The relationship between economic development and the timing and pace of fertility decline

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Abstract

There is a consensus among many demographers that 'socio-economic', 'structural', or 'demand' theories of fertility decline are not consistent with the evidence from cross-country development indicators. This paper examines three alleged predictive failures, and raises doubts about all of them. The paper argues that fertility declines in countries with very low levels of development can, in at least some cases, be plausibly explained by socio-economic theories. It argues that, despite some spectacular outliers, statistical models based on socio-economic theories fit the data moderately well. Finally, it argues that, contrary to previous findings, the relationship between fertility and development has been stable over time. These arguments suggest that socio-economic explanations of fertility decline may have been under-valued.

Introduction

Critics of 'socio-economic', 'demand', or 'structural' explanations for fertility decline often argue that such theories are plausible, but are contradicted by cross-national patterns in variables such as GDP per capita, literacy, enrolment, and life expectancy. An authoritative US National Research Council (2000: 59-60) report maintains that three features of the cross-national data cast doubt on socio-economic explanations:

1. Fertility has declines in countries that score very low on conventional development indicators.
2. Fertility declines under a wide range of circumstances, and is poorly predicted by conventional indicators.
3. The cross-national relationship between development and fertility has been shifting, and recent fertility declines have been occurring at progressively lower levels of development.

Apparent empirical anomalies such as these are often cited as reasons for reducing the weight given to socio-economic theories and paying more attention to family planning programs, cultural specificities, or diffusion.

This paper examines the claim that socio-economic theories are inconsistent with the evidence from the development indicators. For concreteness, it focuses on one type of socio-economic theory: on those that use the idea of a 'quantity-quality' trade-off. The paper asserts that the fertility declines in very poor countries are compatible with quality-quantity explanations. It makes a similar claim about the loose relationship between fertility levels and development indicators. Finally, it presents evidence that the shift in the relationship between fertility and development is less substantial than is often believed.

A socio-economic theory of fertility decline

There are many different accounts of fertility decline that might be labelled as socio-economic, demand, or structuralist theories. The range extends from detailed frameworks like those of Caldwell (1976) or Becker (1991) to vague notions about fertility declining with improved living standards. Evidence that is inconsistent with one theory is not necessarily inconsistent with another. Socio-economic theories therefore have to be assessed one at a time.

This paper focuses on explanations based on a 'quantity-quality' trade-off. The idea is that changes in the socio-economic environment can increase the returns to investment in children's human capital, and that parents are only able to afford these investments if they limit the number of children they have. The most obvious such investment is formal educational, though other types of investment such as nutrition, heath care, and intensive childrearing are also important.

A quantity-quality trade-off is central to many contemporary economic models of economic growth and demographic change (Chu 1998: 133-7), but is not exclusive to economics. It has also, for instance, been presented in anthropological form by Greenhalgh (1988), and is one way of interpreting the explanation, often advanced by

non-demographic commentators, that parents have fewer children because children have become more expensive. There are also important parallels with the quantity-quality trade-offs discussed by evolutionary biologists (Bulmer 1994: 2-6).

The classic set of circumstances encouraging a switch from quantity to quality is when an economy is industrializing, and secure, well-paid jobs requiring formal qualifications are becoming widely available. In such circumstances, education and other human capital investments become a plausible way for parents to lift their children out of poverty and insecurity. This is the scenario represented by standard economic models of economic growth and fertility decline.

There are, however, other scenarios in which returns to investments in child quality can rise. One such scenario is a country with an over-expansionary state sector, in which government jobs are rationed through educational qualifications, low or negative economic growth, and increasing pressure on agricultural land. Just as in the classic successful-economy case, there is a widening gap between the prospects of educated and non-educated children, and hence an incentive to invest in quality. It does not matter to the theory that the educated people may not be productively employed, and that widening gap is due to deterioration of the incomes of uneducated people.

Quantity-quality theories assume that parents bear a significant proportion of the costs of investment in child quality, and that parents cannot borrow money against the promise of future earnings. Without these assumptions, an increase in the returns to investment in child quality should induce parents to have as many children as possible and invest heavily in all of them. However, the cost assumption and the borrowing-constraint assumption are normally both met. Parents in developing countries generally face substantial out-of-pocket costs for children's nutrition, health care, and education. Similarly, borrowing to finance investment in human capital is problematic enough in developed countries (hence the need for student loans schemes), and even more difficult in developing countries.

