Effects of knowledge, acceptance and use of contraceptives on household wealth in 26 African Countries

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Abstract

This paper uses path analysis on a newly built district panel database to examine the effects of family planning factors, through their effects on fertility levels, on aggregate household wealth in 26 African countries. The results show that wealth accumulation in a district increases as the number of births decreases, that an increase in use of contraceptives is associated with a reduction in the number of births, and that the increase in contraceptive use is higher in districts with more knowledge and growing acceptance of contraceptives. Information campaigns are also important through their effects on the knowledge women have of contraceptives. A key role is played by the district’s educational level, with the effects of all family planning factors being stronger in areas with a higher educated adult population.

Keywords
Contraceptive use, fertility, wealth accumulation, district panel, path analysis, Africa

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Introduction

Family planning (FP) plays a pivotal role in population control, poverty reduction, and human development. Robust FP services have a range of benefits, including maternal and infant survival, better nutrition, increased educational attainment, a stronger position of girls and women at home and in society, prevention of sexually transmittable diseases (STDs), and environmental conservation (Bernstein & Hansen, 2006; Griffin, 2006; World Bank, 2004; author’s reference). FP is also a prerequisite for achieving the United Nations’ Millennium Development Goals and for realizing the human right of reproductive choice (Allen, 2007).

Much research has already been conducted on how FP affects health, but much less is known on the effects of FP on the economic situation of households and regions (e.g. Cleland et al., 2006; Singh et al., 2009; Smith et al., 2009). It seems obvious that smaller families, resulting from effective use of FP services, have lower expenses on children and therefore can more easily make ends meet and have higher potential for making savings and investments (Montgomery & Lloyd, 1999; Gillespie et al., 2007; Channon et al., 2010). However the available evidence on the link between FP outcomes and wealth accumulation is still restricted (Greene & Merrick, 2005). There are a number of small-scale studies indicating that through the long-term commitment to FP and maternal-child health, families have more assets and live in better houses (Eastwood & Lipton, 2001; Paes de Barros et al., 2001; Joshi & Schultz, 2007; Adeoti et al., 2009), but broad comparative research on the importance of the various aspects of FP for wealth accumulation and economic growth of regions is still largely lacking.

Such research is particularly needed for Africa, where fertility levels are still very high compared to Asia and Latin America (Bongaarts & Sinding, 2011). Several factors have contributed to this, such as poverty, low education, high child mortality, and the fact that in most African countries FP is low on the political agenda (Blanc & Tsui, 2005; Cleland et al., 2006). For these reasons, Africa’s population has more than quadrupled between 1950 and 2010 and is expected to double again by 2050. The demographic trends in Sub-Saharan Africa have raised concerns about its potential adverse impact on health, social and economic development and the environment (May, 2012).

This paper aims to contribute to the field by presenting a comparative analysis of the relationships between major FP variables and wealth accumulation in 26 African countries. Using an area panel database and applying path analysis, we study the effects of information
campaigns and of knowledge, acceptance and use of contraceptives -- through their effects on the number of births -- on changes in the aggregated household wealth within 462 sub-national areas of the 26 countries. The sub-national areas in most cases are official administrative geographic subdivision of the countries. For these areas different names may be used (states, provinces, regions, districts, governorates,…). Here we use the term ‘district’.

Our research contributes to the literature in several important ways. First, we use a unique new area panel dataset aggregated from Demographic Health Surveys (DHS) that allows us to use a panel design on these basically cross-sectional data. As the 462 sub-national areas are observed at two or more points in time, we can relate changes over time in the central variables to each other. This use of panel data is an improvement over earlier studies, which were mostly cross-sectional in nature and hence had less possibilities to assess the direction of effects.

Second, the use of data at the (sub-national) area level has the additional advantage that this level is more of interest to policy makers than the household level. Investments in FP services are tailored towards specific regions and economic growth is also a regional phenomenon. Third, our research is comparative in nature and covers data for 26 countries from all regions of Africa. It therefore provides a more representative picture than most earlier studies that focused on specific countries or sub-national regions. Fourth, we apply path analysis to investigate the chain of causal relationships between major FP variables and wealth accumulation within the African districts. Path analysis allows us to estimate the total contribution of each of the FP variables to wealth accumulation at the district level (compare author’s reference).

