Research Note

Financial Inclusion and Its Impact on Fertility: An Empirical Investigation

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Abstract

This paper explores the empirical relationship between financial inclusion and fertility, primary developmental outcomes. Some studies show the impact of financial inclusion on different developmental outcomes, such as poverty, inequality, education, health, empowerment and economic growth and development. However, only a few studies have analysed the impact of financial inclusion on specific health indicators. Financial inclusion has a significant impact on fertility decline. This study uses data from 2004 to 2018 from a panel of 152 countries from the World Development Indicators and the IMF's Financial Access Survey to test the link between financial inclusion and fertility. I used techniques, that is, the panel fixed-effect model, SLM test, semi-parametric approach and quantile regression analysis, to understand the relationship between financial inclusion and fertility. The results suggest a non-linear relationship. As financial inclusion increases, fertility initially declines, but after reaching a critical point, the relationship turns positive, showing a U-shaped relationship. Other important variables that statistically influence fertility levels are levels of education, female labour-force participation rates, levels of urbanisation and age dependency. Inflation rate and trade openness also significantly influence fertility. This paper provides some policy implications concerning fertility and financial inclusion.

Keywords

Financial inclusion, fertility, developing countries, development outcomes

Introduction

The literature on financial inclusion can be broadly divided into two streams: studies focusing on the determinants of financial inclusion and those focusing on how financial inclusion can affect development. It has been observed that financial inclusion has a significant direct influence on economic growth (Lenka & Sharma, 2017), poverty and inequality (Chibba, 2009; Neaime & Gaysset, 2018; Park & Mercado, 2015) and a range of education and health-related outcomes (Kuri & Laha, 2011; Posso & Athukorala, 2018). The crucial link between financial inclusion and fertility has not received considerable attention in this growing literature. A handful of studies have examined how micro-credit programmes

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affect fertility, but few have investigated this link at the macro level (Duvendack & Palmer-Jones, 2017; Kuchler, 2012; Pitt et al., 2006). This omission is rather surprising for two reasons.

First, fertility has always been considered an important development indicator since Malthus's theoretical endeavours in the eighteenth century. As is well known by now, Thomas Malthus's 1798 treatise, *An Essay on the Principle of Population*, was a response to the growing radicalism in Britain following the French Revolution (Malthus, 1798). Conservatives initially welcomed the French Revolution, but their opinion soon turned when the revolution's more radical economic consequences became apparent (McNally, 2000). Where others critiqued the radical programme for its existing lacunae, Malthus stressed the impossibility of achieving radical transformation due to the overarching power of human passion, which, when left uncontrolled, tended to create a 'natural inequality' between the population and the rate of growth of subsistence (Charbit, 2009). Several historical studies suggest that the rise of the modern world economy was made possible because of a large increase in productive capacities due to the Industrial Revolution and a concomitant demographic transition that ensured that the fruits of increasing productivity were channelled towards investment rather than consumption (Clark & Cummins, 2009). Studies indicate that fertility in Europe tended to rise with income in the early stages of development but declined thereafter (Weisdorf, 2008). Although the exact nature of the relationship has been a matter of discussion in the sense that the causal chains from development to fertility and from the latter to the former are still being debated, there is a widespread belief that changes in fertility can have significant effects on economic development (Ashraf et al., 2013; Boserup, 1981; Clark, 2005; Galor, 2005; Lewis, 1983). Second, the lacuna is surprising because there is a significant body of literature about the relationship between financial development and fertility, which has emphasised the role that well-developed financial markets can have on fertility (Boldrin et al., 2015; Cigno & Rosati, 1996; Filoso & Papagni, 2015; Lai & Yip, 2019; Sethi et al., 2021; Zakaria et al., 2017). In developing countries where institutional sources of security and welfare remain limited, families and kinship ties often become the most important fallback option (Wood & Gough, 2006). In such contexts, inter-generational contracts tend to play an important role in household decisions, including decisions related to fertility.

Fenge and Scheubel (2017) show that in pay-as-you-go pension schemes, the price effects of contributions tend to promote fertility, but income effects tend to increase the opportunity costs of having more children. Thus, if the income effect outweighs the price effect, the net impact of pension is to reduce fertility. In a similar style, Boldrin et al. (2015) investigate the social security–fertility link and find that increases in social security can reduce fertility. The children and financial assets may be substitutes; and as rates of returns on financial assets improve, the opportunity costs of having children may increase. This link between financial development and fertility in the context of inter-generational decision-making has been at the centre of several empirical studies in recent years. Basso et al. (2014), Cigno and Rosati (1996) and Zakaria et al. (2017) confirm a negative relationship between financial development and fertility. On the other hand, Filoso and Papagni (2015) find that the relationship between the two is more complicated and that credit availability may increase fertility.