Quantity-quality explanations can generally leave open the question of why parents should wish to increase their children's future income or security. The motivation may be a desire to boost the fortunes of the patriline (Greenhalgh 1988) a hope of achieving security in old age, altruism, or a combination of reasons.

Of course, quantity-quality explanations are incomplete. One glaring omission is the absence of any reference to state coercion, despite the major role that coercion paid in fertility decline in the world's most populous country (Wolf 1986). Other omissions include improvements in contraceptive technology, bio-social factors, family systems, and the international diffusion of ideas about 'modern' lives. The interesting question, however, is not whether quality-quantity trade-offs can explain all variation in fertility, which they clearly cannot, but whether they explain a lot of variation or only a little.

Development indicators and tests of theories of fertility decline

There is no reason to expect that the data produced by national and international statistical systems are well-suited to testing theories of fertility decline. Working out what a particular theory predicts about the relationship between development indicators and fertility therefore requires care. This section considers what quantity-quality explanations imply about some indicators that are frequently cited in discussions of fertility decline.

Mortality. All socio-economic theories assume that demand for children is in fact demand for surviving children, so unless parents are producing fewer children than they would like, reduced mortality should lead to reduced fertility. Reduced mortality also lowers the riskiness and increases the expected return of investing in child quality, which may stimulate further declines. Mortality declines are more likely to occur in stable, well-governed countries. If such countries are disproportionately likely to experience shifts to child quality, then this may also be picked up by a mortality variable.

GDP per capita. Higher GDP per capita implies higher income, which, in itself, should actually increase fertility, since it makes children more affordable. Indeed, as Davis (1963)points out, a positive link between income and fertility is a key component of Malthusian theories. However, higher GDP per capita also generally means higher output per worker, which is associated with changes, such as industrialisation and the growth of specialist occupations, that tend to increase the returns to investment in child quality. Higher GDP per capita is also associated with social changes, such as the growth of mass communications, that are likely to influence fertility, though they not included in quantity-quality explanations. GDP per capita therefore belongs in statistical models, but mainly as a proxy for an unknown number of poorly-understood omitted variables.

Agriculture as a percent of GDP; agricultural employment; urbanization. Variables measuring the importance of agriculture and the degree of urbanization provide somewhat more direct measurement of changes in socio-economic structure. They are, however, imperfect indicators of returns to investment in child quality. Growth in the proportional share of urban, non-agricultural industries may imply increases in jobs requiring educational qualifications, or merely increases in the number of food vendors, hairdressers, and construction workers.

School enrolment. Given the central role of education in the quantity-quality trade-off, variables measuring school enrolment deserve special emphasis. The relationship between enrolments and the underlying structural changes is nevertheless complex. One complication is that high enrolment rates may reflect compulsory schooling laws, rather than investment choices by parents; indeed, demographic explanations of fertility decline that tally up the ‘costs and benefits’ of children generally emphasize the cost of schooling far more than its investment value. The importance of compulsory schooling laws should not overstated, however, since developing-country governments are often unable to enforce them, particularly in the poorest countries, and particularly for secondary schooling, which can be expensive. Another

complication is that there may be lags between the rise in returns to schooling and the rise in enrolments. If the quantity-quality account is correct, then parents who already have large families will not be able to afford to respond to increases in returns. Only when children of new cohorts of parents with reduced fertility reach school age will enrolments begin to rise substantially.

Literacy. Adult literacy is often cited as a socio-economic variable that ought to be negatively associated with fertility. However, adult literacy plays no particular role in quality-quantity arguments, which focus on the potential human capital of the children rather than the actual human capital of the parents. Some scholars assume that literate parents are more capable of innovation, but that assumption is not adopted here.

Female labour force participation. Increased opportunities for women to enter the labour market raise the returns to investment in daughters, which falls squarely within the quantity-quality framework. Increased opportunities also raise the opportunity cost of childbearing, which, though important, are not a central focus of the framework. Interpreting the relationship between female labour force participation is always difficult, since rising participation can be an effect of reduced fertility as well as a cause.

Geographical region. Variables indicating geographical region often added to statistical models of fertility decline. These pick up many types of geographical variation. They capture differences in family system, religion, and moral strictures. They also capture differences in economic structure: a sparsely settled African country dependent on mineral extraction has a different economy from a densely settled Asian country with the same GDP per capita.

