Pension Policy Reform and Fertility: Micro Evidence from Ghana

Barbara Ama Zelu, Susana Iranzo, Alejandro Perez-Laborda

Universitat Rovira i Virgili

Preliminary Draft

Abstract This study analyses the long-run and short-run effects of the pension policy reform that took place in Ghana in 2010. Using a difference in difference identification strategy and data from the Ghana Living Standard Survey (GLSS), the results show that the extension of a pension plan to women that were not previously eligible to have a pension reduced the average number of children of women with completed fertility cycle. This is in line with studies for other developing countries such as Brazil and China. The short-run effects on fertility are also explored showing that there has been a reduction in the probability of getting pregnant within a year after the policy was implemented. Additionally, we try to uncover heterogeneous effects of the impact on fertility of pension reform along cultural practices and religion. The results reveal that the negative impact was more pronounced for women from matrilineal culture and Christian women. Finally, we find no evidence of son or daughter preference.

Keywords: Fertility · Pension Reform· Ghana

1 Introduction

Over the past decades, many developing countries have experienced substantial decline in fertility rate. From 6 births per woman in the 1960s to 2.6 births per woman by 2020, (UN Population Division, 2019). Quite a number of studies have attributed this decline to contraceptive use, unmet need for family planning and, women's increase in education (see Gustafsson, 2001, 2005; Nguyen-Dinh, 1997). Nevertheless, the life cycle and inter-generation support hypothesis could also be a possible mechanism in the context of developing countries. Dasgupta, 1993 espoused that in the absence of capital markets, there exists two main incentives for reproduction: firstly, children are viewed as durable consumer goods in that they have inherent value and carry on the family lineage. Secondly, children are considered as old age insurance. Similarly, Leibenstein, 1957 postulated that in circumstances where parents are uncertain about their ability to support themselves during old age they resort to raising children in expectation of reciprocated assistance during old age. [1] Testing this link empirically has however, proved difficult especially at the micro level. A significant number of the existing studies have been conducted for developed countries mostly theoretical and few empirical studies are at the macro level (see Cigno 1993 ; Ehrlich et al., 1998; and fenge et al., 2017). There exists only scanty literature at the micro level and much fewer studies in developing country context. This current study seeks to provide a comprehensive evidence on the impact of introducing and expanding

[1] Thus investment in children is considered as a parental loan which will be paid in the future.

pension benefits on fertility at the micro-level using Ghana as a case study. Ghana like many developing countries has undergone rapid fertility transitions from an average of 7 children per woman in the 1960s to 3.6 children in 2020, (World bank). Given that in Ghana social protection (safety net) is rare specifically old age insurance it was therefore culturally established for children to take care of their parents during old age. And parents also in the bid to ensure old age security resorted to giving birth to many children which increased their probability of being taken care of during their old age. Hence one would expect that in an environment where parents take children as old age insurance the introduction of a social security scheme would affect fertility decisions, since children will no longer or will loosely be considered as an insurance mechanism, but as a consumption good. Prior to 2008, in Ghana, public sector workers received a generous pension benefits (lump-sum amounts and monthly allowances), while those in the private sector only received monthly allowances. In 2008, the Act 766 was introduced which extended a more generous pension benefits to workers in the no-public sector. The objective of this study is to use this reform as a quasi experiment to see how the policy has impacted fertility of women in Ghana. To this end, we use a simple two-period overlapping generation model where we consider two scenarios. We use the Ghana living standard survey waves 4, 5, 6, and 7 to empirically test the model using difference in difference methodology. The results indicate that the Act 766 pension reform in Ghana had a negative effect on the total number of children (long-run) and also the probability of getting pregnant in within a year (short-run). Specifically, 0.58 less children for 45+ women after the policy was implemented. The results also show a proportionate decrease in both the total number of boys and girls, hence we find no evidence of son or daughter preference. Inclusively, heterogeneous effects along culture and religion reveal that the negative effect was more pronounced for women in matrilineal culture, and Christians as compared to Muslims. our study relates to three strands of literature. It contributes to the growing literature on the determinants of fertility, confirming that inter-generational support is one of the drivers of fertility especially in developing countries (Becker, 1960; Becker et al., 1990; Boldrin and Jones, 2002; Banerjee et al., 2010; Oliveira, 2016). Additionally, our study also adds to emerging empirical literature on how the introduction of pension policies affect fertility decisions (Danzer and Zyska, 2023; Shen et al., 2020; Fenge and Scheubel, 2017; Rossi and Godard, 2022). Lastly, the study builds on the literature on how policy influences cultural practices and attitudes (Bau, 2021; La Ferrara and Milazzo, 2017). We contribute to this literature, by demonstrating that, the extension of pension benefits disincentive women to have many children. The remaining of the paper is structured as follows: section 2 we present the literature, section 3 discusses the theoretical framework, section 4 provides detail on the Ghanaian pension reform, section 5 empirical methodology and data description, section 6 we present the results and robustness checks, section 7 some heterogeneous effects and section 8 the conclusion.

2 Literature on Fertility

2.1 Old Age Security Motive and Fertility

The assertion that parents sometimes procreate for old age security has been proven to be true in both theoretical and empirical literature. For example, in a theoretical and empirical analysis Becker (1960) provided evidence

that some parents consider children as durable production good. similarly, Becker et al. (1990) find that parents procreates sometimes not because of the inherent utility they derive from their children, but for the purpose of old age support. Boldrin and Jones (2002) developed a theoretical model where parents depend on children for old age support. Empirically, Jensen (2004) find that in South Africa, each rand of pension benefits to the elderly resulted in the reduction of transfers from children by 0.25-0.30 rand. In China Cai et al. (2006) provide evidence that, private transfer from children is positive when the elderly recipient lives below the poverty line. Equally in China, Ebenstein and Leung (2010) find that parents with sons are less likely to participate in pension plans. Allendorf (2015) in his study demonstrated that in India, women with sons expects support from their son, whiles women with only daughters usually expect support from other sources besides a child. Also, Banerjee et al. (2010) in his study find that Chinese parents depend on children during old age. Likewise, Oliveira (2016) find that parents can improve old age support with an additional child. In the same vein, Bau (2021) find that the introduction of a pension policy in Indonesia and Ghana reduced the practise of matrilocality and patrilocality respectively. Thus, as a result of the pension policy parents reduced the incidence of residing with their children during old age for support.