With our analyses we aim to answer the following research questions:
(1) To what extent are changes in household wealth in districts of African countries related to changes in fertility within those districts?
(2) To what extent are changes in number of births in districts of African countries related to changes in effective contraceptive use within those districts?
(3) To what extent are changes in contraceptive use in districts of African countries related to changes in knowledge and acceptance of modern contraceptives within those districts?
(4) How are knowledge and acceptance of contraceptives related and what is the role of information campaigns?

In the following section, we first describe our theoretical framework and discuss the expected effects of the major factors included in it. Thereafter the data and methods used in this
study are discussed. In the results section, the estimated coefficients of our path models are presented. Both direct, indirect and total effects of the independent variables on wealth accumulation are presented. In the final section, the major findings are summarized and discussed. In that section also arguments for a causal interpretation of the findings are provided.

The model
Figure 1 presents the theoretical model that we have developed to study the pathways through which FP influences wealth accumulation in districts of African countries. The central variables of the model are (changes in) acceptance of contraceptives, actual use of contraceptives, number of births, and wealth accumulation. The model assumes that if acceptance of contraceptives is higher in a region, there will be a boost in actual contraceptive use by women who want to control their pregnancies. This increased use will lead to a better FP situation (lower prevalence of unwanted pregnancies and increased birth spacing; thus a reduction in number of births) in the district. This better FP situation will allow couples to invest more in assets and to save money, which – over time – will contribute to poverty reduction and economic growth.

Figure 1. about here

Number of births and household wealth
We expect that increases in household wealth in a district are stimulated by improvements in the FP situation of households through several pathways: reduction in the number of births, better spacing of births, and fewer pregnancies. Fewer births and appropriate birth spacing reduce the risk of child mortality, stunting and being underweight of children, and improves the health status of their mothers (Yigzaw & Enquasellassie, 2010; Maitra & Pal, 2008; Whitworth & Stephenson, 2002; Ronsmans, 1996; Rutstein, 2005). Reduction in the number of births may also stimulate investments in human capital and family savings (author’s reference; Smith & Ward, 1980).

Several studies indicate that families that use FP have more assets, live in more valuable houses and have better educated children (e.g. Eastwood & Lipton, 2001; Paes de Barros et al., 2001; Adeoti et al., 2009). Evidence from Thailand indicates that reducing family size has positive effects on a couple’s ability to accumulate wealth and participate in new forms of
consumption (Havanon et al., 1990). Joshi & Schultz (2007) provide evidence for Bangladesh that long-term investments in FP programs may increase economic security for families, households, and communities, because it leads to higher incomes, greater accumulation of wealth, and higher levels of education. However, not all studies that have been done find positive effects of FP on household wealth. Some studies found the number of children to correlate negatively with the economic well-being of the family or the direction of the effect to depend on the life-cycle stage of the parents and children, as well as on the existing social settings (Kunovich, 2003; Scholz & Seshadri, 2007; Schultz 2004; 2005).

The presence of young children and pregnancy of the mother may negatively influence women’s possibilities to engage in paid employment through a higher care need and because pregnant women in poor countries are prone to different types of morbidities (UNFPA, 2005; Liu, 2004; author’s reference). Among families with children, wealth may also vary according to family phase and type, with couples with children aged 15 to 24 showing the highest wealth levels and lone parents with young children the lowest (Baekgaard, 1998; Northwood et al., 2002). In this paper, the district’s FP situation is indicated by the average number of children under age six in the district’s households. We expect a higher number of young children to increase expenditures of households and reduce their saving capabilities, and thus to be associated with lower household wealth.

**Contraceptive use and number of births**
The FP situation of a household, as discussed in the preceding section, is expected to be influenced by the actual use the parents make of FP services, in particular their contraceptive use. If no contraceptives or less effective traditional methods are used, preferred FP outcomes are more difficult to achieve. Unfortunately, FP has steadily decreased as an international priority in recent years (Gribble & Haffey, 2008). This is regrettable, as the benefits of FP reach far beyond the individual level for women and their families. Women who can plan the number and timing of their births enjoy improved health, are less likely to have an abortion, and have more educational and employment opportunities, which may enhance their social and economic status and improve their well-being (Shrestha & Manandhar, 2003; Barnett & Stein, 1998; Singh et al., 2004; author’s reference).
To achieve these benefits, it is important that women have access to a wide range of contraceptive methods at all stages of their reproductive lives. However, in Sub-Saharan Africa, only 21% of married women are using FP (Gribble & Haffey, 2008), whereas 24% of women report having an “unmet need” for FP (Sedgh et al., 2007). The most frequently mentioned reason for not using contraceptives by women with unmet need were fear of side effects, health concerns, and inconvenience of use (Sedgh et al., 2007), all reasons that point towards lack of knowledge and restricted acceptance of FP. These factors are therefore also included in our model. They will be discussed in the next section.