The standard development indicators can evidently be expected to pick up some of the changes postulated by quantity-quality theories, but not reliably. The same observation has previously been made about development indicators and socio-economic theories more generally (Hirschman 1994: 222-3; Bongaarts and Watkins 1996: 642-3; Hirschman 2001: 120-1). When allowance is also made for the considerable noise in the data (Srinivasan 1994), it is apparent that tests of socio-economic theories based on the development indicators are necessarily weak.

Table 1, a modifed version of the tables used to define Type-1 and Type-2 errors in statistics, helps clarify the sense in which the tests are weak. The table depicts what happens when predictions about development indicators are used to decide how much weight to assign to a socio-economic theory. Note that the choice depicted is *not* between ‘accepting’ or ‘rejecting’ the theory. As Hirschman (1994: 222) points out, most demographers agree that socio-economic theories have a role in explaining fertility decline, and disagree only on the extent of that role.

Table 1 Using development indicators to make inferences about a socio-economic theory of fertility decline

		Actual importance of the processes described in the socio-economic theory	
		High	**Low**
Consistency between features of the development indicators and predictions of the socio-economic theory	**High**	(a) Correctly give substantial weight to theory	(b) Incorrectly give substantial weight to theory
	Low	(c) Incorrectly give little weight to theory	(d) Correctly give little weight to theory

Suppose, as shown in the lower row of the table, that the predictions of the theory are not borne out by the development indicators, and the theory is accorded little weight. It is possible that the development indicators have given the wrong impression, and that the processes described in the theory are actually important. This is the situation represented by outcome (c). The discussion of the development indicators above suggests that the probability of outcome (c) is quite high, even if the socio-economic theory is in fact correct.

Outcome (b), the opposite type of error, is also possible. When fertility is negatively associated with education, it may be for reasons that are different from those suggested by socio-economic theories. Education may reduce fertility by, for instance, expanding children's social networks (Hirschman 1994: 222-4; Bongaarts and Watkins 1996: 662-3; Potter, Schmertmann et al. 2002: 757-8).

Making inferences based on the consistency between the development indicators and a socio-economic theory is evidently hazardous. It might therefore seem pointless to worry about the consistency between the indicators and the theory, which is the subject of the following three sections. The conclusion of the paper argues, however, that consistency ought to affect people's evaluations of the theories.

Objection one: Level of development too low

The first of the three objections to socio-economic theories made by the National Research Council is that fertility declines have occurred at implausibly low levels of development, as measured by standard development indicators. The NRC cites the examples of Thailand and Indonesia in the 1970s and Nepal and Bangladesh in the 1980s (National Research Council 2000: 59).

This is a valid criticism of the idea that fertility decline is, in some unspecified way, connected to improved living conditions. The criticism is an important one, in that references to 'improved living conditions' are one of the most commonly encountered socio-economic 'explanations'.

However, the objection has much less force when applied to explanations based on a quantity-quality trade-off. What matters to this type of explanation is the existence of an opportunity structure that rewards investment in children's human capital. These sorts of opportunity structures are more likely to emerge in societies scoring high on the standard development indicators. But, as the section above discusses, the link

between structure and indicators is loose. Scholars cannot assume a priori that a low-scoring country does not have the necessary opportunity structure: finding out requires investigation of the country's institutions and social and economic trends.

Bryant (1998) is an attempt to carry out just this sort of investigation in the case of northern Vietnam. Northern Vietnamese fertility first started to decline in the 1960s, with the crude birth rate falling by about 20% during the decade, and continuing to fall thereafter. At this time only 10% of the population lived in urban areas, and GDP per capita may have been as low as $US100 per capita. Life expectancy at birth was probably somewhere between 40 and 50 years[1]. Roughly 90% of children entered primary school, though less than half this number completed it[2]. Overall, northern Vietnam scored low on conventional development indicators.

Although a number of factors, including wartime disruption, contributed to the fertility decline, an important role was played by the particularly strong returns to education operating at the time. Northern Vietnam, like other communist countries, was a two-tier society. The upper tier consisted of state sector employees and their families, who, although poor by any absolute standard, received privileged access to education, health care, pensions, and housing, funded through the central government budget. The lower tier consisted mainly of people in agricultural and handicraft cooperatives, who depended on their cooperatives for employment and social services. The principal route for young people to join the state sector was through education.