Thus, there is strong evidence in support of the old age security motive of child bearing.

2.2 Pension Introduction and Fertility Response

In a theoretical model Wigger (1999) showed that fertility declines by an increase in public pensions. Using Hungarian data Gábos et al. (2009) stated that a 1 percent increase in pensions results decreases fertility by 0.2 percent. Similarly, Fenge and Scheubel (2017) and Cigno et al. (2002) investigating the Bismack's pension system in Germany find an overall negative impact of the pension introduction on fertility. In a cross country analysis, In the study of the pensions systems in the UK, US, Italy, and Germany Cigno and Rosati (1996) find that pensions benefits have a negative impact on fertility in all the four countries. Galasso et al. (2009) showed that an increase in pensions is correlated with a significant declines in fertility in a panel of 80 countries. Likewise, Ehrlich and Kim (2007) in a panel of 57 countries demonstrated that pay as you go benefits generates an incentives to have fewer children. And the effect is greater for OECD countries that non-OECD countries. Additionally, Boldrin et al. (2015), in a panel and cross country studies find government social security benefits have a substantial negative impact on fertility and accounts for about 55% to 65% of variations in population across Europe and the US. In a cross country analysis, Zhang and Zhang (2004) estimated that fertility is declining in social security. At the micro level Shen et al. (2020) investigated the impact of the new Chinese rural pension reform on fertility and find a negative causal relationship. Additionally, Rossi and Godard (2022), finds a negative impact of pension extension on fertility in Namibia. Lastly, Danzer and Zyska (2023) is the study of the Brazilian pension system showed that the extension of pension to rural workers reduced completed fertility by 1.3 children in the long run. From the above review, we can see that a good proportion of the literature are studies conducted at the macro level, some theoretical models and mostly for developed countries and just a handful of studies at the micro level. The objective of the existing studies is bridge

this gap and contribute to the growing empirical literature on pensions benefits and fertility in a developing country context.

3 A Simple Model of Fertility and Pension

We consider the impact of a pension policy in a two period overlapping generation model (OLG) to motivate our empirical analysis. This model is slightly different from Miyazaki (2013) and Shen et al. (2020) in the sense that, while the former models assumes the presence of old age savings, in our model we assume that savings is zero which captures best the Ghanaian or developing country context. Thus, children are the only means of consumption smoothing. In this model the individual lives through three periods, childhood, adulthood, and old age. When the individual is a child she lives with her parents who take care of her development. In adulthood she earns some wage and makes pension contributions, and during old age she retires and her consumption consists of pensions and some support(income) from her children. In adulthood, the individual decides to consume and have children. As it is standard, in the model children are considered as consumption good and investment or durable production good. That is we assume parents are altruistic, such that they derive utility from consumption in the first period C_t^1, consumption in the second period C_{t+1}^2, and the number of children n_t. Thus, the life time utility of an individual that lives in generation t can be written as follows:

$$U_t = logC_t^1 + \beta logC_{t+1}^2 + \gamma logn_t \tag{1}$$

Where U_t is the life time utility, C_t^1 is consumption in first period, C_{t+1}^2 is the consumption in second period, n_t is number of children of individual i, $\gamma(\gamma > 0)$ represent utility weight of raising children. Firstly, we consider a scenario when the individual does not make pension contributions and hence will not receives pension benefits during old age. Thus this individual will be subjected to the following budget constraint:

$$W_t = C_t^1 + \theta W_t + \rho n_t \tag{2}$$

W_t is the wage income which is split between consumption, raising children and supporting parents during their old age. ρ is the cost of raising a child, $\theta(\theta > 0)$ rate of expenditure to support elderly. To simplify we assume all children contribute the same amount to support their parents during old age. In the second period the individual's budget constraint can be expressed as:

$$C_{t+1}^2 = \theta W_{t+1} n_t \tag{3}$$

where C_{t+1}^2 is equal to the income support from the children the individual had in the previous period.

Maximizing the utility function (1) and subject to the budgets constraints (2) and (3) the optimal number of children where the individual does not receive a pension is as following:

$$n_0^* = \frac{(\gamma + \beta)(1 - \theta)W_t}{\rho(1 + \gamma + \beta)} \tag{4}$$

Secondly, we consider the scenario when the individual will receive pension instead of relying on support from her children. Here we assume that the individual has a pensions contribution rate of η. Then this individual faces the following budget constraint:

$$W_t(1 - \eta) = C_t^1 + \rho n_t \tag{5}$$

$$C_{t+1}^2 = g\eta W_t = G \tag{6}$$

Where η rate of pension contribution, g government pensions generosity and, G is pension from government during old age. Given that this individual has the same life time utility as the first case we maximize equation (1) subject to (5) and (6) to get the optimal number of children of an individual who will receive pension.

$$n_1^* = \frac{\gamma(1 - \eta)W_t}{\rho(1 + \gamma)} \tag{7}$$

To find the difference between the optimal number of children when individuals receives pension as compared to no pension we subtract (4) from (7) to arrive at the following:

$$n_1^* - n_0^* = (\theta - \eta)\gamma(1 + \gamma + \beta) < 1 \tag{8}$$

For most plausible parameter values the optimal number of children with pension will be smaller than the optimal number of children without pension. From (8) we can see that when the rate of contribution to pension η is greater than the rate of contribution to old age support θ the expression will be strictly negative, meaning that a more generous pension will lead to women having fewer children.