**Knowledge, acceptance and use of contraceptives**

The actual use of contraceptives at the household level depends besides on the availability of accessible FP services in the local environment, on the knowledge people have of FP measures, and their attitudes towards (acceptance of) these services (Emens, 2008; Pebley & Brackett 1982; Mahmood & Ringheim 1996; author’s reference). A lack of knowledge of FP sources and methods is often cited as a key variable in determining contraceptive use (Bongaarts & Bruce, 1995; Casterline & Sinding, 2000; Korra, 2002). It is expected that the more people know about and accept modern contraceptives, the more they will use them (see Figure 1). Knowledge of contraceptives is considered one of the essential factors associated with effective use of these methods. Biney (2011) observed that lack of knowledge about contraceptives among Ghanaian women led to failure of contraceptive use which in turn led to unintended pregnancies and induced abortions. Similarly, Lindstrom & Hernandez (2006) found that limited knowledge of contraceptive methods among recent rural-urban migrants in Guatemala was associated with unmet need and limited choice of contraceptives.

Knowledge about contraceptives and their side effects may affect their actual use also indirectly, through its effect on the attitudes people have regarding contraceptive use (Easterlin & Crimmins 1985; Chipeta et al., 2010; Fikree et al. 2001; Smith, 2002). Nigerian women with positive attitudes towards contraception (i.e. those who approved FP and those who discouraged early marriages) were found to use contraceptives more than other women (Odimegwu, 1999). Zabin et.al. (1993) further showed in their study on the relationship between attitude and behaviour among adolescents in Baltimore that positive attitudes towards contraception had a significant effect on contraceptive use. Davidson and Jaccard (1979) also provide evidence that
married women’s attitudes towards birth control are positively correlated to their actual use and author’s reference found district-level use of contraceptives to be positively affected by knowledge and acceptance of contraceptives in African countries.

**Information campaigns**
There is evidence that FP messages through media may play an important role in increasing the knowledge of FP methods and through this increased knowledge also their acceptance and use, especially in those areas where the literacy level is low (Easterlin & Crimmins, 1985; Saluja et al., 2011; Fikree et al., 2001). Several empirical studies have shown that mass media campaigns may lead to behavioural changes and in this way reduce fertility (Olaleye & Bankole, 1994; Jato et al., 1999; Agha & Van Rossem, 2002; Das Gupta et al., 2003, Islam & Kabir, 2000; Cheng 2011, Rabbi, 2012). For example, in Bangladesh, mass media exposure was found to be a significant differential of fertility, even after controlling for the effects of contraception and socio-economic status (Rabbi, 2012). Cheng (2011) established that in Taiwan mass media and social networks played important roles in disseminating contraceptive knowledge and that women transformed this knowledge into behaviour - that is, contraceptive knowledge reduced fertility. Another study in Pakistan showed that people who had exposure to condom advertisements on radio or TV experienced increases in the following areas: perceived availability of contraceptives, discussion of FP, approval of FP, and procurement of contraceptives (Agha & Meekers, 2010).

**Control factors**
Besides the variables of interest, our model contains two control factors that are known or expected to influence wealth accumulation, fertility changes and use and knowledge of FP services. The first control factor is education. Education provides people with the knowledge and skills they need to live better lives. One extra year of schooling may increase an individual’s earnings by up to 10% (UNESCO, 2011). Education of women is one of the key factors driving fertility reduction. Women with higher levels of education are more likely to delay and space their pregnancies and to seek health care and support (UNESCO, 2011). Education influences women’s reproduction by increasing their knowledge of fertility, by increasing their socio-economic status, and by changing their attitudes towards fertility control (Castro & Juarez,
Education is also closely linked to the use of contraceptives: more educated women are more likely to use FP (Kasarda et al., 1986, Robey et al., 1992, Saleem & Bobak, 2005; Ainsworth et al., 1996; Rutenberg et al., 1991). A major pathway by which education influences women’s contraceptive use is through increasing their level of knowledge (Hemmings et al., 2008).