In normal circumstances, non-state-sector parents might have despaired of getting their children into the state sector. But during the 1960s and early 1970s the number of openings was unusually high, because funding from the Soviets enabled the northern Vietnamese government to rapidly expand the state sector. The number of state sector employees grew from 0.5 million in 1960 to 1.8 million in 1975, an increase of 1.3 million; the working-age population at the end of the period was 11.0 million (Fforde and Paine 1987: Table 4.1). Paying for the children's education was, nevertheless difficult. Northern Vietnamese families lived barely above subsistence, and parents were required to contribute to schooling costs. Providing children with secondary schooling was particularly difficult, as children generally had to live away from home.

In 1960s northern Vietnamese, then, incentives to favour 'quality' over 'quantity' were strong, even though the country scored low on conventional development indicators. The northern Vietnam case involved an unusual set of conditions. But so, perhaps, have other low-scoring countries where fertility has declined. For instance, Caldwell et al (1999) find that standard development indicators understate the amount of socio-economic change that has occurred in Bangladesh, and that this socio-

[1] The UN Population Division uses a combined figure for northern and southern Vietnam of 45 years for the period 1960-1965.

[2] This figure, which is necessarily approximate, was calculated from educational attainment data from the 1989 Census (Bryant 1996). The calculations assume that people attended primary school when they were aged around 5-10 years. Note that the gross enrolment rate would probably have been lower than the proportion who ever attended school.

economic change, in conjunction with family planning programs, has contributed to fertility decline in Bangladesh. The fact that a country is very poor does not necessarily mean that socio-economic theories cannot help explain its fertility decline.

Objection two: Limited predictive power

The second National Research Council objection, which is related to the first, is that fertility declines have occurred under a wide variety of socio-economic conditions. In some countries, fertility has declined at very low levels of development, as measured by standard development indicators, while in other countries it has declined at very high levels of development. Claims that socio-economic theories have a poor predictive record are sometimes substantiated by citing a few notable predictive failures. It is better, however, to see how the theories fare across a large sample of countries, by estimating a statistical model.

Some statistical models testing socio-economic theories predict the level of fertility in each country; some predict the date when each country's fertility transition. The path-breaking analysis by Bongaarts and Watkins (1996) contains both. Models predicting dates involve special difficulties, however. Deciding when a fertility decline begins is arbitrary in a significant minority of cases where there is no clear maximum or turning point. In addition, fertility in contemporary developing countries often peaked in the 1960s or earlier[3], and socio-economic data for this period are scarce, leading to numerous missing observations. This paper therefore looks only at models trying to predict fertility levels (though in future work I intend to look at models predicting dates.)

Table 2 shows results from a very simple model, based on a number of development indicators that hopefully capture some of the social changes that are emphasized by quantity-quality explanations. The sample is that of Casterline (2001: 44), and consists essentially of the developing countries that had populations of one million or more in 1970. The regional groupings also come from Casterline. Nine periods are used: 1960-1964, 1965-1969, and so on up to 1995-1999. A list of the countries and data sources is given in the Appendix.

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[3] Casterline Casterline, J. B. (2001). The pace of fertility transition: National patterns in the second half of the twentieth century. Global Fertility Transition. R. A. Bulatao and J. B. Casterline. New York, The Population Council. has convincingly argued that the onset of fertility decline should normally be located at the point where fertility reaches its highest value. Bongaarts and Watkins Bongaarts, J. and S. C. Watkins (1996). "Social interactions and contemporary fertility transitions." Population and Development Review **66**(4): 639-82. follow the 'Princeton Rule' and locate the onset at the point where fertility has declined 10% from its maximum. Use of the Princeton rules yields later onsets, often substantially so.

Table 2 Results for a model of the total fertility rate in 94 countries, 1960-1999

Variable	Estimate	Standard error	P-value
(Intercept)	11.510	0.509	0.000
Life expectancy	-0.058	0.008	0.000
Gross primary enrolment (%)	0.002	0.002	0.163
Gross secondary enrolment (%)	-0.025	0.003	0.000
Log of GDP per capita (PPP)	-0.302	0.063	0.000
Percent urban	-0.004	0.003	0.130
Hectares of arable land per person	0.222	0.172	0.199
Region			
Central Asia (reference category)	-	-	-
East, Southeast, South Asia	-0.663	0.315	0.036
Latin America and the Caribbean	0.025	0.326	0.939
North Africa and West Asia	0.489	0.325	0.133
Sub-Saharan Africa	-0.089	0.327	0.785

Adjusted R-squared: 0.7812
Note: The estimation method used was ordinary least squares. For data sources and a list of countries, see Appendix 1.