4 The Pension Reform in Ghana

As a former British colony, Ghana had in place pension benefits for civil servants. Thus, prior to 2010 there was non-uniformity in pensions benefits in Ghana. With a more generous lump-sum benefits and monthly pension allowances paid to the public sector, and a less generous benefits with only monthly allowances paid to workers in the private sector. Upon some agitations from the less generous pension recipients and the government realising that these workers were retiring worse off than when they were working. Saw the need to review the pension's law and extend a more generous pensions benefit for all workers in Ghana. In 2008 the new pension's law, the Act 766 was introduced, but implemented in 2010. Which extended a mandatory pensions benefit for all workers in the public and the private sector under a three tier system. This is to ensure that all workers receive both lump sum benefits and monthly allowances when they retire. The first Tier is the Basic National Social Security Scheme for all workers in Ghana. It is a defined benefit scheme and mandatory for workers to have 13.5% contributions

made on their behalf by their employer. This will be paid in monthly allowances upon retirement. The Second tier is a defined contributory occupational pension scheme mandatory for workers with 5% contribution made by employees themselves. This will be paid in lump-sum amount upon retirement. The third tier which is a voluntary fully funded and privately managed provident fund and personal pension scheme which is targeted at workers in the informal sector who do not have the necessary documentation to join the tier I and II. The policy obligated compulsory coverage for all workers in the formal and informal sector. The objective of the reform was to ensure financial independence for retirees, increase retirement income security for formal and informal sector workers, and to enhance the pension system.

4.1 Fertility trend In Ghana

Data from the Ghana Demographic Health Survey indicate that there have been fluctuations in the total fertility rate in Ghana with this fluctuations mostly dominated with declines. The world bank also recorded that the total fertility rate (TFR) in Ghana has been declining, however the decline is at a decreasing rate. For example, in 1950, Ghana's total fertility rate was 6.3 births per a woman and it increased and then peaked at 7 birth per woman by 1968. From then on the TFR began to decline nonetheless at a slower rate. The TFR decreased from 7 births per woman in the 1960s and 1970s to 6.6 births per woman in the 1980s. From 1980 to 1990 the total fertility rate decreased by 0.973 and between 1990 to 2000 the rate of decline was 0.776. By 2019, TFR was at 3.844 births per woman. Some studies have attributed this decline in fertility to changes in demand for children as a result of evolving social norms, educational reforms such as free compulsory basic education (FCUBE), the contraceptive marketing project, family planning policies among others. Amidst this period of declining fertility Ghana also implemented a comprehensive pension policy which may likely affect affect fertility rates.

5 Methodology

5.1 Empirical Strategy

To empirically estimate the impact of the Act 766 pension reform on fertility we employ three strategies: First we looked at how completed fertility (.ie.), the total number of children of women of 45+ years old evolved over time, before and after the policy reform. In a Pseudo difference in difference analysis we compared these women (45+) to women within ages 15-30 years as a control group. The reason being that the women within ages 15-30 years are too young for their fertility decisions to be (fully) affected by the policy. Firstly, younger women still face the risk of children's survival (child mortality) they may hoard children. Secondly, unlike older women who have full knowledge about the physical, mental, health capabilities, gender and and attitudes of their children, younger mothers do not have these information and hence may hoard children. Lastly, we expect an immediate effect of the policy on women close to the end of their fertility cycle and also closer to their retirement age. Since the policy increases their certainty on the number of children they want to have. For the short run analysis we used standard

difference in difference where we estimated the likelihood of pregnancy within a 12 month period across sector of employment before and after the policy reform. The treated group are individuals working outside the public sector. Since they are the ones affected by the extension of the generous pensions benefits. The control group consists of individuals working in the public sector. In practice we estimate the following model:

$$y_{itr} = \beta_1(Treated_i \times Post_{it}) + \beta_2 Treated_i + \beta_3 X_{it} + wave_t + Region_t + \epsilon_{it} \tag{9}$$

Where y_{itr} is Number of children of individual i or whether the woman has been pregnant in the prior 12 months, $Treated_i$ is a dummy equal to one if an individual will receives pension; $Post_{it}$ is a dummy equal to one for observations after 2010, coefficient of interest is β_1, the coefficient of the interaction term between $Treated_i$ and $Post_{it}$. If the pension led to a decline in fertility then we expect β_1 to be negative and if the opposite occurs then we expect β_1 to be positive. X_{itr} is a set of covariates, for example, age, age-squared education, employment status, a dummy for marital status, if father or mother live in the household etc. We also included region's fixed effects and survey year fixed effects, and ϵ_{it} is the error term. The assumption underlying the identification is the parallel trend assumptions. Implying, the outcome variable for the treatment and control group are expected to evolve on a similar trends over time. While this assumption can not be empirically tested, a graphical representation of the outcome variables of interest before and after the policy can be used to ascertain its validity. We did this in figure 1 where we plotted the average number of children for the treatment and control group from 1999 to 2017. The diagram shows that the average number of children for the treatment and control group exhibit similar trend. However, in the treatment group there was a sharp decline after 2010, and stabilizes thereafter

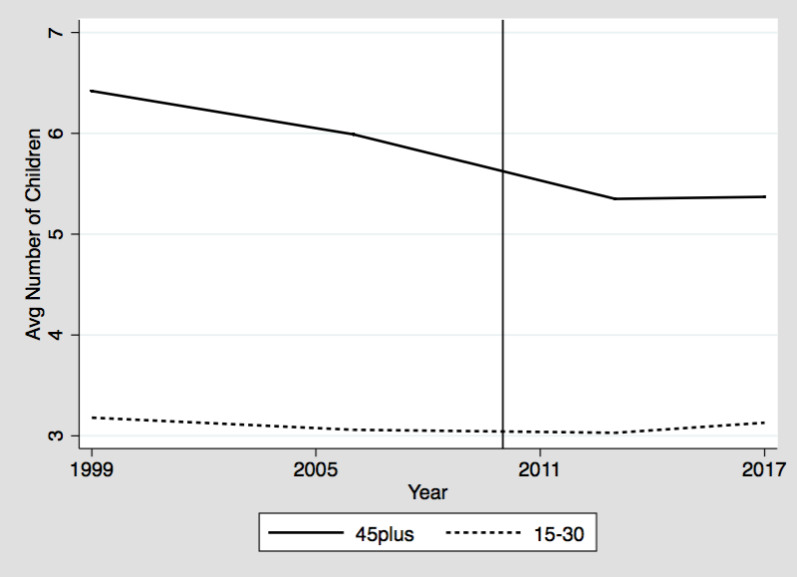


Fig. 1
Notes:This figure shows the trend of the average number of children by age cohorts
Author's own construct from GLSS data.