As we have noted, previous literature has studied the fertility–financial development link but given that financial development and financial inclusion are distinct concepts—concepts that can potentially even run in opposite directions and thus cannot easily be equated to each other—the link between financial inclusion and fertility is an important one and deserves to be carefully studied. The results of the empirical investigation undertaken in this paper reveal that financial inclusion and fertility have a non-linear relationship. Considering this, the rest of the paper is arranged as follows: Sections 2 and 3 of the paper outline the review of the theoretical linkages between financial inclusion and fertility and the empirical methodology, respectively. Section 4 describes the findings, and Section 5 provides the conclusions. The descriptive statistics were given in the Appendix.

Financial Inclusion and Fertility: Theoretical Channels

One way to think about financial inclusion is to juxtapose it with the widely used notion of financial development. The term 'financial development' refers to the process by which financial markets reduce transaction costs, diversify risks, improve economic coordination and enable better allocation of resources and thus enable economies to save and innovate at faster rates (Levine, 1997). Hence, there can be little doubt that financial development is crucial for making financial services and institutions more accessible to individuals. Yet, in the context of developing countries where massive social, cultural and legal barriers prevent individuals from partaking in economic life, very often, individuals from marginalised backgrounds are excluded from financial markets (Ghosh & Vinod, 2017). It has, thus, been widely noted that gender, caste, race, ethnicity and other social markers are often correlated with economic and social outcomes (Bailey et al., 2018; Mosse, 2018). Financially excluded people face different forms of social and economic discrimination at different levels in society, and such exclusion can potentially coexist with high levels of financial development (Dymski, 2006; Shah et al., 2007). It is here that it becomes important to differentiate financial development from financial inclusion because where the former focuses on the availability of quality financial services, appropriate institutions and well-developed markets, the latter is focused entirely on the issue of accessibility.

It is within this context that there have been several attempts to bring to the forefront of policymaking the issue of financial inclusion, as best exemplified by the Grameen Bank experiments in Bangladesh (Yunus & Weber, 2007). Increasing academic attention has been paid to issues of accessibility and to the multiple barriers that prevent individuals from utilising existing financial services. In this regard, several attempts have been made to explain the nature of financial inclusion and examine its determinants (Bozkurt et al., 2018; Govindapuram et al., 2023; Zins & Weill, 2016). While these studies focus on how financial inclusion affects socio-economic outcomes, there is a relative dearth of work done on the explicit link between financial inclusion and fertility. Theoretically, the relationship is ambiguous and empirical evidence too has not provided any conclusive evidence regarding the relationship. Traditionally, the standard 'old-age security' hypothesis—which suggests that households' decisions regarding family size are motivated by the future income that children earn and share with their parents during their old age—predicts a negative relationship between financial development and fertility (Caldwell, 1976; Chakraborty & Das, 2005; Neher, 1971). This result is driven by the assumption that the decision of family size is determined by the fact that children are viewed as just another kind of asset that parents can use to transfer income from one period to the next. Households are likely to rely on children in situations where alternative vehicles of savings are missing or are too costly to access. It follows, therefore, that when financial markets are underdeveloped, households may be incentivised to rely on children as instruments of savings, thus increasing desired fertility within households. Well-developed financial markets that provide affordable and easy-to-use assets, however, are likely to be linked with lower fertility (Basso et al., 2014; Lehr, 1999; Zakaria et al., 2017). It is to be noted that the predicted negative relationship between financial markets and fertility in the old-age hypothesis relies heavily on the assumption of substitutability between children and financial assets. This view has been critiqued strongly in the literature on historical grounds (Galor, 2012).

This paper shifts focus to the link between financial inclusion and fertility. Empirical studies on this link are sparse but there is reason to believe that financial inclusion may be a powerful determinant of fertility behaviour. One of the most talked about channels through which financial inclusion may affect fertility is via its impact on the autonomy of women and its contributions to their empowerment (Hendriks 2019). Micro-finance programmes across the developing world are usually targeted towards women with the aim of empowering them. As Pitt et al. (2006) note, participation of women in micro-credit programmes tends to improve their autonomy on several counts, including their say in family planning and contraception use.

