Fertility and Development: Evidence from North Africa

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Abstract

I conduct a weak-exogeneity test of Becker's propositions on the effects of fertility and investment in physical capital on development by using Granger-causality tests and examining whether past changes in fertility can explain changes in development and investment. Overall, the empirical results tend to be consistent with causality from fertility to development (at least in the weak exogeneity sense) but I find mixed results on the impact of fertility on investment in physical capital.

I. Introduction

Gary Becker's seminal work on fertility and development identifies important channels through which fertility may impact development (Becker, 1960; Becker et al., 1990). In this paper, I test Becker's propositions that fertility influences development and investment in physical capital, while properly studying the time-series properties of these variables and testing whether changes in fertility precede (Granger-cause) changes in investment and income per capita. I focus the analysis on four North African countries that are very similar in religion and cultural characteristics.

Currently, the World Bank includes Morocco and Tunisia in the late-demographic dividend group, while Algeria and Egypt are in the early-demographic dividend group. Historical data on fertility in Egypt, Algeria, Morocco and Tunisia show that its long-run behavior in Tunisia was significantly different from that in Algeria, Egypt, and Morocco (Figure 1), and that this disparity was primarily due to major differences in governments' approaches to population policy and family planning (Baliamoune-Lutz, 2015.) However, all four countries exhibit symptoms of the so called 'gender equality paradox' since significant progress in closing gender gaps in education and health was not accompanied by a comparable increase in female economic and political empowerment (World Bank, 2013).

High fertility rates tend to be correlated with greater gender inequality and lower per-capita income. At least in theory, higher income enables investment in human capital (health and education) and this, in turn, induces families to have less children. Some of the channels via which fertility may impact income include children's education and health, and women's

participation in formal labor markets (Bloom et al. 2009; Miller, 2010). However, whereas it is observed that developed economies have much lower fertility rates relative to most developing countries, evidence on causality from development (higher per-capita income) to fertility remains mixed.[1] This is because transition from high to low fertility rates has been associated primarily with greater gender equity which occurred "almost exclusively within family-oriented institutions" McDonald (2000). In the absence of gender equality—which is often the norm in patriarchal societies, such as those in North Africa, gender systems where men tend to make decisions about the use of contraceptives, desired number of children, and son preference tend to dominate.

I use Granger-causality tests to investigate whether past changes in fertility can explain changes in development and investment. This is a weak test of Becker's propositions on the effects of fertility on development and investment in physical capital. For fertility to cause development and investment, changes in fertility have to precede changes in the other variables. Obviously, precedence is a necessary but not sufficient condition; but evidence of its absence implies that causality is highly unlikely. Overall, the empirical results tend to be consistent with causality from fertility to development, at least in the weak exogeneity sense. On the other hand, I find mixed results on the impact of lower fertility on investment in physical capital.

II. Setting and data

To explore whether fertility precedes development and investment in physical capital, I first need to investigate whether the time series are stationary in levels. A shock to a variable will have

[1] For a useful discussion of the major propositions on the links between fertility and development, see Bryant (2007).

only a temporary effect if it is stationary but the effect will be more permanent if it is nonstationary. In the absence of structural breaks, the continuous decline in fertility rates may suggest that the mean value is changing with no possibility of mean reversion (nonstationarity) and indeed, unit-root tests that do not properly take into account structural breaks would lead to this conclusion, and often result in non-rejection of a false null hypothesis. Thus, I use the Zivot-Andrews (Zivot and Andrews, 1992) unit-root test to determine whether the variables of interest are level-stationary [I(0)]. This test identifies the endogenous structural break(s) and reports the date/year of the break (Table 1). Once I determine the integration order of the variables, I perform Granger causality tests with lag orders that have been selected based on five criteria (Table 2). Fertility is represented by the number of births per woman. Development is proxied by income (in log) which is measured by GDP per capita in constant 2010 US dollars. The indicator of investment in physical capital is gross fixed capital formation (% of GDP). All data are from the World Bank's World Development Indicators Database (online) and cover the period 1971-2014.[2]

III. Results

The results displayed in Table 1 indicate that fertility is level-stationary (with a break in the intercept or the trend) in all four countries. Interestingly, while the break occurred in the trend in Egypt, Morocco and Tunisia, fertility in Algeria had the break in the intercept (in 2000). Table 1 also shows that there is evidence of unit-root in four cases only; investment in Algeria, Egypt

[2] The same tests were performed for the period 1971-2010 (before the start of the Arab Spring) but the results are qualitatively the same.

and Morocco, and income in Egypt. In Tunisia, all three variables, fertility, income and investment are level-stationary.