5.2 Data

Our empirical analysis exploits cross sectional data from the 1999, 2006, 2013 and 2017 versions of the Ghana Living Standard Survey (GLSS). The GLSS is a nationally representative data set that consists of rich variables at the individual and household levels. The study made use of mainly variables from the fertility history questionnaire, employment status, and information on demographic characteristics. For the measure of fertility we used the total number of children, total number of boys and girls for the long-run analysis, and have you been pregnant in the last twelve (12) months for the short-run analysis. After merging and cleaning the data we had a total sample of 24,000 women between the ages of 15-65 years. First, we use the full sample and then we split the sample according to age cohort 45+, 30-44 years and 15-29 years. To see how the pension reform affects completed fertility over time, we categorize women with age 45+ as the treatment group and women between 15-29 years as the control group. For the short run analysis we use the non-public sector as the treatment group since workers in the public sector have already being receiving pension benefits.

5.3 Descriptive Statistics

Table 1 reports the summary statistics for all the variables used for the analysis. The first columns captures statistics for the full sample and the subsequent four columns presents for the sub samples of 45 and above women, 15-30 years women, women working in the public sector, and non public sector respectively. For the full sample we can see that the average number of children is 3.75 per women, 69% are married, 69% are Christians, 20% are Muslims, 49% are matrilineal, 29% partially completed primary school, 11% completed primary school , 17% have high school education. For 45+ plus women, 67% are married whiles for 15-30years women 57%. Equal proportions of both sub samples are Christians and Muslims. 49% of both samples are matrilineal. For public and non public sector workers 69% of both groups are married. Also, as can be seen from figure 1, that average fertility has been declining across all age groups. However, the decline is sharper and steeper for women 45+ after 2010 which is the year of the reform.

6 Results

Table 2 reports the long-run impact of the Act 766 pension reform on fertility, (ie.) the total number of children. In column (1) we wanted to see how total fertility has evolved overtime, thus before and after the policy reform. Hence we estimated a regression using a sample of only 45+ women before and after the policy. The coefficient of interest is that on Post, which is negative and statistically significant at 1%. This implies that on average there is a reduction in the number of children by 0.58 after the policy reform. In column (2) we considered the women 45+ as the treated group compared to women between 15-30years as the control group. The coefficient of interest is on the interaction term $Treat \times Post$, which is negative and statistically different from zero at 1%. This indicates that women 45+ had 0.67 less children than women between 15-30 years after the reform was passed. We then included

Table 1: Descriptive Statistics

	Full sample				
Variables	Mean	45plus	(15-30)	Public sector	Non-Public Sector
Total Number of Children	3.75	5.61	2.27	2.44	3.78
preg12	0.16	0.02	0.27	0.14	0.16
Age	33.97	47.07	23.61	33.72	33.90
Married	0.69	0.67	0.59	0.69	0.69
No religion	0.03	0.04	0.03	0.01	0.03
Catholic	0.14	0.15	0.14	0.22	0.14
Protestant	0.14	0.17	0.13	0.23	0.28
Charismatic	0.29	0.26	0.30	0.33	0.12
Other Christian	0.12	0.11	0.12	0.09	0.20
Islam	0.20	0.16	0.22	0.11	0.08
Other Religion	0.07	0.10	0.06	0.01	0.49
Matrilineal	0.49	0.49	0.49	0.54	0.39
No Education	0.39	0.49	0.31	0.05	0.49
Partially completed Primary	0.29	0.19	0.36	0.06	0.30
Primary Completed	0.11	0.01	0.15	0.04	0.11
HighSchool	0.17	0.26	0.13	0.25	0.16
Vocational	0.04	0.03	0.04	0.37	0.03
Tertiary	0.01	0.01	0.01	0.23	0.01
Not Working	0.16	0.13	0.23	0.01	0.17
Self Employed	0.76	0.80	0.69	0.02	0.78
Paid Employee	0.08	0.07	0.08	0.97	0.06
wave4	0.11	0.07	0.10	0.01	0.11
wave5	0.15	0.12	0.14	0.10	0.15
wave6	0.30	0.24	0.27	0.10	0.30
wave7	0.44	0.57	0.49	0.53	0.44
WesternRegion	0.09	0.09	0.10	0.10	0.09
CentralRegion	0.09	0.10	0.09	0.12	0.09
GreaterRegion	0.10	0.10	0.08	0.14	0.09
VoltaRegion	0.10	0.10	0.09	0.08	0.10
EasternRegion	0.09	0.10	0.09	0.09	0.09
AshantiRegion	0.12	0.11	0.12	0.13	0.12
BrongAhRegion	0.09	0.08	0.09	0.10	0.09
UpperEastRegion	0.09	0.10	0.10	0.08	0.09
UpperWestRegion	0.10	0.11	0.09	0.11	0.10
NorthernRegion	0.13	0.10	0.14	0.05	0.13
Quintiles1	0.29	0.28	0.25	0.06	0.29
Quintiles2	0.21	0.21	0.21	0.10	0.21
Quintiles3	0.18	0.18	0.19	0.12	0.18
Quintiles4	0.17	0.17	0.18	0.22	0.18
Quintiles5	0.15	0.16	0.17	0.50	0.15

controls to the estimation as can be seen in column (3), the effect increased to 0.83 and is statistically significant at 1%. We wanted to see the impact at the granular level, hence we then split the sample into working, married and non-married which can be seen in columns (4), (5), and (6) respectively. For the working sample there has been a reduction of 0.72 children, 0.69 for married and for non-married 1.17 all statistically significant at 1% [2]. The results show a stronger effect for non-married women, and this can be explained by the fact that unlike married women who have the financial support of their husband and therefore have more financial security. But non-married women are more financially precarious and hence the extension of the generous pension is gives them more financial relief causing the impact to be bigger. In columns (7) and (8) we estimated the impact of the policy on the total number of boys and girls respectively. We see that the reduction has been proportionate about 0.42 and 0.40 less boys and

[2] This shows that there has been a decline in both marital and non marital fertility although the decline in non marital fertility is higher

