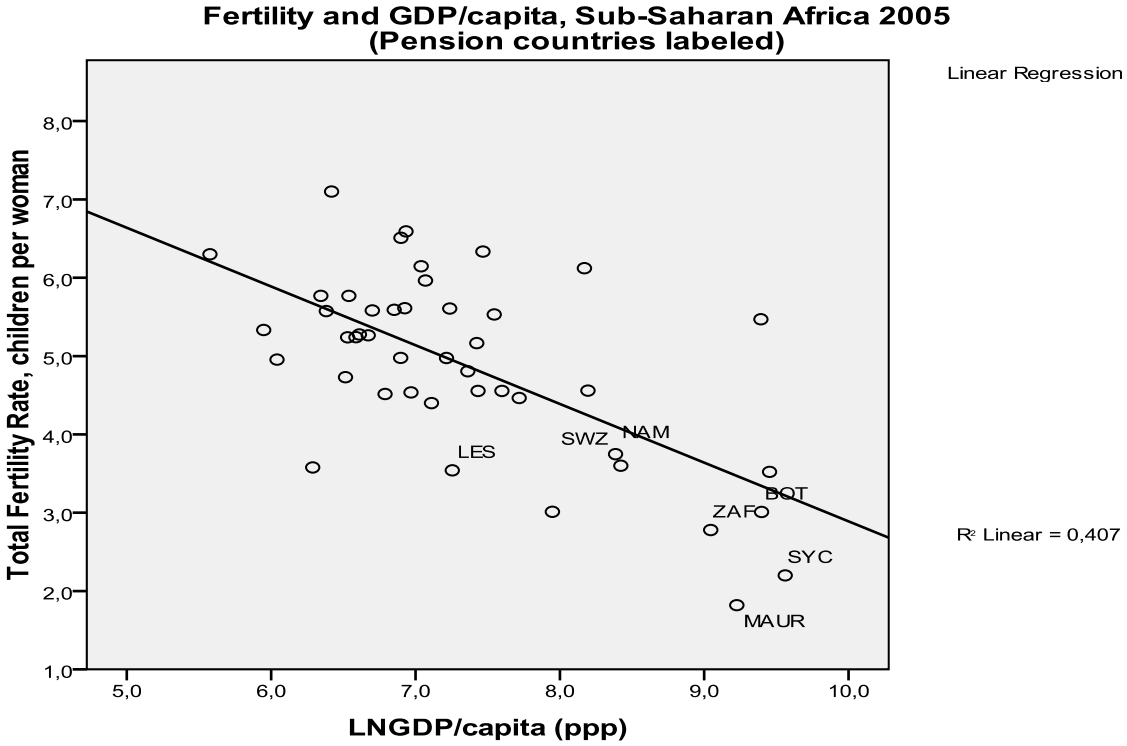
Some 'eyeball-econometrics'