Given that women have been shown to have a preference for smaller families, this may be a very important channel through which inclusion may reduce fertility (Cleland et al., 1994; van Ginneken & Razzaque, 2003). A second important channel through which financial inclusion may affect fertility is through its economic effects on household income and economic security. As has been noted, financial inclusion has been shown to be an effective tool to promote poverty alleviation, increase entrepreneurship and improve the overall economic security of households (Chibba, 2009; Neaime & Gaysset, 2018; Park & Mercado, 2015). These processes may set fertility declines by altering incentives and opportunity costs of having larger families.

To summarise, the impact of financial inclusion on fertility has received scant attention. The few studies that have looked at it have done so from a micro-perspective, and cross-country analysis of this link has not attracted much scholarly attention. It is with this in mind that the rest of the paper looks at the financial inclusion–fertility link.

Data and Empirical Methodology

Given the complexities of the association between financial inclusion and fertility, this paper employs a panel of 152 countries to explore the relationship. Given that the demographic transition literature has stressed the complex, non-linear nature of demographic change, the empirical specification departs from the usual linear specifications that have been commonplace within this strand of literature and explores potential non-monotonicities in the finance–fertility relationship to better capture the dynamics between financial inclusion and fertility. To do so, the paper uses both the panel fixed effect with a quadratic term as given in equation (1) and semi-parametric fixed-effects regression as given in equation (2):

$$Y_{i,t} = \beta_0 + \beta_1 IFI_{i,t} + \beta_2 IFI^2_{i,t} + \beta_3 X_{i,t} + \epsilon_{i,t} \quad (1)$$

$$Y_{i,t} = \beta_0 + m\left(IFI_{i,t}\right) + \beta_1 X_{i,t} + \epsilon_{i,t} \quad (2)$$

where Y indicates the rates of fertility, X is the vector of explanatory variables affecting the fertility, IFI is an index financial inclusion variable and IFI^2 is the squared term to show the possibility of non-linearity in financial inclusion. Further, i indicates country, t for time periods and ϵ shows an unexplained part.

The dependent variable of interest is the fertility (LnFR), which is defined as the number of total births per woman. The control variables include infant mortality rate (LnIMR), which refers to the number of infant deaths per 1,000 live births. Improvements in infant mortality can reduce fertility, but in general, the relationship is ambiguous because levels of fertility may depend on levels of mortality and we also take into account per capita income (LnGDPPC) to capture the effect of income and development levels on fertility (Basso et al., 2014; Becker, 1960; Filoso & Papagni, 2015; Zakaria et al., 2017). Previous literature has noted the significance of education (LnEdn) in the context of fertility—higher levels of education generally result in lower fertility since parents are interested in the quality of their children rather than quantity of education (Becker, 1960). We further consider the extent of urbanisation as measured by the percentage of the urban population in the total population (LnUrba); previous studies have shown that urbanisation increases the cost of raising children (Galloway et al., 1998). Another feature that affects the opportunity cost of childbearing is age dependency (LnAgeDe) (Zakaria et al., 2017). I finally also add inflation (LnInfl) and trade openness (LnTRADE) as measures of macroeconomic stability (Filoso & Papagni, 2015). The paper draws on data from 152 countries between 2004 and 2018.[1]

Following the literature on financial inclusion,[2] I use data on the number of bank accounts per 1,000 population (depositors), number of bank branches per 100,000 population (branches) and number of ATMs per 100,000 people from the World Bank's WDI. I also take usage indicators of the volume of credit and deposits relative to GDP from the IMF's FAS. The study uses these indicators of financial inclusion to compute an IFI using principal component analysis (PCA). Measuring a holistic and unbiased composite financial inclusion index is a challenging assignment for researchers. Meanwhile, previous studies (Arora, 2014; Chakravarty & Pal, 2013; Gupte et al., 2012; Sarma, 2008) have used different methods (like the distance-based approach adopted by the UNDP to compute HDI, Analytical and Hierarchical Process (AHP) and the axiomatic approach) to compute an IFI. Each method has its own merits and demerits for the computation of the index. Most of the studies have used AHP for the weights of the variables in the composite index construction. However, the problem with AHP is that no prior information is available about a particular variable's weight (Lenka & Barik, 2018), and weightage can vary from one researcher to another researcher based on their assumption. So, there may be better methods to determine the weight of factors included in the multidimensional index than AHP. Also, looking at the volatile nature of financial access variables, AHP and the distance-based approach may not solve unbiased index construction. To overcome these deficiencies, this study relies on the statistical procedure for the construction of weights of the factors, that is, the PCA method. In the case of PCA, it assigns equal weightage to every indicator, hence, there are no biases in indicator selection.