Besides individual education, also the educational level of the context in which one lives is important (Kravdal, 2002). There is evidence for African countries that access to education is an important determinant of wealth accumulation, with wealthy households being concentrated in areas where over half of heads received formal education (Burke et al., 2007; Burger et al., 2006). The education level of other people in the community may play a role through social learning and other indirect effects (Bongaarts & Watkins, 1996; Kohler et al., 2001; Montgomery & Casterline, 1996).

Another, closely related, characteristic of the context that may play a role is its level of urbanization. Women living in rural areas tend to use fewer contraceptives and have more children than their urban counterparts (Rutstein, 2005; Conde-Agudelo & Balizan, 2006). In the 1990s, urban fertility in Sub-Saharan Africa was on average almost 30% lower than rural fertility (Shapiro & Tambashe, 2000; Dudley & Pillet, 1998). More recently, African countries like Ethiopia still show very high fertility rates in rural areas, whereas fertility in the cities has decreased considerably (Tadesse & Headey, 2012). A major reason might be that the costs of children are higher in more developed and urban areas than in rural areas (Smith & Gozjolko, 2010).

Data and Methods

Data

Our hypotheses are tested on a newly built district panel dataset. The data are derived from a harmonized set of Demographic and Health Surveys (DHS) that were constructed as part of the “Database Developing World” project (www.datdevworld.org), in which household level datasets for many developing countries are connected and harmonized. The division of countries into sub-national regions (called ‘districts’ here) was made on the basis of the regional codes available in the datasets. These codes often, but not always, follow the major administrative
geographic divisions of the countries. The districts were for our analyses subdivided into urban and rural areas, on the basis of the urbanization variable available in the datasets.

We created a district-level panel dataset by aggregating variables from the household datasets to the district level. For each included country, data for two or more years were aggregated so that episodes were created over which changes within districts could be studied (compare author’s reference). Depending on the years in which the surveys were held, the duration of the episodes varied between three and six years, except for Morocco with an episode of 11 years. The study covers a time period of about two decades, covering the last decade of the 20th century and the first decade of the 21st century. The first year is 1992 (Morocco) and last year is 2011 (Ethiopia, Senegal and Zimbabwe). The aggregation was done separately for the urban and rural areas of the districts. As some districts were completely urban, the number of areas included in our analyses is less than twice the number of districts. Our district panel dataset contained data for 462 rural/urban areas of 237 districts within 26 African countries. For several countries, two episodes were available. The total number of cases (episodes) on which the analyses are run is therefore 731. Further information on the included countries, districts, and episodes is presented in Appendix A.

Method

The data are analysed using path analysis. Path analysis allows us to estimate the strength and sign of the assumed causal relationships in our model using multiple dependent variables (Wright, 1920; Li, 1975). Our path model contains one final dependent variable – change in wealth -- and several intermediate dependent variables – change in number of recent births, change in contraceptive use, and change in acceptance of contraceptives. A path model shows the nature and direction of causal relationships and includes estimates of the strength of those relationships, the path coefficients. To obtain the path coefficients, for each dependent variables a separate Ordinary Least Squares (OLS) regression analysis is performed. Path coefficients are the standardized regression coefficients of these models. The standardization acts to remove differences in scale among variables and to make them comparable. The path coefficients of the separate regression models can be combined to compute indirect and total effects of the independent variables on the dependent variable(s) of interest. Indirect effects are calculated by taking the product of the direct paths, while the total effect is the sum of direct and indirect
effects. To address the fact that the districts are nested within countries, all analyses are controlled for country level fixed effects by incorporating country dummies in the model.

**Measurement**

The major dependent variable in the model is the average annual change in household wealth in the district. Household wealth is used as a proxy for income and is measured by an index constructed on the basis of the mean of the standardized versions of six variables aggregated from our household datasets: the percentages of households in the district with a fridge, car, television, electricity, running water and flush toilet (compare author’s reference).