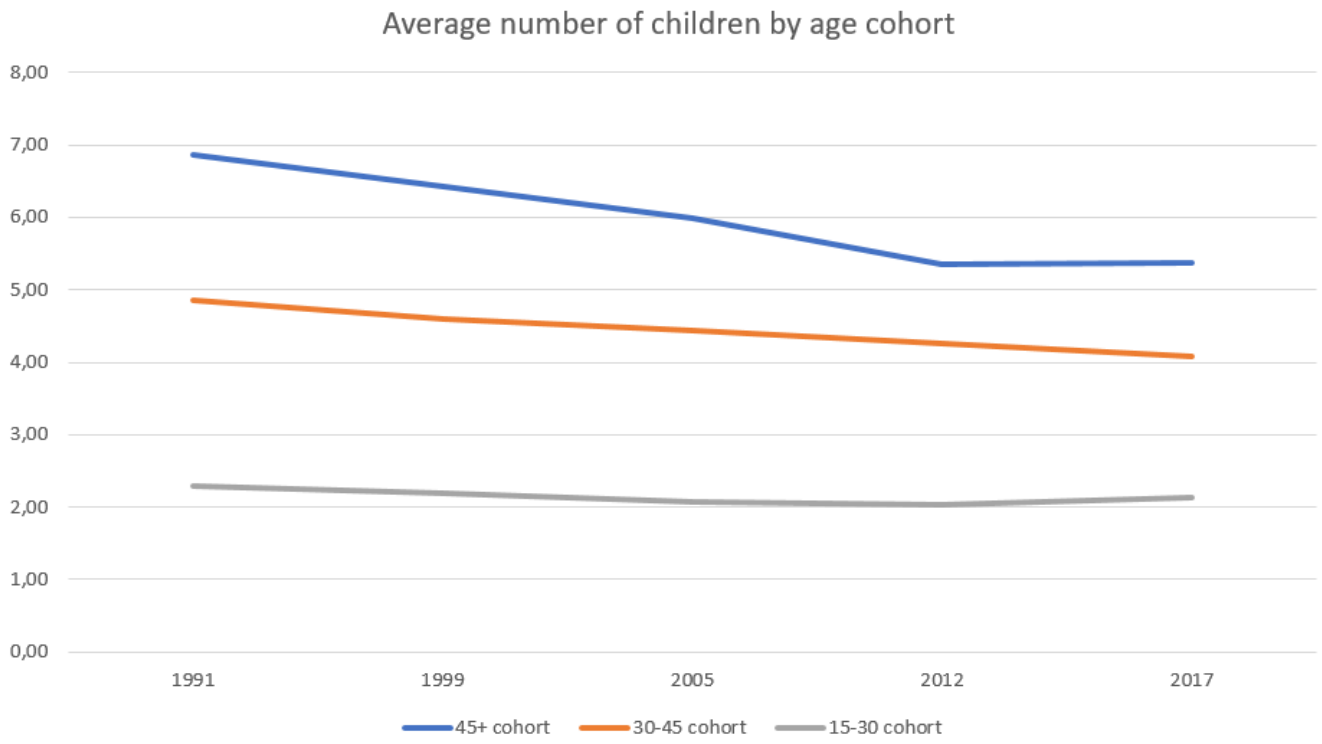


Fig. 2
Notes:This figure shows the average number of children by age cohorts
Author's own construct from GLSS data.

girls respectively, after the reform.

In table 3 we present the short run effect of the pension reform on fertility. Here we looked at the probability of getting pregnant in a twelve month period before and after the policy. Each column represents a different model specification. In column (1) we use a sample of women between the ages of 15-44 in the non- public sector as the treatment group and women in the public sector as the control group. We estimated the model without including control variables and the results indicate that after the policy reform the probability of getting pregnant in a given year reduced by 9 percentage points, and significant at 5%. In column (2) we included control variables and the probability of getting pregnant reduced by by 15 percentage points which is significant at 1%. We then split the sample into different age cohorts, (i.e) young (15-29) and middle age (30-44). We see that there has been a decline in the probability of getting pregnant in both age groups after the reform. For example, in column (3) the probability of non-public sector women within the age of 15-29 years getting pregnant in a year reduced by 13 percentage points and significant at 10%. For women between 30-44 in column 4, the probability reduced by 14 percentage points and statistically significant at 1%.

7 Mechanisms

Here we disentangle the potential forces propelling the decline in fertility in Ghana. The existing literature reveal that there are plethora factors that could be behind the declining fertility such as increase in the literacy rate

Table 2: Long-run Impact of Pension Reform on Fertility

Dep Variable :	Number of Children						Number of Boys	Number of Girls
	45plus	All women	All women	Working	Married	NonMarried		
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Post	-0.58 ***							
	(0.16)							
Treat×*Post*		-0.67 ***	-0.83 ***	-0.72***	-0.69***	-1.17***	-0.42 ***	-0.40***
		(0.11)	(0.09)	(0.16)	(0.11)	(0.17)	(0.05)	(0.08)
Controls	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Regions FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.22	0.41	0.52	0.46	0.55	0.46	0.33	0.33
Observation	4,412	16,419	15,891	1,256	12,353	3,538	15,887	15,891

Notes: This table reports the long-run impact of the Act 766 reform on fertility. The outcome variable for columns (1-6) is the total number of children. For column (7-8) it's the number of boys and number of girls respectively. All estimates except column 2, include individual characteristics such as Age, Marital Status, Educational Level, Religion, Employment status, Father live in Household, Mother live in Household, regional fixed effects include 9 dummies for region of residence and time fixed effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Short-run Impact of Pension Reform on Fertility

Dep Var:	Pregnant in the Last 12 Months					
	15-44	15-44	15-29	30-44	Married	Non-Married
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)
Nonpublic×*Post*	-0.09 **	-0.15 ***	-0.13 *	-0.14***	-0.18***	-0.07
	(0. 04)	(0.03)	(0.07)	(0.03)	(0.04)	(0.05)
Controls	No	Yes	Yes	Yes	Yes	Yes
Regions FE	No	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes
R-squared	0.01	0.08	0.05	0.05	0.07	0.07
Observation	29,045	23,941	8,752	15,189	19,479	4,771

Notes: This table reports the short-run impact of the Act 766 reform on fertility.
The outcome variable for columns (1-6) is have you been pregnant in the last 12 months.
and the treated category is non-public sector workers and public sector workers as control
All estimates except column 1, include individual characteristics such as Age, Marital Status
Educational Level, Religion, Employment status, Father live in Household, Mother live in
Household, regional fixed effects include 9 dummies for region of residence and time fixed
effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$,
** $p < 0.05$, *** $p < 0.01$

of women, the use of contraceptives, increase in the opportunity cost of rearing children, and transition in social economic status among others, Bryant (2007). As can be seen in table 4 that the use of contraceptive does not seem to be the mechanism through which fertility have been declining post 2010.