To estimate the regression (equation 1), I used the panel fixed effect model. The fixed effect model allows us to control for country-fixed effects so that differences between individual nations can be accommodated from different intercepts. Further, I perform a Hausman test to confirm the usage of fixed effects, and based on our results, the fixed effect model is considered (Baltagi, 2008). The quadratic terms in equation (1) capture potential non-linearities in the relationship being analysed. To statistically test it, the SLM test for the existence of a U-shape relationship is employed as a confirmatory test. The relevance of the quadratic term and the range of extremum values have been the focus of most previous approaches. Lind and Mehlum (2010) employed Sasabuchi's (1980) likelihood ratio methods to establish a more powerful test for detecting a U-shaped link between independent and dependent variables.

Equation (1) imposes a functional form on the link between financial inclusion and fertility, but the regression specification in equation (2) relaxes this assumption by utilising semi-parametric specification following (Baltagi & Li, 2002). This allows an unrestricted functional form to be used to model the impact of the IFI. Here, Y is a dependent variable, that is, fertility rate; X is a vector of control variables and the IFI enters non-parametrically to see the non-linear relationship (Baltagi & Li, 2002; Verardi, 2013; Zouaoui et al., 2018).

Results

Regression Results

This section presents empirical results. Table 1 gives results for the fixed-effect model for a sample of 152 countries. Models 1–6 successively add an independent variable to the model. All models give evidence of a non-linear association between fertility and financial inclusion (Lai & Yip, 2019). Initially, the IFI is inverse with coefficients between –0.38 and –0.42, and the results are statistically significant. An IFI^2 shows a positive coefficient ranging between 0.29 and 0.44 and is significant at 1%. This indicates that the relationship between fertility and financial inclusion is non-linear and U-shaped. The levels of education significantly influence fertility levels; the coefficient shows that as education

Table 1. Fixed-effect Model with IFI and IFI2 (N = 152).

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	LnFR	LnFR	LnFR	LnFR	LnFR	LnFR
IFI	–0.418***	–0.414***	–0.414***	–0.393***	–0.422***	–0.375***
	(0.130)	(0.131)	(0.131)	(0.132)	(0.133)	(0.134)
IFI2	0.305**	0.319***	0.319***	0.288**	0.330***	0.440***
	(0.119)	(0.121)	(0.121)	(0.122)	(0.120)	(0.106)
LnEdn	–0.150***	–0.130***	–0.130***	–0.139***	–0.101***	–0.100***
	(0.027)	(0.029)	(0.032)	(0.033)	(0.038)	(0.031)
LnGDPPC		–0.020	–0.019	–0.014	–0.013	0.027**
		(0.015)	(0.013)	(0.014)	(0.014)	(0.012)
LnIMR			0.002	–0.006	–0.030	–0.011
			(0.030)	(0.029)	(0.029)	(0.022)
LnFLPR				–0.145*	–0.144*	–0.043
				(0.084)	(0.082)	(0.059)
LnUrba					–0.290**	–0.135*
					(0.115)	(0.076)
LnAgeDe						0.425***
						(0.048)
LnTRADE						0.031**
						(0.015)
LnInfl						0.008***
						(0.003)
Constant	2.022***	2.101***	2.087***	2.676***	3.717***	0.367
	(0.098)	(0.116)	(0.202)	(0.383)	(0.506)	(0.455)
Observations	607	607	607	607	607	593
R^2	0.297	0.306	0.306	0.327	0.357	0.571
U-test	0.087	0.061	0.063	0.107	0.051	0.002

Note: ***P < 0.01, **P < 0.05 and *P < 0.1. Standard errors are in parentheses. Used robust and cluster ID for controlling autocorrelation and heteroscedasticity.

increases, fertility decreases in all the models. This result is in line with previous studies which suggest that improvements in human capital tend to increase the opportunity costs of having children and thus reduce fertility (Chun & Oh, 2002). This means that countries with a larger proportion of literates tend to have a lesser number of children as compared to less-literate countries—a result that is similar to previous studies (Basso et al., 2014; Filoso & Papagni, 2015; Zakaria et al., 2017). The coefficients on GDP per capita are not statistically significant in most models, but in model 6, it is positive and significant—likely suggesting that income and fertility are positively related. There are of course reasons to believe that as income increases, fertility would fall, but the demographic transition literature is also suggestive of more complicated patterns of change (Luci & Thévenon, 2011).