The independent variables used in the model are a number of district-level indicators, including number of recent births, contraceptive use, acceptance of contraceptives, knowledge of contraceptives, and discussion of contraception in the media. Number of recent births is the average number of children under six of women aged 20-40 in the district’s households at time of survey. Contraceptive use is the percentage of women using modern contraceptives among all women aged 25-40 who would like to use contraceptives and are sexually active in the district. Acceptance of contraceptives is the percentage of women in the district who stated they are not opposed to using contraceptives among all women aged 25-40 for whom contraceptives might be relevant (hence excluding those who never had sex, who did not want sex, who desired a birth, who were infecund or in menopause). Knowledge of contraceptives is the percentage of women aged 25-40 in the district who reported that they knew at least one method of modern contraceptives. Discussion of contraceptives in the media (media campaigns) is measured by the percentage of women in the district that heard about contraceptives on television and/or radio. Of the control factors, level of urbanization is measured by a dummy indicating whether (1) or not (0) the district is categorized as urban. District educational level is indicated by average number of completed education years of individuals aged 20 and over in the district.

For our dynamic variables -- wealth, number of recent births, contraceptive use, acceptance of contraceptives, knowledge of contraceptives, and media campaigns -- both their value in the first year of the episode (referred to here as time period T1) and their value in the last year of the episode (time period T2) was computed. To measure the degree of change in these variables, the value at T1 is subtracted from the value at T2. Because the episodes differ in length, we divide the outcome of the subtraction by the number of years between T1 and T2, to get the average
annual change in the variables. For the dynamic dependent variables also their value at T1 is included in the models, to control for convergence effects (regions with low contraceptive use have more room for improvement than regions with high contraceptive use, etc.). All variables except the urbanization dummy were standardized before being entered in the analyses.

Results

Table A1 in the appendix presents values for the central variables in our model at T1 and the annual percentage change between T1 and T2. Household wealth at T1 was highest in Egypt, followed by Namibia and Morocco, while Chad, Rwanda and Mozambique had the lowest wealth levels. There is a rather general increase in wealth over time, except for Niger, Nigeria, Rwanda and Senegal which show a slight decrease. Noteworthy are the wealth increases in Lesotho and Cote d’Ivoire. The number of recent births at T1 was highest in Chad and Niger and lowest in Cote d’Ivoire and Lesotho. Comparing changes in wealth and number of births at T1, we find that it is the two countries (Lesotho and Cote d’Ivoire) that had lowest average number of births at T1 that show the highest increase in wealth. In many countries the number of births has decreased in the period under study. Only four countries, Cameroon, Cote d’Ivoire, Nigeria, and Tanzania showed an increase in recent births.

The descriptive statistics further show that Egypt had the highest percentage (90.4%) of women using modern contraceptives while this percentage was lowest in Benin, Chad and Cote d’Ivoire where less than 30% of women were using contraceptives. In terms of changes in contraceptive use, Senegal registered the highest increase, while Tanzania registered a reduction in use. Acceptance of contraceptives was generally high at T1 with most countries having over 70% of women accepting modern contraceptives. However, acceptance is still low in Senegal where slightly above 50% of women accept modern contraceptives. Regarding change in acceptance, the trend is mixed; some countries showed an increase while others showed a decrease with Guinea and Niger registering a huge decline. Knowledge of modern contraceptives at T1 is almost universal (over 95%) in half of the countries being studied, while the rest have above 75% of women knowing at least one modern contraceptive method. The changes over time are very small with Mali, Niger and Senegal showing a slight decrease in knowledge. Information campaigns at T1 were highest in Malawi with 74% of women having heard about
contraceptives on TV and/or radio while it was lowest in Cote d’Ivoire at 9%. Therefore, it makes sense that Cote d’Ivoire showed the highest increase in information campaigns over time.

**Path analysis**

Table 1 presents the results for the different regressions that were performed as part of our path analysis. The obtained path coefficients for the relationships among the variables of our theoretical model are shown in Figure 2. The regression results reveal that a decrease in the number of recent births in a district is associated with an increase in wealth accumulation in that district. This result is in line with our expectation that fewer births would increase the chances of households to accumulate different types of assets. Given that all variables are standardized, the path coefficient of -0.461 indicates that a standard deviation reduction in births in a district is associated with an increase of the districts wealth level by 0.461 standard deviation.

We also find that districts where the use of contraceptives increases over time show a significant decrease in the number of births. A standard deviation increase in modern contraceptive use is associated with 0.161 standard deviation reduction in number of births in the district. Results further show that the increase in use was significantly higher in districts that showed an increase in acceptance of modern contraceptives and that had a higher starting level of contraceptive knowledge. A further increase in knowledge did not affect contraceptive use significantly. The most likely explanation for this is the very high starting level of knowledge on contraceptives in most study countries, as was found in the descriptive analysis. Regions that experienced a larger change in knowledge thus probably were backward regions with a relatively low (starting) level of both knowledge and use. The increase in acceptance was strongest in districts with a high level of knowledge of modern contraceptives and where the level of knowledge increased over time.