8 Heterogeneous Effects

There are two major family systems in Ghana, namely, the patrilineal system where kinship is passed through the fathers lineage. And the matrilineal where kinship is passed to the mothers lineage. Each system practices different customs when it comes to taking care of old age parents. Under the patrilineal and patrilocal family systems, sons are considered key to old age support. And parents live with their sons after they get married. The opposite is

Table 4: Mechanisms: Use of Contraceptive

Dep Variable :	Birth Control						
	All women	All women	Working	Married	NonMarried	15-29	30-44
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Treat×*Post*	0.01		-0.05				
	(0.01)		(0.06)				
Nonpublic×*Post*		0.01		0.14	-0.15 *	-0.25***	0.07
		(0.10)		(0.18)	(0.04)	(0.05)	(0.11)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.09	0.05	0.10	0.07	0.05	0.10	0.06
Observation	19,758	21,431	1,590	9,009	12,353	14,027	16,412

Notes: This table reports the use of contraceptives as a mechanism to fertility decline. The outcome variable for columns (1-6) is the tot number of children. For column (7-8) it's the number of boys and number of girls respectively. All estimates except column 2, include individual characteristics such as Age, Marital Status, Educational Level, Religion, Employment status, Father live in Household, Mother live in Household, regional fixed effects include 9 dummies for region of residence and time fixed effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

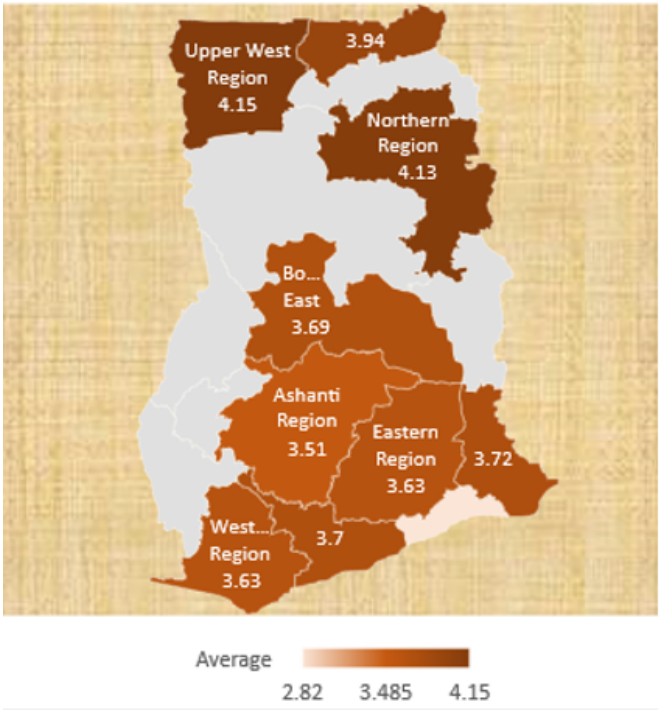
through for matrilineal culture where daughters are key to old age security. In Ghana the Akan ethnic group are matrilineal and they are comprised of the Akims, the Asantes, the Fantes, Akuapims, Kwahus, and the Denkyiras sub ethnic groups. Which are located in the central south of the country. This can be seen in figure 3, the regions with less thick colours are the matrilineal and the very thick shading are the patrilineal groups. This figure shows that there exist heterogeneous fertility across the two cultures, with the patrilineal culture having a high fertility rate.

Similarly, there exists two major religions in Ghana, Christianity with forms about 59% of our sample and Islamic region with is 20% of our sample. This two religions have different beliefs around marriage and child bearing which in turn will affect their levels of fertility. Christians are mostly monogamous while Muslims are polygamous and have high early marriages.

We used triple difference in difference to estimate heterogeneous effects across cultural practices (matrilineal verses patrilineal culture) and religious affiliations (Christians verses Muslims).

8.1 By Patrilineal and Matrilineal Culture

In table 4, we present the results on the heterogeneous effects of Acts 766 along cultural practices in Ghana. The coefficient of interest is the one on the interaction term $Matrilineal \times Treat \times Post$. From column (1) the results show that women from matrilineal culture reduced their total number of children by 0.57 as compared to their patrilineal counterparts. For the total number of boys the was a reduction of 0.35 boys as can be seen in column 2. And for the total number of girls there was a reduction of 0.23 girls after the policy reform all of which are significant at 1%. In column the coefficient is not significant. for the short run dependent of variable. This is either because there are no heterogeneous effects or it cannot be precisely estimated due to very few samples of the public



Author's own construct from GLSS data.

Fig. 3

Notes:This figure shows the average number of children by regions in Ghana

sector- matrilineal interactions.

8.2 By Religion

Table 5 captures the heterogeneous impact of the policy by religious affiliation both in the long run and the short run. In column (1), for Christians there has been a decrease of 0.73 children after Act 766 was passed as compared to Muslims. For total number of boys and girls the decrease was 0.37 and 0.34 in columns (2) and (3) respectively which are all significant at 1%. The coefficient of $Christian \times Treat \times Post$ in the short run is not significant. This is either because there are no heterogeneous effects or it cannot be precisely estimated due to very few samples of the public sector- Christian interactions.

9 Robustness Checks

Results are largely consistent across specifications with different sample restrictions. Excluding the 5th income percentile which are likely to have oldage support o income even without government pensions reported tables 7, and 8. Estimation without the Greater Accra region presented in tables 9, and 10 in the appendix. We also included birth control (contraceptive use) and the results are largely similar to the main result.