The coefficient on female labour participation rates shows that as the female labour supply increases, it reduces fertility. Increased labour-force participation improves women's financial autonomy, which has been known to reduce fertility (Malhotra et al., 1995; Upadhyay et al., 2014). The rate of urbanisation is inversely related to fertility, so, as urbanisation increases, fertility decreases. This sign is in line with other studies and reflects the fact that in urban areas, both men and women may have to work, given the higher costs of living in urban areas than in rural areas (Lai & Yip, 2019; Zakaria et al., 2017). Age dependency is positive and significant, and it is similar to Zakaria et al. (2017, 660) who state that 'as

Table 2. Fixed-effect Model with IFI and IFI2 (N = 103).

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	LnFR	LnFR	LnFR	LnFR	LnFR	LnFR
IFI	–0.450***	–0.463***	–0.469***	–0.452***	–0.522***	–0.521***
	(0.133)	(0.137)	(0.141)	(0.140)	(0.132)	(0.113)
IFI2	0.265	0.337*	0.351*	0.334*	0.413**	0.512***
	(0.172)	(0.179)	(0.191)	(0.189)	(0.185)	(0.145)
LnEdn	–0.137***	–0.112***	–0.108***	–0.116***	–0.072*	–0.063**
	(0.028)	(0.030)	(0.037)	(0.036)	(0.041)	(0.029)
LnGDPPC		–0.029	–0.026*	–0.024	–0.022	0.030**
		(0.018)	(0.015)	(0.015)	(0.015)	(0.014)
LnIMR			0.011	0.004	–0.029	–0.024
			(0.036)	(0.036)	(0.034)	(0.027)
LnFLPR				–0.136	–0.131	–0.009
				(0.100)	(0.095)	(0.070)
LnUrba					–0.322**	–0.162**
					(0.130)	(0.081)
LnAgeDe						0.515***
						(0.075)
LnTRADE						0.025
						(0.015)
LnInfl						0.010**
						(0.004)
Constant	2.103***	2.210***	2.135***	2.692***	3.828***	–0.008
	(0.097)	(0.114)	(0.238)	(0.476)	(0.608)	(0.638)
Observations	388	388	388	388	388	374
R^2	0.378	0.396	0.396	0.414	0.455	0.671
U-test	0.37	0.2	0.2	0.21	0.13	0.006

Note: ***P < 0.01, **P < 0.05 and *P < 0.1. Standard errors are in parentheses. Used robust and cluster ID for controlling autocorrelation and heteroscedasticity.

dependency decreases fertility declines because when proportion of working age increases proportion of dependent decreases. When working age population increases their opportunity cost of bearing and raising children increases, as a result, fertility will decrease'. The two macroeconomic indicators—trade openness and inflation—significantly influence levels of fertility, and the results of the sign are similar to those obtained by previous literature (Filoso & Papagni, 2015).

From the main sample, I also estimate the regressions for a sub-sample of 103 low- and middle-income countries (Table 2). In the first case, IFI, the coefficients range between –0.45 and –0.52, and for IFI^2, the coefficients range between 0.26 and 0.51; these are significant at the 1%. This relationship confirms the possibility that there is a U-shaped relationship between fertility and financial inclusion. Other macroeconomic variables such as levels of education are inversely related to fertility and significant. The GDP per capita is significant in models 3 and 6, and in other models, it is not significant. Infant mortality rates and female labour-force participation are neither significant nor robust. Further, levels of urbanisation negatively (-0.32 and -0.16) affect fertility at 1% and 5% in models 5 and 6, respectively. Age dependency and inflation are robust and significantly influence levels of fertility. The trade openness is not significant.

The signs on the quadratic terms are consistent with a U-shaped linkage, but following previous literature, the presence of the non-linearity is checked using the SLM test, and the results were significant in all the models. In both Tables 1 and 2, the *P* values suggest that there is in fact a U-shaped relationship between the two variables. Previous studies on micro-credit and fertility have largely adopted linear models. Barring some exceptions, this is also the case with studies looking at the financial development and fertility linkage. However, much of the literature on demographic transitions has stressed the non-linear nature of population dynamics (Galor, 2005, 2012; Weisdorf, 2008). Keeping this in mind, our results suggest that at lower levels of financial inclusion, fertility decreases with financial inclusion, but beyond a point, the relationship turns positive. To understand this result, I must first and foremost recognise that it is in developing countries that financial exclusion is the greatest, and that comparatively speaking, citizens of developed nations have much better access to financial services (Swamy, 2014). Thus, in the contexts of developing countries where social security is relatively weak, fertility is above average, and informal familial arrangements are crucial for meeting welfare needs, fertility choices may be strongly driven by old-age security incentives. That is, in the absence of saving instruments, households may be forced to rely on children as substitute vehicles for savings. In such cases, as financial inclusion improves, one can expect parents to reduce fertility and rely more on readily accessible financial services. Eventually, as access to financial resources improves, families have adequate instruments of saving and thus view children not as sources of security but as sources of pleasure—providers of psychic income (Becker, 1960). This result also lines up with Bhupatiraju (2022), who finds that in households with three or more children, women's access to banks is likely to reduce fertility, while at the lower end of the fertility spectrum, access to banks is likely to increase fertility.