All variables indicating the starting level of our dynamic variables show significant negative effects, thus confirming the existence of convergence effects: regions with higher starting levels have less remaining possibilities for an increase. The effect of the district’s educational level is also largely in line with expectations. Districts with a more highly educated population at T1 show a higher increase in wealth, a larger reduction in births, and stronger increase in knowledge, acceptance and use of modern contraceptives. The larger reduction in births in more highly educated and urban areas suggests that FP is more effective in those areas. The results
further show that wealth accumulation is highest in the urban areas, which makes sense given the better employment opportunities there.

Insert Table 1 and Figure 2 here

Information campaigns on contraceptives in the media are positively associated with an increase in knowledge of modern contraceptives, as could be expected. We have tested whether media campaigns should also be in the other FP models. However, as this variable was not significant in any of the other models, we decided to include it only in the knowledge model.

Insert Table 2 here

Figure 2 shows the size of the direct effects of the independent variables on the outcome variables. Path analysis also offers the possibility to compute indirect and total effects on the outcome variables. These effects are important, because they show how wealth accumulation is indirectly affected by FP variables that at first glance have little to do with the decisions of households regarding investing in household wealth. Table 2 shows the coefficients for the direct, indirect and total effects. Given that these are standardized coefficients, the effect sizes are comparable with each other. Of the FP variables, only the change in the number of births in the district is directly related to the changes in wealth in the district. All other FP variables exert their influence indirectly, through their effect on the change in the number of births.

The indirect effects of the FP variables are all positive. Hence an increase in modern contraceptive use, an increase in acceptance of contraceptives, and an increase in knowledge of contraceptives are all associated with a larger increase in wealth. The static control variables – education and urbanization at T1 -- show positive total effects on the change in wealth accumulation.

**Conclusion**

In this paper we studied the effects of FP variables on economic development at the level of districts within African countries. More in particular, we wanted to assess whether an increase in knowledge, acceptance and use of contraceptives at the district level would stimulate wealth
accumulation of households within the districts through a reduction in the number of births. To answer this question we have applied path analysis to a new area panel database with information for urban and rural areas of 462 districts within 26 African countries.

Our analyses showed that a decline in the average number of births in a district is positively associated with an increase in average household wealth in the district. The reduction in the number of births was stronger in districts that showed a larger increase in contraceptive use. The increase in contraceptive use, in turn was stronger in districts where women had more knowledge on contraceptives and where acceptance of contraceptives increased in the study period. Acceptance of contraceptives was higher in districts with more and with increasing knowledge. Information campaigns were found to have positive effects on knowledge of contraceptives, but had no direct effects on their acceptance and use.

Our research thus reveals the existence of a causal chain that runs from information campaigns, through knowledge of FP, acceptance of FP, use of FP and reduced fertility, towards an increase in household wealth and economic growth. Each link in this chain contributes itself positively to wealth accumulation and operates at the same time as a relay station through which the effects of factors lower in the chain are passed. Our results make clear that through this chain, FP factors like knowledge and acceptance of contraceptives, which at first sight have little to do with household wealth may exert a positive influence on wealth accumulation of households and economic growth of regions.

Another important finding of this study is that the educational level of the population in a district plays a cardinal role at all levels of our model. In districts with a more highly educated population, knowledge, acceptance and use of contraceptives showed a stronger increase, the decrease in the number of births was larger, and wealth accumulation was stronger. Hence education seems an important catalyst of the processes by which FP factors may foster economic growth. With regard to the other control factor in our models, urbanization, findings indicate that fertility reduction and wealth accumulation were stronger in urban areas, whereas increases in contraceptive use were similar in urban and rural areas.