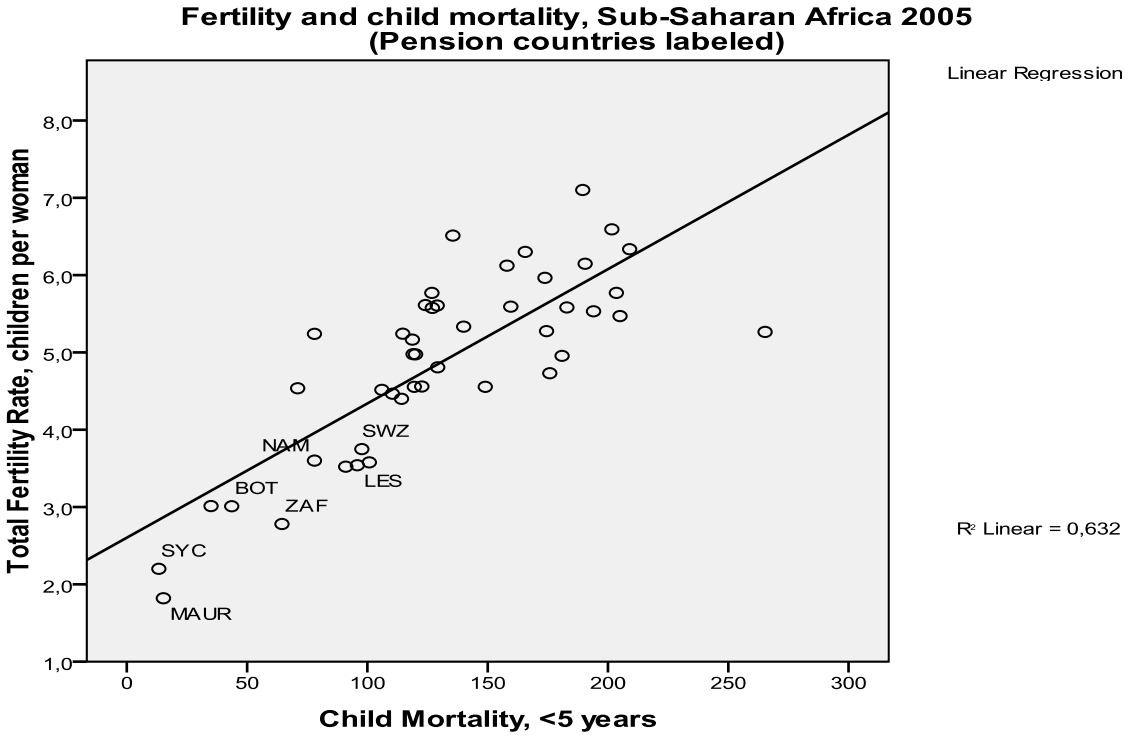
Initially some graphical illustration of a possible pension-fertility link in Africa will be presented. Regression results based on African panel data will follow.