As an alternative check, a semi-parametric regression for the full model (model 6) is also estimated, and the results are presented in Table 3. These results are similar to the results in Tables 1 and 2. The levels of education are negatively and significantly affecting fertility. For low- and middle-income countries, it is –0.04, and for all sample countries, it is 0.7. Urbanisation is inversely related to fertility (–1.8 and –1.9), and it is significant at a 5% level of significance for both samples of countries.

Table 3. Semi-parametric Results.

Variables	*N* = 103	*N* = 152
LnEdn	–0.042*	–0.072**
	(0.021)	(0.02)
LnGDPPC	0.034**	0.037**
	(0.021)	(0.01)
LnIMR	0.027	0.027
	(0.02)	(0.02)
LnFLPR	0.028	0.002
	(0.049)	(0.044)
LnUrba	–0.179**	–0.189**
	(0.064)	(0.066)
LnAgeDe	0.465**	0.378**
	(0.046)	(0.045)
LnTRADE	0.012	0.01*
	(0.004)	(0.005)
LnInfl	0.004*	0.005**
	(0.002)	(0.002)
R^2	0.557	0.399

Note: ***$P < 0.01$, ** $P < 0.05$ and *$P < 0.1$. Standard errors are in parentheses. Used robust and cluster ID for controlling autocorrelation and heteroscedasticity.

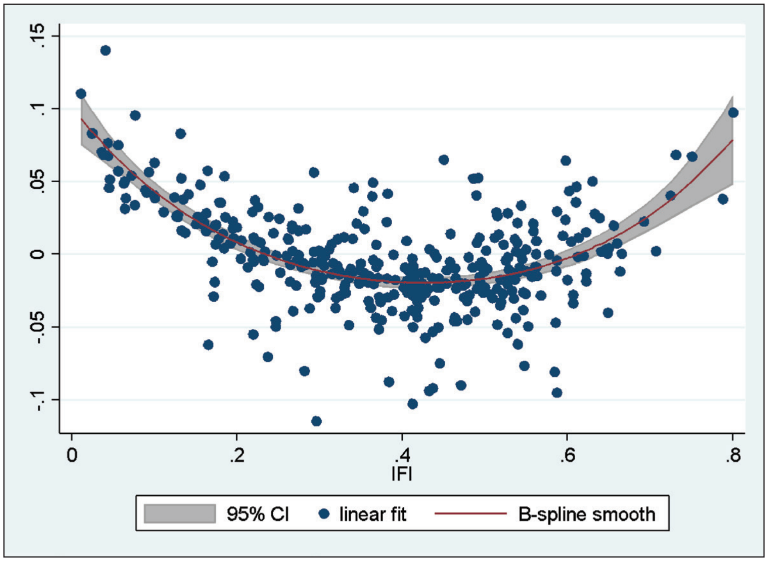

Figure 1. For Low- and Middle-income Countries (*N* = 103).

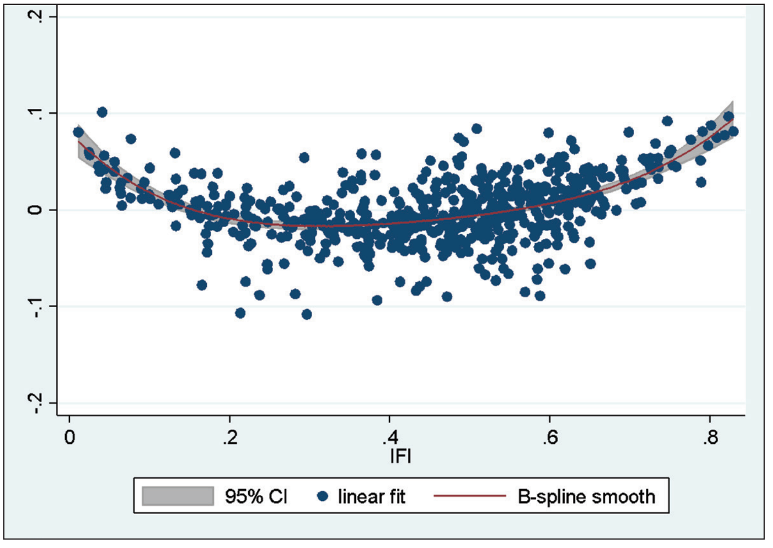

Figure 2. For All Countries (*N* = 152).