The only three variables that have much explanatory power are life expectancy, secondary enrolment, and GDP per capita, plus the variables representing geographical region. Experimentation shows that there is little change in fit if the remaining socio-economic variables—primary enrolment, percent urban, and arable land per person—are replaced with alternative variables, such agricultural employment, or are dropped altogether. The absence of a relationship between primary enrolment and fertility, combined with the strong relationship between secondary enrolment and fertility, is interesting. It is not investigated here, however, since the focus is on the overall fit to the data, rather than the coefficients.

Table 3 Prediction errors from the model in Table 1

Absolute difference between predicted and actual value	Percent of observations	Proportional difference between predicted and actual value	Percent of observations
Less than 0.5 births	48%	Less than 10%	52%
Less than 1.0 births	81%	Less than 20%	81%
Less than 1.5 births	95%	Less than 30%	92%
Less than 2.0 births	99%	Less than 40%	96%

Table 3 presents data on the extent to which predicted values from the model in Table 2 match actual values. The predicted values come within 0.5 births of the actual values 48% of the time, and come within 10% of the actual values 52% of the time. There are a small number of large outliers: 5% of predicted values differ from actual values by at least 1.5 births.

Using a robust estimator[4] improves the fit marginally: for instance, the proportion of predicted values that are within 0.5 of the actual values rises from 48% to 49%. A better fit can also be obtained by allowing coefficients to differ by geographical

[4] Specifically, Huber's M-Estimator, implemented in the software package *R* with the function *rlm* (Venables and Ripley 2002; R Development Core Team 2004).

region (and dropping primary enrolment, percent urban, and land per person to avoid using up too many degrees of freedom). In this version, the proportion of predicted values that are within 0.5 births of the actual values rises to 53%, and the proportion that are within 1.5 births rises to 99%.

The fit of all these models is inferior to that of the models estimated by Potter, Schmertmann, and Cavenaghi (Potter, Schmertmann et al. 2002: Table 2) in a similar exercise using small regions in Brazil. In their rural sample, the proportion of predicted values that were within 0.5 births of the actual value was 59%, and in their urban sample it was 70%[5]. One plausible reason why the fit obtained by Potter *et al* is better is that there are fewer unmeasured differences between Brazilian regions than there are between countries (Potter, Schmertmann et al. 2002: 757).

Reasonable people can disagree on whether the errors summarized in Table 3 indicate an adequate fit. However, in the social sciences, a simple model using poor quality data that comes within 10% of the true value half the time, and 30% of the true value 92% of the time is, arguably, doing rather well. Quantity-quality theories do not, in any case, predict a perfect fit, since the indicators that are used only partly capture the socio-economic changes emphasized by the theories. The NRC claim that socio-economic theories have low predictive power can, on these grounds, be questioned.

Objection three: Shifts in the relationship between fertility and development indicators

The third National Research Council objection is that the relationship between fertility and the development indicators has shifted over time. Fertility declines, the NRC argues, have occurred at progressively lower levels of development. To illustrate the point, the NRC present data showing that the level of literacy when countries begin their fertility transitions is lower the more recently the transitions have begun (National Research Council 2000: Figure 3-3). As described above, quality-quantity theories accord no particular significance to adult literacy, so this observation does not count against them. However, the NRC also draws heavily on the 1996 article by Bongaarts and Watkins that used more comprehensive indicators and found clear evidence of a shift over time.

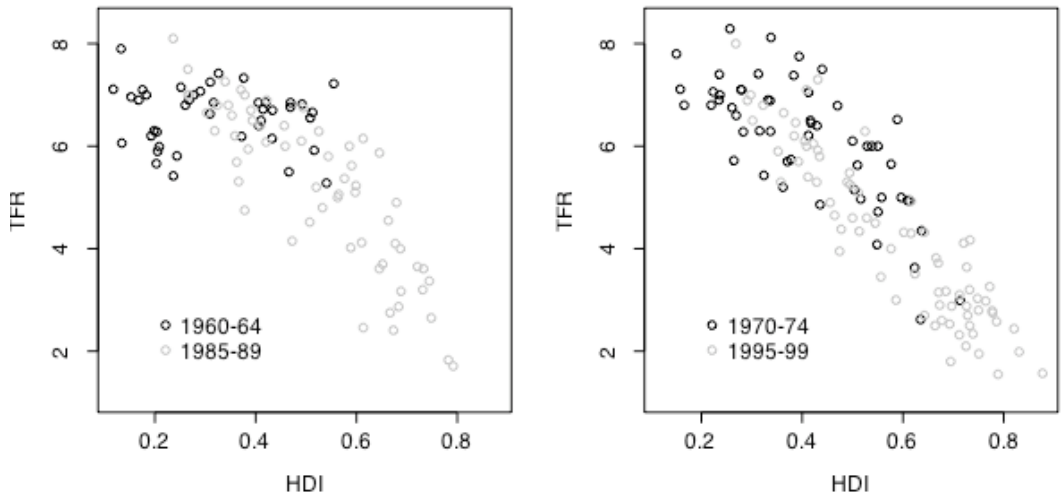
In the nine years since Bongaarts and Watkins published their analysis many new socio-economic data have become available, and older data have been revised. This section examines whether the shifts identified by Bongaarts and Watkins are still apparent in the data. No attempt is made to identify the onset of fertility transition, so, as in the previous section, only some of the findings of Bongaarts and Watkins are discussed.