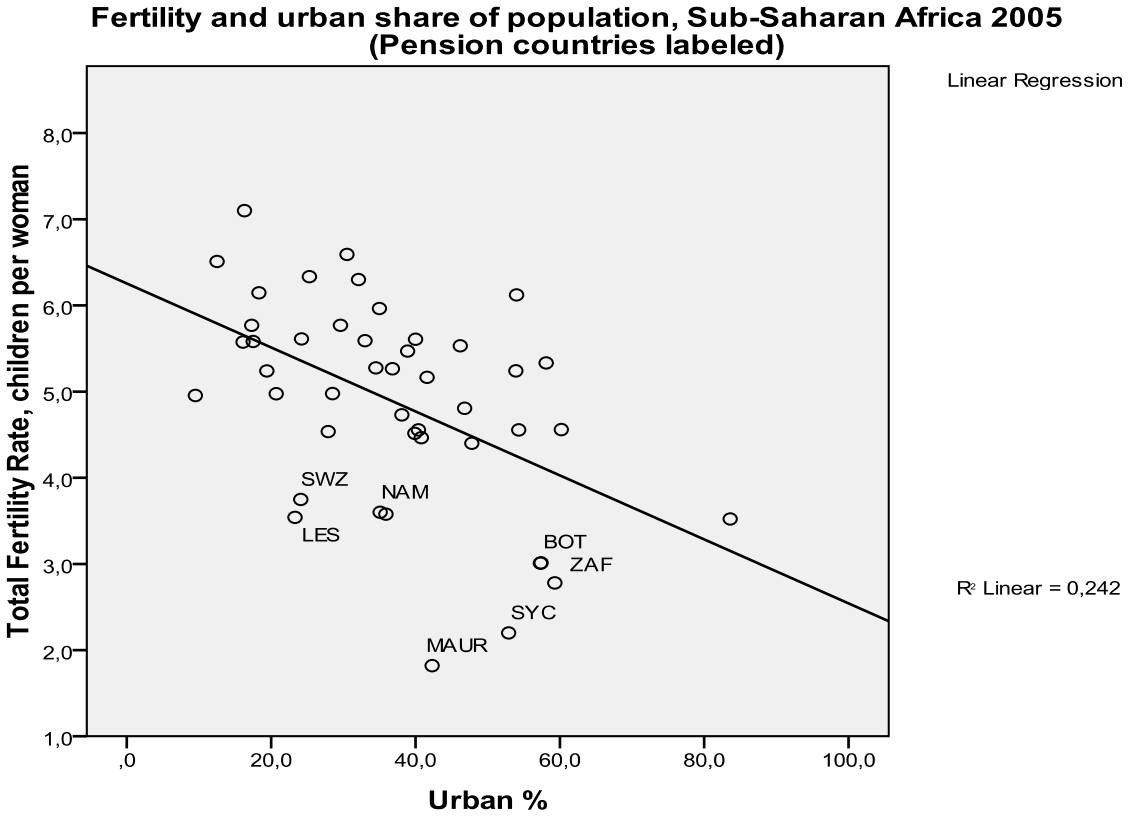
The cross-country picture

In diagrams 1-3 the 2005 fertility rates of Sub-Saharan African countries is plotted against their GDP/capita (ln-form of GDP/capita chosen to increase visibility), urban share of population and child mortality. The high coverage pension countries are labelled at their data points (also Swaziland and Lesotho are labelled although their systems were introduced as late as 2004 and 2006).

Diagram 1-3 (data sources, see annex 1)







These three diagrams basically tell us the following:

-Lower fertility among Sub-Saharan African countries is clearly correlated with higher GDP/capita, higher urban share and lower child mortality, as indicated by trend-lines and R^{2}'s .

-The pension countries are at the lower end in terms of fertility rates, but also at the higher end when it comes to GDP/Capita and urbanization and at the lower end when it comes to child mortality.

-Finally, and most importantly for the purpose here, the pension countries are grouped below the trend-lines. This shows us that these countries are at the lower end in terms of fertility also given their level of GDP/capita, urban share and child mortality. Their lower fertility levels can hence not solely be ascribed to the fact that they have reached a higher level of economic and social development as measured here. Simple eye-measuring of the distance to the trend-lines would indicate that their fertility rates are very roughly one unit lower (i.e. one child less per woman) than expected given their position in terms of these three development indicators.