Note: *Y*-axis is fertility and *X*-axis is the index of financial inclusion.

Age dependency, GDP per capita, trade openness and inflation are robust and significantly influence fertility. Further, female labour-force participation and infant mortality are not significant. The semi-parametric results are similar to the panel fixed-effects model.

Figure 1 shows a relationship between fertility and the index of financial inclusion for a sample of all 152 countries. This gives evidence of the non-linear relationship between IFI and fertility, obtained by employing the semi-parametric analysis. The curve is U-shaped. Figure 2 shows a relationship between fertility and the IFI for a sample of 103 low- and middle-income countries. The U-shape is more prominent for the full sample countries and a little flatter for low- and middle-income countries.

Quantile Regression Results

As one final check of results, the relationship between financial inclusion and fertility is estimated using quantile regression for panel data (Baker, 2016; Powell, 2014, 2022). Quantile regression techniques were originally proposed by Koenker and Bassett (1978). Traditional regressions based on OLS focus on conditional means of the dependent variable, and in doing so, they assume that the relationships between dependent and independent variables remain constant across the distribution. Studying global characteristics is valuable, but in several real-world instances, researchers may also want to capture aspects that are more local by studying the relationship between dependent and independent variables over the entire distribution. For example, the relationship between financial inclusion and fertility may vary across the fertility distribution, which may not be adequately captured by OLS-style regressions.

> The use of traditional regressions can cause an overestimation or underestimation of the coefficients and hence, not take into account the heterogeneous distribution of the data. Therefore, the study uses the quantile regression for panel data proposed by Koenker and Bassett (1978). This method is used to overcome the limitations of traditional regression approaches. Among the advantages of using quantile regressions is that it allows flexibility in the slope throughout the distribution. Furthermore, quantile regression provides more accurate and robust findings in the presence of outliers and heavy-tailed distributions. (Alvarado et al., 2021, p. 5)

Previous paragraphs explained how financial inclusion impacts fertility using panel FF techniques. In this section, I deploy panel quantile regression techniques following Filoso and Papagni (2015) for the entire sample. The results (Table 4) confirm that there is a non-linear relationship between financial inclusion and fertility in all the quantiles, except for the highest quantile (90%). Thus, largely speaking, the U-shaped pattern that was obtained previously seems to hold for all the quantiles except for one. In the highest quantile, the quadratic term shows a negative relation (-0.099) and is significant. This seems to imply that as financial inclusion progresses, fertility declines. This may be a result of the fact that in higher-fertility quantiles, children and financial assets may be substituted, and hence, investments in financial assets crowd out children as suggested by the old-age security hypothesis (Bhupatiraju, 2022). The level of education is negatively related to fertility and is significant, but it has a positive relationship with the fertility rate in the 75% quantile. GDP per capita is significant and positive in all the quantiles, except in the 25% quantile where it is not significant. Infant mortality rates directly influence fertility in all the quantiles and are significant at 1%. Female labour-force participation is negatively related to the fertility rate, and the significant level is 1% in all quantiles except in the 25% quantile where is it 10%. Urbanisation rates are positively related to fertility up to the 50% quantile. After that, it is negative in quantiles of 75% and 90%, respectively. Age dependency is positive and significant in all the quantiles. Further trade openness is significant in all the quantiles and positive, and negative in only the 50% quantile. The inflation rate is positive and significant in quantiles of 10%, 75% and 90%. The results for panel quantile regression are largely like the previous techniques considered in this study.

Figure 3 depicts the coefficients of conditional quantiles. Here, I can see the trend for all the variables considered in different quantiles. The trend lines show how the observations change from the lowest quantile to the highest quantile. IFI and IFI^2 follow the patterns that I explained prior. Interestingly, GDPPC initially decreases and then starts to increase over the higher quantiles, that is, GDPPC has similar effects on the lowest and highest quantiles, but its effect is rather small on the middle quantiles.

Table 4. Panel Quantile Regression for All Countries Sample (N = 152).