To perform Ganger-causality tests, I use all stationary variables in level and the non-stationary ones in first-difference. In all four countries, the statistical evidence indicates that fertility Granger-causes income and this causality is bi-directional in Algeria and Morocco but not in Tunisia and Egypt. Fertility Granger-causes investment in physical capital only in Tunisia and Morocco. Overall, the empirical results are consistent with Becker's propositions that lower fertility leads to both higher investment in physical capital and development, but only in the case of two North African countries out of four.

IV. Discussion

Culture and religion influence gender systems in many parts of the world and, therefore, can significantly determine the long-run behavior of fertility. To minimize the differences in culture and religions, I focus on four Arab countries in North Africa. All four countries practice predominantly Sunni Islam and have populations that are for the most part of Arab origins (although Morocco and Algeria have a large population of Berbers but no significant differences between Arabs and Berbers in the behavior of fertility have been documented.) Yet, the four countries followed dissimilar trajectories in long-term fertility choices.

The empirical results point to the important role of lower fertility in development in the case of developing countries. Given that Egypt and Algeria still have relatively high fertility rates (about 3.5 and 2.85, respectively), policies that aim at reducing fertility should target changes in family

laws so that women have more control within the household over factors that influence fertility. Recent data from Egypt show increases in fertility rates in the last year or so. With youth unemployment already very high in the region, higher fertility rates mean more unemployed young people and more reasons to join protest movements or crime groups, or leave the country. The phenomenon of 'brain drain' can also be explained by the effects of fertility on development (Becker et al. 1990).

A possible explanation of the finding that fertility does not Granger-cause investment in Algeria and Egypt is that human capital may not have reached a critical mass that would trigger higher investment in physical capital. However, this may apply to Egypt since its investment share of GDP has declined from 26.9% to 12.6% over one generation (1990-2014). In the case of Algeria, on the other hand, investment went from 26.9% (same as Egypt's) in 1990 to 36.7% in 2014. However, a closer look at the Algerian economy reveals that a large portion of the physical capital is used in the natural resource (natural gas) sector. This sector is capital-intensive and does not create significant employment opportunities to absorb human capital. Perhaps, theories of fertility and development should take this into account, as dependence on natural resources (and the associated rents) may prevent a country from benefiting from the demographic dividend.