Table 5: Heterogeneous Impact of Pension Reform on Fertility by Culture

	Number of Children	Number of Boys	Number of Girls	Pregnant in the last 12 months
Variable	(I)	(II)	(III)	(IV)
Matrilinear $\times Treat \times Post$	-0.57 ***	-0.35 ***	-0.23 ***	-0.004
	(0.13)	(0.07)	(0.10)	(0.01)
Controls	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R-squared	0.50	0.31	0.30	0.09
Observation	13, 514	13,510	13, 514	21,439

Notes: This table reports the heterogeneous impact of the Act 766 reform on fertility both in the short run and in the long run. The outcome variable for columns (1) is number of children, column (2) number of boys, column (3) number of girls, column (4) is have you been pregnant in the last 12 months. and the treated category is 45+ women from column (1-3) non-public sector workers for column (4). All estimates individual characteristics such as Age, Marital Status Educational Level, Religion, Employment status, Father live in Household, Mother live in Household, regional fixed effects include 9 dummies for region of residence and time fixed effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$,** $p < 0.05$, *** $p < 0.01$

Table 6: Heterogenous Impact of Pension Reform on Fertility by Religion

	Number of Children	Number of Boys	Number of Girls	Pregnant in the last 12 months
Variable	(I)	(II)	(III)	(IV)
Christian $\times Treat \times Post$	-0.7 ***	-0.37***	-0.34 ***	-0.02
	(0.09)	(0.05)	(0.09)	(0.01)
Controls	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R-squared	0.51	0.31	0.31	0.08
Observation	13,514	13,510	13,514	21, 439

Notes: This table reports the heterogeneous impact of the Act 766 reform on fertility both in the short run and in the long run. The outcome variable for columns (1) is number of children, column (2), number of boys, column (3) number of girls, and column (4) is have you been pregnant in the last 12 months. The treated category is 45+ women from column (1-3) non-public sector workers for column (4). All estimates individual characteristics such as Age, Marital Status Educational Level, Religion, Employment status, Father live in Household, Mother live in Household, regional fixed effects include 9 dummies for region of residence and time fixed effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$,** $p < 0.05$, *** $p < 0.01$

10 Conclusion

This study contributes to the growing literature on the nexus between pension policy and fertility response. We exploit the Act 766 pension reform in Ghana and the results indicate that extending a more generous pension benefits has a significant negative impact on total completed fertility and probability of getting pregnant in a year, thus declining fertility both in the long run and short- run. The negative effect is similar for total number of boys and girls, and the impact persists along different domains, such as working sample, married and non married individuals, religion and culture. Particularly, there was an overall decline in marital and non marital fertility. The results also indicate that policies have different impact depending on culture. For policy implication, the results suggest that providing social safety net, specifically, old age insurance can help reduce population growth in developing countries.

Table 7: Long-run without the 5th Quintile

Dep Variable :	Number of Children						Number of Boys	Number of Girls
	45plus	All women	All women	Working	Married	NonMarried		
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Post	-0.85 ***							
	(0.25)							
Treat×*Post*		-0.87 ***	-0.82 ***	-0.78***	-0.68***	-1.27***	-0.44 ***	-0.39***
		(0.07)	(0.10)	(0.20)	(0.11)	(0.23)	(0.07)	(0.10)
Controls	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Regions FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.20	0.43	0.55	0.47	0.57	0.46	0.35	0.33
Observation	2,924	13,044	12,575	779	9,963	2,612	12,571	12,575

Notes: This table reports the long-run impact of the Act 766 reform on fertility. The outcome variable for columns (1-6) is the total number of children. For column (7-8) it's the number of boys and number of girls respectively. All estimates except column 2, include individual characteristics such as Age, Marital Status, Educational Level, Religion, Employment status, Father live in Household, Mother live in Household, regional fixed effects include 9 dummies for region of residence and time fixed effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Short-run without the 5th Quintile

Dep Var:	Pregnant in the Last 12 Months					
	15-44	15-44	15-29	30-44	Married	Non-Married
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)
Nonpublic×*Post*	-0.02 ***	-0.17 ***	-0.06 *	-0.15***	-0.16***	-0.13
	(0. 01)	(0.02)	(0.03)	(0.02)	(0.03)	(0.04)
Controls	No	Yes	Yes	Yes	Yes	Yes
Regions FE	No	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes
R-squared	0.00	0.08	0.05	0.05	0.07	0.08
Observation	23,531	19,985	7,380	12,605	16,297	3,688

Notes: This table reports the short-run impact of the Act 766 reform on fertility.
The outcome variable for columns (1-6) is have you been pregnant in the last 12 months.
and the treated category is non-public sector workers and public sector workers as control
All estimates except column 1, include individual characteristics such as Age, Marital Status
Educational Level, Religion, Employment status, Father live in Household, Mother live in
Household, regional fixed effects include 9 dummies for region of residence and time fixed
effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$,
** $p < 0.05$, *** $p < 0.01$

11 Appendix

Table 9: Long-run without Greater Accra region

Dep Variable :	Number of Children						Number of Boys	Number of Girls
	45plus	All women	All women	Working	Married	NonMarried		
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Post	-0.86 ***							
	(0.23)							
Treat×*Post*		0.88 ***	-0.80 ***	-0.75***	-0.63***	-1.28***	-0.40 ***	-0.40***
		(0.07)	(0.11)	(0.26)	(0.11)	(0.18)	(0.07)	(0.10)
Controls	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Regions FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.21	0.43	0.54	0.50	0.58	0.48	0.34	0.33
Observation	3,132	13,044	13,707	928	10,796	2,916	13,703	13,707

Notes: This table reports the long-run impact of the Act 766 reform on fertility. The outcome variable for columns (1-6) is the total number of children. For column (7-8) it's the number of boys and number of girls respectively. All estimates except column 2, include individual characteristics such as Age, Marital Status, Educational Level, Religion, Employment status, Father live in Household, Mother live in Household, regional fixed effects include 9 dummies for region of residence and time fixed effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Short-run without Greater Accra region

Dep Var:	Pregnant in the Last 12 Months					
	15-44	15-44	15-29	30-44	Married	Non-Married
Variable	(I)	(II)	(III)	(IV)	(V)	(VI)
Nonpublic×*Post*	-0.02 **	-0.13 ***	-0.06 *	-0.13***	-0.18***	-0.06
	(0.005)	(0.03)	(0.03)	(0.03)	(0.03)	(0.06)
Controls	No	Yes	Yes	Yes	Yes	Yes
Regions FE	No	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes
R-squared	0.01	0.09	0.06	0.06	0.08	0.08
Observation	23,531	21, 634	8,069	13,565	17,480	4,154