A major question, which remains to be answered, is whether the relationships identified in this paper are causal effects. This question cannot be answered on the basis of our analyses alone, because what we observe are not cause-effect relationships (as in controlled experiments), but simultaneous changes over time. Hence the direction may as well go in the opposite
direction, with increasing wealth being the cause instead of the effect of a reduction in the number of births. However, there are good arguments for causality running at least partly from reduction of births towards wealth increase. Given the basic costs of food and clothing, young children under the age of six cost more money than they bring in. To this the cost should be added of medical care during pregnancy, delivery, and thereafter (including the costs of treatment of delivery complications) and the foregone earnings due to the fact that the mother is less able to work during pregnancy and when the child is young. Hence deciding not to take a child may save poor households a substantial amount of money in the succeeding years, which can be used for buying assets, making investments, and for savings.

Of course, there might also be a reversed effect, with wealthier households deciding to take less children, because they want to invest more in each child’s education. But even then, this reduction of the number of children can be seen as a strategy that allows these households to keep up their higher living standard while at the same time increasing their investments in their children’s education. As these investments, made possible by reduced fertility, may lead to further economic growth at both the household and district level, they might in fact strengthen the causal effect of fertility reduction on economic growth. As several studies have indeed shown that a reduction in number of births is associated with an increase in children’s schooling (author’s reference), we can with even more certainty conclude that fertility reduction is good for wealth accumulation of households and regions.

Policy implications

Our findings provide several important practical implications for policy makers on how to develop FP based strategies that would enhance economic growth and alleviate poverty. Our model has demonstrated that decreasing the number of births may play an important role in improving the level of development of regions within African countries by increasing the wealth level of households within the region. Our findings further emphasize the importance of education, which has a positive direct effect on district-level wealth, as well as important indirect effects due to significant stimulating effects on all key variables in the model. Given the large effect of education on the number of births people experience and through this on their wealth, it is of utmost importance that policies aimed at improving availability and quality of educational facilities are implemented.
Our findings further emphasize the importance of contraceptive knowledge, acceptance and use in helping parents to regulate their births and through this yielding better socio-economic outcomes. Thus, it is important for policy makers, as well as other stakeholders who aim to achieve economic growth, to promote contraceptive use behaviour. This can be achieved by information campaigns that reduce fears about negative side effects of contraceptives and by making sure that FP service facilities are readily available and easily accessible by the general public. Our analysis shows that the effect of information campaigns on acceptance and use of contraceptives runs mainly through its effect on contraceptive knowledge.
References


Korra, A. (2002). Attitudes toward family planning, and reasons for non-use among women with unmet need for family planning in Ethiopia. Calverton, Maryland, USA: ORC Macro.


Table 1. Standardized multilevel linear regression coefficients for main dependent variables in the path model

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<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>SE</th>
<th>Sig.</th>
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<tbody>
<tr>
<td><strong>Change in wealth</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Change in recent births</td>
<td>-0.461</td>
<td>0.036</td>
<td>0.000</td>
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<tr>
<td>Wealth at T1</td>
<td>-0.708</td>
<td>0.084</td>
<td>0.000</td>
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<td>District education level at T1</td>
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<td>0.007</td>
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<td>Urbanization</td>
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<td>0.007</td>
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<tr>
<td><strong>Change in recent births</strong></td>
<td></td>
<td></td>
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<tr>
<td>Change in % of women using modern contraceptives</td>
<td>-0.161</td>
<td>0.034</td>
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<tr>
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Table 2. Direct, indirect and total effects of focus variables on the annual change in wealth accumulation

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<td>Change in information campaigns</td>
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<td>Recent births at T1</td>
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Figure 1
Figure 2
### Table A1. Average values at T1 and annual percentage change of the central variables.

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<th>Country</th>
<th>Wealth at T1</th>
<th>Δ wealth</th>
<th>Births at T1</th>
<th>Δ births</th>
<th>CU at T1</th>
<th>Δ CU</th>
<th>acceptance of FP at T1</th>
<th>Δ FP acceptance</th>
<th>knowledge of CM at T1</th>
<th>Δ CM knowledge</th>
<th>T1 info campaigns</th>
<th>Δ info campaigns</th>
</tr>
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<tr>
<td>Benin</td>
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<td>0.019</td>
<td>1.170</td>
<td>-0.005</td>
<td>0.289</td>
<td>0.013</td>
<td>0.732</td>
<td>0.010</td>
<td>0.873</td>
<td>0.008</td>
<td>0.394</td>
<td>0.024</td>
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<td>0.344</td>
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<td>0.796</td>
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<td>0.007</td>
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<td>0.000</td>
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<td>0.845</td>
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<td>0.026</td>
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<td>0.763</td>
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<td>0.008</td>
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