	(1)	(2)	(3)	(4)	(5)
Variables	10%	25%	50%	75%	90%
IFI	–0.480***	–0.402***	–0.406***	–0.396***	–0.132***
	(0.036)	(0.063)	(0.052)	(0.052)	(0.034)
IFI2	0.343***	0.413***	0.209***	0.208***	–0.099***
	(0.037)	(0.144)	(0.048)	(0.052)	(0.026)
LnEdn	–0.095***	–0.032**	–0.064***	0.015*	–0.035***
	(0.011)	(0.016)	(0.006)	(0.009)	(0.006)
LnGDPPC	0.069***	–0.015	0.026***	0.053***	0.067***
	(0.002)	(0.022)	(0.002)	(0.002)	(0.002)
LnIMR	0.185***	0.130***	0.108***	0.151***	0.141***
	(0.003)	(0.007)	(0.003)	(0.004)	(0.003)
LnFLPR	–0.053***	–0.013*	–0.014***	–0.041***	–0.075***
	(0.006)	(0.007)	(0.004)	(0.003)	(0.005)
LnUrba	0.059***	0.065***	0.031***	–0.041***	–0.100***
	(0.006)	(0.018)	(0.003)	(0.005)	(0.004)
LnAgeDe	0.756***	0.803***	0.835***	0.824***	0.798***
	(0.021)	(0.038)	(0.005)	(0.006)	(0.014)
LnTRADE	0.014***	0.017***	–0.019***	0.013***	0.029***
	(0.003)	(0.003)	(0.005)	(0.002)	(0.002)
LnInfl	0.043***	0.013	–0.002	0.013***	0.013***
	(0.005)	(0.008)	(0.003)	(0.004)	(0.003)
Observations	593	593	593	593	593
Countries	152	152	152	152	152

Note: Standard errors in parentheses (Bootstrap). ***P < 0.01, **P < 0.05 and *P < 0.1.

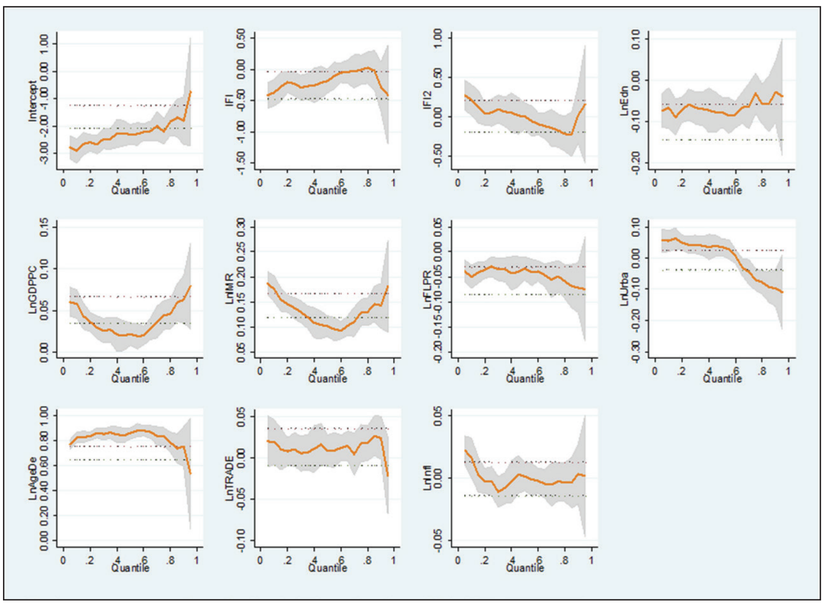

Figure 3. Quantile Regression Plots.

This is also the case for infant mortality. The proxy for urbanisation has a positive effect on the lowest fertility quantiles but a negative one at higher ones.

Conclusion

This paper examines the relationship between financial inclusion and fertility in a panel of 152 countries for the period 2004–2018. It uses two methods, parametric and semi-parametric to estimate the results. The main findings of this study are that there exists a U-shaped relationship between financial inclusion and fertility, both when the full sample of 152 countries is studied and when a smaller sample of 103 low- and middle-income countries is analysed. The existing literature on financial inclusion and fertility is sparse and even the studies that exist usually draw on micro-data sets and rely on linear specifications. By contrast, this paper looks at cross-country evidence, and more importantly, focuses on possible non-linearities. Other results suggest that higher levels of education have a strong negative impact on fertility decisions, while GDP per capita income has an ambiguous effect. Age dependency has a positive and strong relationship with fertility, while macroeconomic indicators like trade openness and inflation rates also have a positive and significant effect on fertility. These findings are robust across specifications. They also hold for all but the highest quantiles when estimated using panel quantile regressions. The government needs to focus on aspects of financial inclusion and fertility for better economic outcomes.

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Notes

1. The author considers only those countries with data for at least 80% of the period. To smoothen out fluctuations and to account for missing data, the author considers three-year averages for all the variables.
2. Used (Sarma, 2008).

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