References

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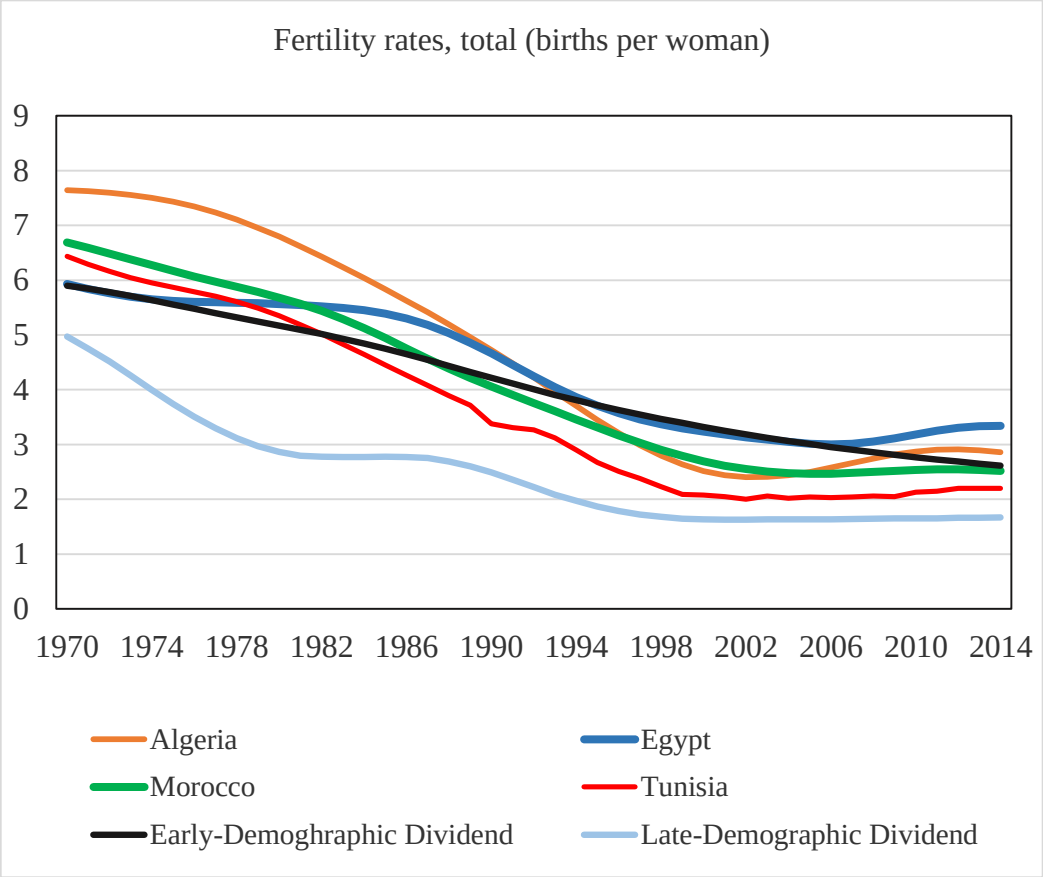
Figure 1



Source: World Development Indicators Database online (World Bank), accessed on September 19, 2016.

Table 1. Zivot-Andrews unit-root test statistic (lag order)

	Level	Year of break	Difference	Year of break
Algeria				
Fertility	-5.225*** (8)	2000 (intercept)	--	--
Income	-4.937** (7)	1990 (intercept)	--	--
Investment	-4.355* (1)	2003 (trend)	-6.703*** (1)	1979 (intercept)
Egypt				
Fertility	-5.305**(4)	2003 (trend)	--	--
Income	-4.807 (4)	2007 (both)	-5.271*** (3)	1988 (trend)
Investment	-4.471 (2)	1991 (intercept)	-6.412*** (1)	1997 (intercept)
Morocco				
Fertility	-5.498*** (4)	1998 (trend)	--	--
Income	-5.170** (3)	2001 (trend)	--	--
Investment	-4.167 (1)	1998 (trend)	-9.876*** (2)	1988 (both)
Tunisia				
Fertility	-4.926*** (1)	1999 (trend)	--	--
Income	-5.056 ** (1)	1986 (intercept)	--	--
Investment	-5.253*** (1)	1985 (both)	--	--

Notes: The year of the break is as indicated and I also report (in parentheses) whether the break was in the intercept (mean reversal), the trend, or both.

,* Indicate 5% and 1% levels of significance, respectively.

Table 2. Granger-causality tests – summarized results

	Fertility and income (log) Wald statistic [decision] (lag order)[a]		Fertility and investment Wald statistic [decision] (lags order)[a]	
Null hypothesis	Fertility does not Granger-cause income	Income does not Granger-cause fertility	Fertility does not Granger-cause investment	Investment does not Granger-cause fertility
Algeria	11.75** [reject] (2)	21.75** [reject] (2)	6.94 [accept] (4)	3.00 [accept] (4)
Egypt	63.67** [reject] (4)	1.57 [accept] (4)	2.67 [accept] (4)	0.68 [accept] (4)
Morocco	10.05* [reject] (4)	15.76* [reject] (4)	10.22* [reject] (2)	4.01 [accept] (2)
Tunisia	7.53* [reject] (4)	3.40 [accept] (4)	11.39** [reject] (4)	3.87 [accept] (4)

* Significance at the 5-percent level; ** significance at the 1-perecent level.

[a] The lag order is selected based on four criteria (sequential modified LR test statistic, final prediction error, Akaike information criterion, Schwarz information criterion, and Hannan-Quinn information criterion.