The time series picture

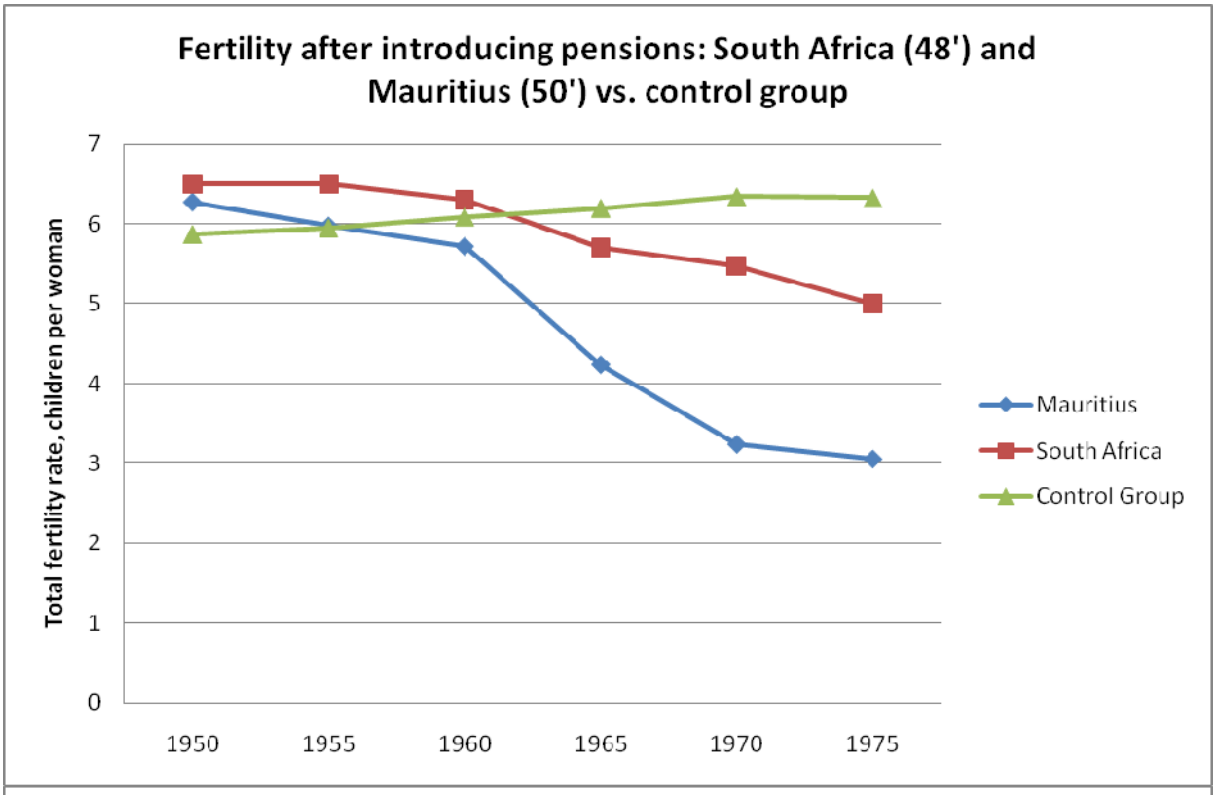
Is this a relationship that holds also over time, i.e. has fertility in pension countries tended to decline (with some lag) after the introduction of pensions, and more so than in comparable countries? In order to make this comparison a control group of countries is needed. We also need to consider the fact that systems have been introduced at different points of time during a period when general fertility levels have started to decline in the region.

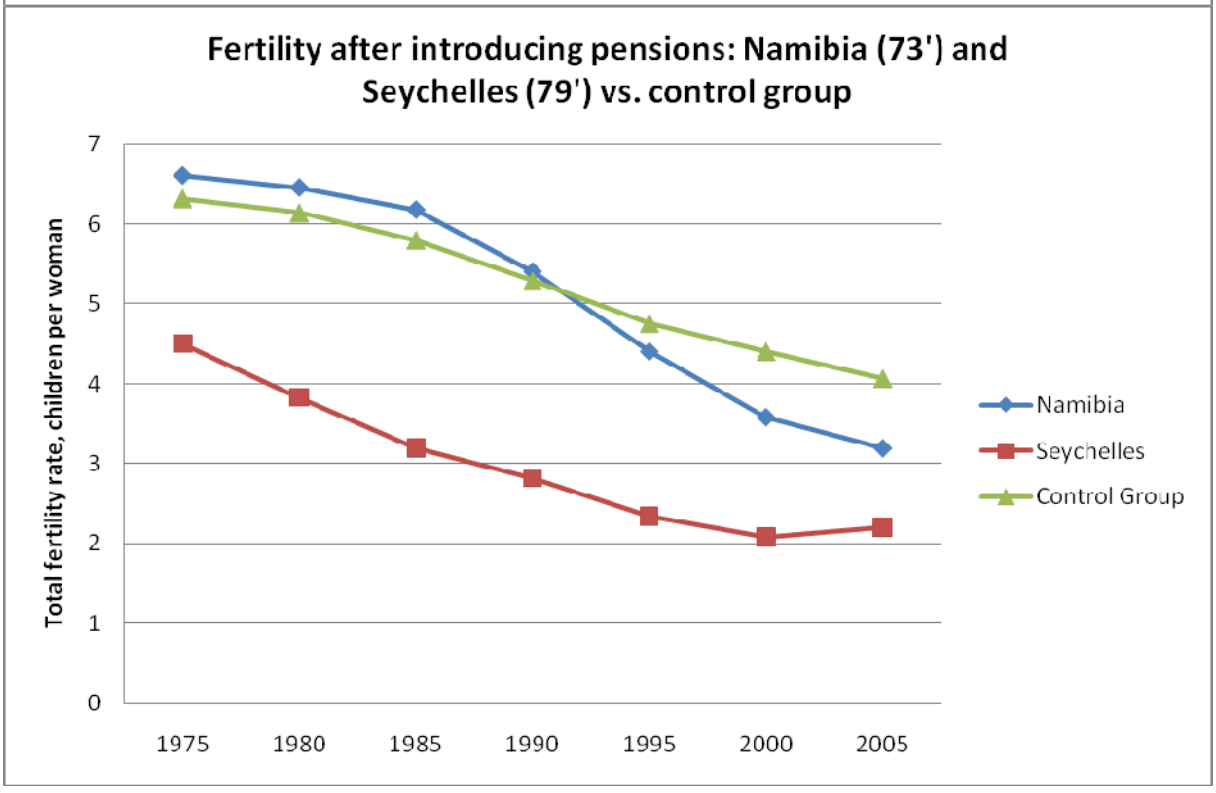
Historical data in Sub-Saharan Africa does not permit an advanced propensity score matching, but it is clear that GDP/capita is a key factor determining whether an African country is likely to introduce a high coverage pension system or not.[6] South Africa, Mauritius, Namibia and Seychelles, Botswana and Swaziland were all among the top ten African countries in terms of estimated GDP/capita at the time of introducing their systems (Lesotho the only exception in this respect).