Bongaarts and Watkins (1996: Figure 3) test for changes in the cross-sectional relationship between fertility and development by plotting the total fertility rate against the Human Development Index (HDI) in 1960-65 and 1985-90. (The HDI is a

[5] Potter et al also estimate a fixed effects model. This is something I intend to try in future work.

convenient summary measure for overall socio-economic development, incorporating GDP per capita, life expectancy, literacy, and education[6] (UNDP 2004: 259)). They find that, except at very low levels of HDI, the predicted TFR for a given HDI is lower in 1985-90 than in 1960-65. As they point out, this result is similar to Preston's (1975) finding of a changing relationship between mortality and the level of economic development.

Figure 1 The relationship between the total fertility rate and the Human Development Index



The left panel of Figure 1 shows data for (essentially) the same two periods, though unlike in Bongaarts and Watkins (1996: Figure 3), all the data points are plotted, rather than just summary measures. Plotting all points makes it clear that a substantial proportion the two scatterplots do not overlap, which makes comparison difficult. In the section where they do overlap, however, TFR is generally lower in 1985-89 than in 1960-64, consistent with Bongaarts and Watkins. The right panel of Figure shows results for 1970-74 and 1995-94. For HDI values of around 5, TFR is generally lower in 1995-99 than in 1970-74. The most striking feature of graph, however, is how similar the two distributions are.

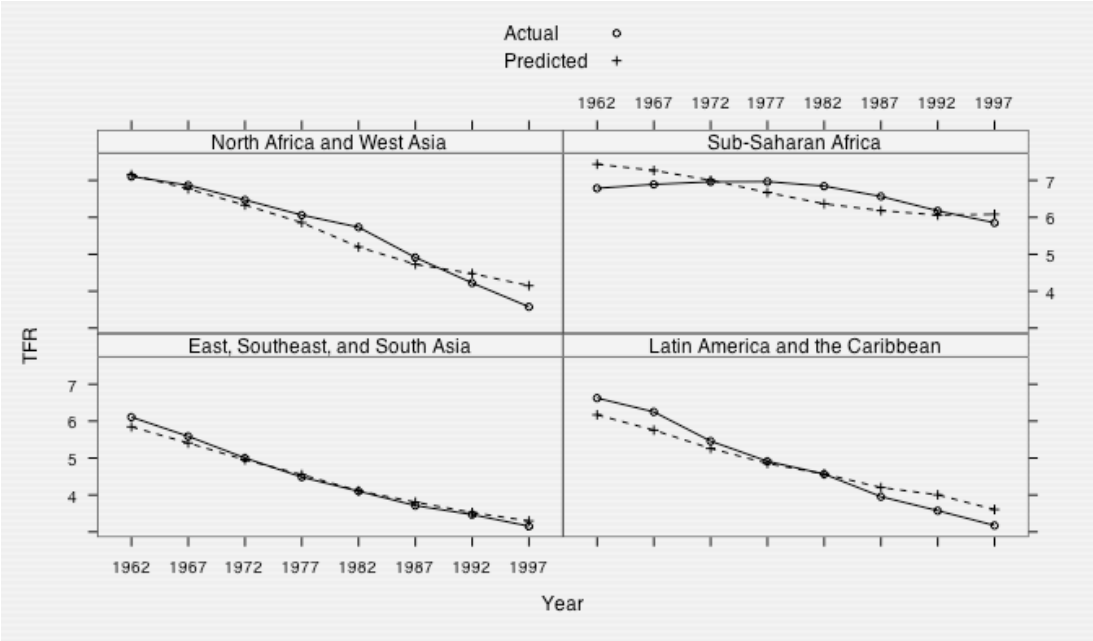
In addition to the bivariate analysis based on the HDI, Bongaarts and Watkins (1996: Appendix B) estimate a multivariate model in which the TFR is a non-linear function of six standard development indicators, plus variables measuring the passage of time. They find that, for a given level of development, the predicted level of fertility falls over time.