Notes: This table reports the short-run impact of the Act 766 reform on fertility.
The outcome variable for columns (1-6) is have you been pregnant in the last 12 months.
and the treated category is non-public sector workers and public sector workers as control
All estimates except column 1, include individual characteristics such as Age, Marital Status
Educational Level, Religion, Employment status, Father live in Household, Mother live in
Household, regional fixed effects include 9 dummies for region of residence and time fixed
effects. Robust standard errors clustered at the regional level are in parentheses. * $p < 0.10$,
** $p < 0.05$, *** $p < 0.01$

References

Agbaglo, E., Agbadi, P., Tetteh, J. K., Ameyaw, E. K., Adu, C., and Nutor, J. J. (2022). Trends in total fertility rate in ghana by different inequality dimensions from 1993 to 2014. *BMC women's health*, 22(1):49.

Alesina, A. and Fuchs-Schündeln, N. (2007). Good-bye lenin (or not?): The effect of communism on people's preferences. *American Economic Review*, 97(4):1507–1528.

Allendorf, K. (2015). Fertility decline, gender composition of families, and expectations of old age support. *Population research and policy review*, 34:511–539.

Banerjee, A., Meng, X., and Qian, N. (2010). The life cycle model and household savings: Micro evidence from urban china. *National Bureau of Demographic Dividends Revisited*, 21:21.

Bau, N. (2021). Can policy change culture? government pension plans and traditional kinship practices. *American Economic Review*, 111(6):1880–1917.

Becker, G. S. (1960). An economic analysis of fertility. In *Demographic and economic change in developed countries*, pages 209–240. Columbia University Press.

Becker, G. S., Murphy, K. M., and Tamura, R. (1990). Human capital, fertility, and economic growth. *Journal of political economy*, 98(5, Part 2):S12–S37.

Boldrin, M., De Nardi, M., and Jones, L. E. (2015). Fertility and social security. *Journal of Demographic Economics*, 81(3):261–299.

Boldrin, M. and Jones, L. E. (2002). Mortality, fertility, and saving in a malthusian economy. *Review of Economic Dynamics*, 5(4):775–814.

Bryant, J. (2007). Theories of fertility decline and the evidence from development indicators. *Population and development review*, pages 101–127.

Cai, F., Giles, J., and Meng, X. (2006). How well do children insure parents against low retirement income? an analysis using survey data from urban china. *Journal of public Economics*, 90(12):2229–2255.

Cigno, A., Casolaro, L., and Rosati, F. C. (2002). The impact of social security on saving and fertility in germany. *FinanzArchiv/Public Finance Analysis*, pages 189–211.

Cigno, A. and Rosati, F. C. (1996). Jointly determined saving and fertility behaviour: theory, and estimates for germany, italy, uk and usa. *European Economic Review*, 40(8):1561–1589.

Danzer, A. M. and Zyska, L. (2023). Pensions and fertility: Microeconomic evidence. *American Economic Journal: Economic Policy*, 15(2):126–165.

Dasgupta, P. (1993). *An inquiry into well-being and destitution*. Clarendon Press.

Ebenstein, A. and Leung, S. (2010). Son preference and access to social insurance: evidence from china's rural pension program. *Population and Development Review*, 36(1):47–70.

Ehrlich, I. and Kim, J. (2007). Social security and demographic trends: Theory and evidence from the international experience. *Review of Economic Dynamics*, 10(1):55–77.

Fenge, R. and Scheubel, B. (2017). Pensions and fertility: back to the roots: Bismarck's pension scheme and the first demographic transition. *Journal of Population Economics*, 30:93–139.

Gábos, A., Gál, R. I., and Kézdi, G. (2009). The effects of child-related benefits and pensions on fertility by birth order: A test on hungarian data. *Population studies*, 63(3):215–231.

Galasso, V., Gatti, R., and Profeta, P. (2009). Investing for the old age: pensions, children and savings. *International tax and public finance*, 16:538–559.

Gustafsson, S. (2001). Optimal age at motherhood. theoretical and empirical considerations on postponement of maternity in europe. *Journal of population economics*, 14:225–247.

Gustafsson, S. (2005). Having kids later. economic analyses for industrialized countries. *Review of Economics of the Household*, 3:5–16.

Holmqvist, G. (2011). Fertility impact of high-coverage public pensions in sub-saharan africa. *Global Social Policy*, 11(2-3):152–174.

Jensen, R. T. (2004). Do private transfers 'displace'the benefits of public transfers? evidence from south africa. *Journal of Public Economics*, 88(1-2):89–112.

La Ferrara, E. and Milazzo, A. (2017). Customary norms, inheritance, and human capital: evidence from a reform of the matrilineal system in ghana. *American Economic Journal: Applied Economics*, 9(4):166–185.

Leibenstein, H. (1957). The theory of underemployment in densely populated backward areas. *Economic backwardness and economic growth*.

Miyazaki, K. (2013). Pay-as-you-go social security and endogenous fertility in a neoclassical growth model. *Journal of Population Economics*, 26:1233–1250.

Nguyen-Dinh, H. (1997). A socioeconomic analysis of the determinants of fertility: The case of vietnam. *Journal of Population Economics*, 10:251–271.

Oliveira, J. (2016). The value of children: Inter-generational support, fertility, and human capital. *Journal of Development Economics*, 120:1–16.

Rossi, P. and Godard, M. (2022). The old-age security motive for fertility: evidence from the extension of social pensions in namibia. *American Economic Journal: Economic Policy*, 14(4):488–518.

Shen, Z., Zheng, X., and Yang, H. (2020). The fertility effects of public pension: Evidence from the new rural pension scheme in china. *Plos one*, 15(6):e0234657.

Wigger, B. U. (1999). Pay-as-you-go financed public pensions in a model of endogenous growth and fertility. *Journal of Population Economics*, 12:625–640.

Zhang, J. and Zhang, J. (2004). How does social security affect economic growth? evidence from cross-country data. *Journal of population Economics*, 17:473–500.