Based on the ranking in terms of estimated GDP/capita (see annex 1 for data sources) one five-country control group is created for the case of South Africa and Mauritius which introduced their systems in 1948 and 1950; Gabon, Angola, Namibia, Congo Rep and Sudan form that control group as they were closest to South Africa and Mauritius in terms of estimated GDP/capita PPP 1950. Correspondingly, another five-country control group is created for Namibia and Seychelles which introduced their systems in 1973 and 1979; i.e. Gabon, Swaziland, Congo Rep, Angola and Botswana.

[6] A simple regression analysis, based on the control variables available in Annex 1, would also point out GDP/capita as the strongest determinant of whether a country has a pension system of this kind in place.

Diagram 4-5 (data sources, see Annex 1)





In Diagram 4 and 5 the fertility curves are shown for South Africa/Mauritius and Namibia/Seychelles respectively, together with the fertility curves of their control groups (the fertility indicator used here is based on UN data available as from 1950 in five year intervals). In the cases of South Africa, Mauritius and Namibia there are visible kinks on the fertility curve some ten years after the introduction of the pension system, and their curves decline faster than the curve of their control groups. In the case of Seychelles this is not the case; fertility is falling just slightly more rapidly than in the control group but without any visible kink on the curve after introducing the pensions. (The exercise is not repeated for Botswana, Lesotho and Swaziland as their pensions systems are too recent to serve our purpose here.)

Summarizing the time series picture, it appears that in at least three out of four cases fertility has fallen faster after the introduction of pensions (with some lag), and faster than for a control group of comparable countries.

6. Econometric results

Based on what is visible to the eye alone, there are some indications to support the hypothesis of a pension-fertility link in Africa. However, if we move forward in the understanding that this is also a causal link, some of the usual objections immediately present themselves: omission of variable bias, underlying trends in time series, reversed causality etc. To approach these objections econometric tools need to be applied.

Table 3 presents the results of OLS-regressions, based on Sub-Saharan African panel data 1960-2006, 46 countries. Explanations of sample, definitions and data sources are available in Annex 1. The fertility rate (TFR) refers to the average rate for the following five year period. As exact data on pension expenditures and coverage is lacking, the pension variable has been constructed as a dummy variable. It has been lagged 10 years, so the dummy '1' stands for '10 years with high-coverage pension system'. There is some arbitrariness in the choice of this lag but it can be shown that it is not the choice of lag that drives the result, see below.