An alternative way of using multivariate models to test for shifts over time is to examine how residuals vary over the period being modelled. This is the approach taken by Potter et al (2002), and by this paper. Figure 2 shows average fertility rates, by region and period. Central Asia has been excluded from the analysis because the required data are only available for the 1990s. The circles in Figure 2 represent actual

[6] In fact, the HDI did not include education when Bongaarts and Watkins carried out their study. However, the education index accounts for only one-ninth of the total HDI, and HDIs calculated in the new way and the old way are highly correlated.

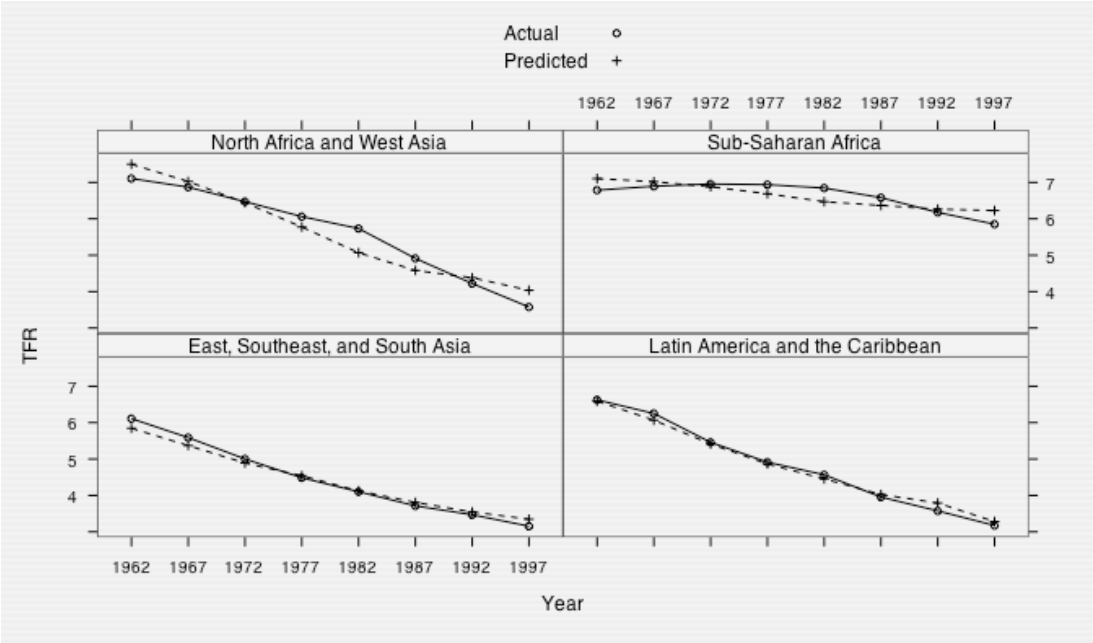
values, and the crosses represent predicted values from the model shown in Table 2. This model does not include variables measuring the passage of time. Shifts in the relationship between the development indicators and fertility show up as gaps between the predicted and actual values.

Figure 2 Regional averages for actual and predicted TFR, using the model of Table 2



The model does a rather poor job of predicting time trends in African fertility. Latin America and the Caribbean shows the clearest evidence of a downward shift in the fertility for a given level of development: the model under-predicts fertility at the beginning of the period, and over-predicts it at the end. East, Southeast, and South Asia shows the same pattern, on a much smaller scale. North Africa and West Asia also shows this pattern, provided attention is confined to the 1980s and 1990s. The under-predictions and over-predictions need, however, to be set against fact that the model accounts for the vast majority of the substantial fertility decline in each of the three regions outside Sub-Saharan Africa.