Three control variables are used in all models: GDP/capita, urban share of population and child mortality. There are quite pragmatic reasons for the choice of these three control variables: They have frequently been used in the literature (see Table 1) and there are few other relevant indicators available for Sub-Saharan Africa 1960 onwards, unless sample size is to be seriously affected. Various theoretical considerations can justify their inclusion. The urbanization indicator may capture such factors as the changing costs and benefits of having children in an urban setting; the weakening of family ties; improved access to health services, including family planning; and more exposure to 'modern' norms and values. Child mortality may capture both a reduced motive for childbearing as more children survive and improved access to health services, including family planning. GDP/capita is of course linked to a whole range of transformative processes in a society. None of these variables can be assumed to be completely exogenous in relation to fertility, but given the purpose of this study that may not be a major concern.

In Model 1 the fertility rate is simply regressed on GDP/Capita, child mortality and the urban share of population. In Model 2 we add the pension variable. All four variables come out as significant. The Beta-coefficient of the pension variable could be interpreted as saying that having had a high-coverage pension system for 10 years is associated with a reduction in the fertility rate by as much as 1,3 children per woman.

The result is obviously open to the critique that it might be driven by omitted variables. It could for instance be a special structural factor in pension countries that make them more likely to introduce these pensions *and* to have a more rapid fertility decline, without any causal relation between pension and fertility. One could think of a number of such potential factors, but data availability (particularly in the 60s and 70s) makes it difficult to experiment with more variables without severely reducing the sample size. However, to the extent that this unknown factor is

reasonably time-invariant it can still be controlled for by introducing country-fixed effects (each country given a dummy variable). This is done in model 3. As seen the beta-coefficient of the pension variable remains significant, but slightly reduced from -1,3 to -1,1. It is hence not the omission of a structural variable of this kind that drives the result.

The issue of bias resulting from time series correlation is addressed in similar fashion by introducing time fixed effect in model 4. As each year is given its own dummy we can be sure that the result is not driven by some continent-wide time trends that happen to correlate with each other. The Beta-coefficient of the pension variable once again remains significant, and at -1,4.

In Model 5 both country and time fixed effects are combined. This means that there are now simultaneous controls for unobserved time-invariant country specific characteristics and continent-wide time specific trends. Even under this restrictive specification the Beta-coefficient remain significant, but drops to -0,5.

Table 3. OLS regression results

Variable	1	2	3	4	5	6
Pension (lag=10)		-1,34	-1,13	-1,41	-0,46	-0,73
		-16,9	*-9,5*	*-19,7*	*-5,1*	*-6,3*
GDP/capita PPP	-7,1(E-5)	-1,9(E-5)	-2,9(E-5)	-5,4(E-5)	-3,3(E-5)	2,4(E-5)
	-8,2	*-2,2*	*-2,2*	*-6,8*	*-3,3*	*-2,2*
Urban share of pop.	-0,027	-0,028	-0,071	-0,017	-0,025	-0,028
	-17,1	*-19,3*	*-30,3*	*-12,1*	*-11,4*	*-12,3*
Child Mortality <5	0,008	0,007	0,002	0,006	-0,004	-0,003
	28,9	*26,3*	*5,2*	*22,6*	*-8,9*	*8,1*
Country fixed effects			Included		Included	Included
Time Fixed effects				included	Included	included
Population above 65						-0,16
						-6,2
Adjusted R2	0,63	0,68	0,85	0,74	0,92	0,91
No. of observations	1934	1934	1934	1934	1934	1899
No. of countries	46	46	46	46	46	46

Dependent variable: TFR (Total fertility rate, five-year averages for following period). Table reports Beta-coefficients from OLS regressions, with t-statistics in italics. Significance level at 5% for t>1,96.

Reversed causality bias is an issue that merits some comments. If reduced fertility is a factor that increases the likelihood of the introduction of a pension system, then that would produce a potential bias in these results. It is not an unreasonably assumption that this could be the case. In the literature one mechanism that has been suggested is based on political economy considerations (Entwistle and Winegarden 1984). Lower fertility means fewer children to take care of more elderly, so one could imagine that pressure builds up on politicians, from the elderly as well as from their potential care-givers, to set-up public pension schemes. Fewer children would also free-up public resources that could be used for this purpose. One argument against this reversed causality hypothesis in this context is the fact that in the cases of South Africa and Mauritius the pensions were introduced while fertility levels were at high levels (approximately 6 children per woman) and the fertility decline came in the decades after the introduction (this is however not the case to the same extent in Botswana, Lesotho, Seychelles

and Swaziland where fertility rate stood at 3-4 children per woman at the moment of introducing pensions). Another argument against a reversed causality mechanism is the political context in which these pensions were originally introduced; in non-democratic countries (South Africa/Namibia during apartheid, Mauritius before independence and Seychelles during one party regime) the scope for a majority of voters to directly influence pension policies is likely to be limited.

In the pension-fertility literature some studies have tried to address the potential reversed causality bias by introducing the variable 'share of population above 65' to capture the strengthened demand side for pensions as demographic structure changes (Galasso et al, p 14). As an additional control the variable 'population above 65' is included in model 6, but with the effect that the Beta-coefficient of the pension variable is increased.

Finally, Table 4 gives some indications of the robustness of these results. First, different lags of the pension variable are inserted to the Model 2 of Table 3. As shown, using a ten year lag or a five year lag does not impact much on the Beta-coefficient, which stays around -1,3. Adding a five year lead to the dependant TFR- variable (and using no lag on the pension variable) also leaves the Beta-coefficient roughly unaltered. The result after constructing a 'gradual impact' pension variable is also reported, as this probably better reflects the reasonable assumption that these systems gradually build up over time in terms of coverage, credibility and impact on perceptions. The variable has been constructed so as to approach unity as the years pass after the introduction of a pension system[7]. This formulation of the pension variable produces the strongest level of significance of the Beta-coefficient.

Table 4

Variations of Model 2: impact on pension variable coefficient		
	B-coefficient of pension variable	(t-value)
Different lags/leads:		
Pension (lag=10)	-1,34	*-16,9*
Pension (lag=5)	-1,31	*-16,7*
Pension (lag=0), TFR (lead=5)	-1,26	*-16,1*
Pension gradual impact	-1,58	*-18,3*
Excluding countries:		
Excl South Africa	-1,62	*-18,1*
Excl Mauritius	-0,93	*-9,8*
Excl Namibia	-1,49	*-17,1*
Excl Seychelles	-1,38	*-16,8*
Excl 'not middle income'	-0,84	*-9,7*
Different periods		
1960-1990	-1,56	*-16,2*
1980-2006	-1,08	*-12,9*

The data sample was also divided into two time periods, 1990-2006 and 1960-1990 (using pension with lag=10). As shown in Table 4 the beta coefficients remain significant, but higher in the earlier period (-1,6 vs. -1,1).

[7] The variable has been calculated as $[1-0,9^{t})]$, with *t* the number of years with pensions. Constructed in this way the variable comes close to 0,7 after 10 years and 0,9 after 20 years.

Finally Table 4 also reports the impact on the beta-coefficient of the pension variable (with lag=10) when some countries are excluded. Running the regression just with Sub-Saharan African middle-income countries changes the Beta coefficient downwards, to -0,8. Also, excluding just one pension country from the sample can have a considerable impact, producing Beta-coefficients in the range of -0,9 to -1,6 (the strongest effect coming from exclusion of South Africa or Mauritius, as reported in Table 4). This sensitivity of the results should come as no big surprise, given the few pension countries available in our sample.

Reviewing all model results it is still noteworthy that the Beta-coefficient of the pension variable has remained significant in all of them, and in no case outside the range of -0,5 to -1,6.