Figure 3 Regional averages for actual and predicted TFR, using a model in which coefficients vary by region



Potter et al (2002) allow urban and rural areas to have different sets of coefficients. Figure 3 shows what happens when the same thing is done for different regions (and, as described above, the variables for primary enrolment, percent urban, and land are dropped.) The revised model achieves a much better fit for Sub-Saharan Africa. Intriguingly, in both Sub-Saharan Africa and North Africa and West Asia the model over-predicts fertility at the beginning and end of the period, and under-predicts it in the middle. In Asia and Latin America there are hardly any prediction errors. Overall, the revised model accounts for almost all the decline in fertility across the four regions, and provides no evidence of a systematic downward shift in the relationship between fertility and development.

Conclusion

There is a consensus among many demographers that 'socio-economic', 'structural', or 'demand' theories of fertility decline are not consistent with the evidence from cross-country development indicators. This paper has examined three alleged predictive failures, and raised doubts about all of them. The paper has argued that fertility declines in countries with very low levels of development can, in at least some cases, be plausibly explained by socio-economic theories. It has argued that, despite some spectacular outliers, statistical models based on socio-economic theories fit the data moderately well. Finally, it has argued that, contrary to previous findings, the relationship between fertility and development has been stable over time.

After establishing the second and third of these arguments in the Brazilian case, Potter et al (2002) end with something of an anti-climax. They note that the impressive fit achieved by their statistical models, and the stability of the fertility-development relationship, are both compatible with diffusionist explanations as well as socio-economic ones. All they are therefore willing to conclude is that "social interaction is

more closely tied to and dependent on the accompanying process of development than has previously been acknowledged" (Potter *et al* 2002: 759).

Is this really all that can be concluded from Potter et al's results and from the results presented here? It is certainly true that consistency with the evidence from the development indicators does not conclusively establish the importance of socio-economic explanations, just as inconsistency does not prove their insignificance. But consistency is nevertheless more likely if the processes identified by socio-economic theories matter a great deal than if they do not. Conversely, inconsistencies, such as shifts in relationships, are more likely if processes such as diffusion matter. In other words, consistency with the development indicators does have modest diagnostic value. If so, and if socio-economic theories of fertility decline are more consistent with the evidence from development indicators than was previously thought, then socio-economic theories of fertility decline should be accorded more weight than was previously thought.

Appendix: Additional information on the statistical models

Appendix Table 1 Countries used in the statistical models

Central Asia	Mongolia	Guatemala	Turkey	Liberia
Azerbaijan	Myanmar	Haiti	Yemen	Madagascar
Kyrgyz Republic	Nepal	Honduras	**Sub-Saharan Africa**	Malawi
Tajikistan	Pakistan	Jamaica		Mali
Turkmenistan	Papua New Guinea	Mexico	Angola	Mauritania
Uzbekistan	Philippines	Nicaragua	Benin	Mozambique
East, Southeast, and South Asia	Singapore	Panama	Botswana	Niger
	Sri Lanka	Paraguay	Burkina Faso	Nigeria
Afghanistan	Thailand	Peru	Burundi	Rwanda
Bangladesh	Vietnam	Puerto Rico	Cameroon	Senegal
Bhutan	**Latin America and the Caribbean**	Venezuela	Centr. Afr. Rep.	Sierra Leone
Cambodia		**North Africa and West Asia**	Chad	Somalia
China	Bolivia		Congo, Dem. R.	South Africa
Hong Kong	Brazil	Algeria	Congo, Rep.	Sudan
India	Chile	Egypt	Cote d'Ivoire	Tanzania
Indonesia	Colombia	Iraq	Eritrea	Togo
Iran	Costa Rica	Jordan	Ethiopia	Uganda
Korea, Dem. Rep.	Cuba	Lebanon	Ghana	Zambia
Korea, Rep.	Dominican Rep.	Morocco	Guinea	Zimbabwe
Lao PDR	Ecuador	Syria	Kenya	
Malaysia	El Salvador	Tunisia	Lesotho	

Note: The sample and the regional groupings are the same as those used by Casterline (2001).

Appendix Table 2 Sources of data

Variable	Source
Life expectancy; Percent urban; Hectares of arable land per person	The World Bank's *World Development Indicators* online database.
Primary and secondary enrolment	Data for 1960-1964 from the database accompanying Easterly (1999), available on the World Bank website. Data for 1970-1999 from the *World Development Indicators*. Estimates for 1965-1969 were obtained by linearly interpolating the figures for 1960-1964 and 1970-1974.
GDP per capita, PPP	The Penn World Tables, Version 6.1 (Heston, Summers et al. 2002)

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