There are still reasons to be cautious when interpreting these results. A weak spot is the fact that the results depend on such a limited number of countries with 'high-coverage' pensions; just five Sub-Saharan African countries have had high-coverage pensions in place for more than ten years. Secondly the pension variable used has been a rough proxy, a lagged dummy, as historical data on exact coverage and on pension expenditures is lacking. Thirdly, it has not been possible to operate with a wider range of fertility determinants as control variables without severely affecting the sample size, something that has been dealt with by controlling for fixed country- and time effects.

7. Concluding remarks

Do high-coverage pension systems in Africa, which are able to provide some minimum old-age security to the vast majority of the population, have an impact on fertility? Theories assuming that the choice of family size is influenced by concerns for old age security would predict this to be the case. Empirical results from other parts of the world, where this pension fertility link has been tested, would also lead us to assume so. The findings presented here lend further support for believing this assumption to be correct. Results indicate that having a high-coverage pension system in Sub-Saharan Africa is associated with a reduction of the fertility rate in the range of 0,5 to 1,5 children per woman, depending on model specification. The result is surprisingly robust, and holds over time as well as cross-country wise. It should still be interpreted cautiously, given data limitations and the quite small number of countries with high-coverage pensions that drive the result.

If these findings are to be believed, which are the policy implications? A fertility impact of the indicated magnitude is clearly significant when assessing costs and benefits of introducing old-age pension schemes. However, the author of this paper does not want to argue that fertility reduction should be the main motive for introducing old-age pensions, as considerations related to poverty, dignity, social cohesion and humanitarian principles are likely to weigh heavier, just as in the case of child-related cash transfers. Furthermore, to the extent that fertility is a major concern, then there exists a wide range of other policy instruments to influence fertility levels, likely to be cheaper and more efficient than pensions in reaching that objective. Much is left to be done when it comes to implementing reproductive health policies in Sub Saharan Africa.

Still, we want to know the full range of consequences of different policy actions, also if unintended side-effects. The fertility impact of child-related cash transfer in developing countries apparently is heatedly debated, while scant attention is paid to the fertility impact of old-age cash transfers. The results presented here serve to remind us that a balanced social protection approach, caring for both elderly and children as proposed by the UN social protection floor, might contribute to a balanced fertility impact as well.

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Annex 1: sample, data and sources

Sample
Data used in regressions are for the period 1960-2007 with sample including all Sub-Saharan African countries listed in World Bank/World Development Indicators. Missing values have been reduced by using moving five year-averages of available data in the cases of infant mortality and total fertility rate, and by using estimated time series from elsewhere in the case of GDP/capita PPP (see below). The basic model uses 1934 country/year observations (46 countries, 47 years with 228 values missing).

TFR
Total Fertility Rate, children per woman. Calculated as moving averages of the following five-year period.

Source: World Bank, World Development Indicators

Table 3 and diagram 4-5 use TFR based on UN fertility data (which has data from 1950 for these countries).

Source: World Population Prospects, 2006 revision, United Nations Population Division. Downloaded at *www.gapminder.org/downloads/documentation/#gd008*.

PENSION
Dummy variable (=1) for countries having a high-coverage pension system, with lag as specified. The 'Pension Gradual Impact' indicator is calculated according to the formula $[1\text{-}0{,}9^{t}]$ where *t* stands for the number of years with a high-coverage pension system.

GDP/Capita PPP
GDP per capita, adjusted for purchasing power parities in fixed 2005 prices. Data is based in World Bank International Comparison Program and further compiled by Gapminder Foundation (full documentation on the compilation exercise downloadable).
Source: The Gapminder Foundation, downloaded at
www.gapminder.org/downloads/documentation/#gd001

Urban share of population
Source: World Bank, World Development Indicators

Child mortality <5years
Mortality rate, children under 5 (per 1,000). Calculated as moving 5 year averages.
Source: World Bank, World Development Indicators

Population above 65
Share of population above age 65.
Source: World Bank, World Development Indicators

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