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Desired Fertility and the Impact of Population Policies

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Desired levels of fertility account for 90 percent of differences across countries in total fertility rates. Reducing the demand for children — for instance by giving girls more education — is vastly more important to reducing fertility than providing more contraceptives or family planning services.

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Summary findings

Ninety percent of the differences across countries in total fertility rates are accounted for solely by differences in women's reported desired fertility. Using desired fertility constructed from both retrospective and prospective questions, together with instrumental variables estimation, it is shown this strong result is not affected by either ex-post rationalization of births nor the dependence of desired fertility on contraceptive access or cost. Moreover, despite the obvious role of contraception as a proximate determinant of fertility, the additional effect of contraceptive availability or family planning on fertility - quantitatively small and explains very little cross country variation. These empirical results are consistent with theories in which fertility is determined by parent's choices about children within the social, educational, economic, and cultural environment parents, and especially women, face. They contradict theories that assert a large causal role for expansion of contraception in the reduction of fertility.

This paper — a product of the Office of the Vice President, Development Economics — is part of a larger effort to investigate the impact of population policies. An edited version of this paper will appear in the March 1994 volume of the *Population and Development Review*. Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Patricia Cook, room N5-057, extension 33902 (85 pages). March 1994.

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From 1950 to 1990, population in the developing world grew at historically unprecedented rates, more than doubling to reach 4.2 billion. By 2025, population in the developing world is projected to exceed 7 billion (World Development Report, 1992). Even those skeptical about the destructive power of the population bomb should be convinced that the political, economic, and environmental landscape of the next century will be largely affected by the speed of the demographic transition in developing countries.[2] Policies which can accelerate (or delay) this transition have been the focus of countless debates since 1798, when Malthus warned that the "power of population" would someday overwhelm the planet.

Since mortality rates have and are continuing to fall rapidly almost worldwide, differences in fertility are the dominant determinant of the evolution of population in the

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[1] The views expressed in this paper are exclusively those of the author

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[2] The debate about the population and economic performance relationship has a long history, Kelley (1988) and Birdsall (1988) are useful reviews. The importance for population growth for political balance is argued forcefully by Paul Kennedy in Preparing for the 21st Century. The links with the environment (updating many others) are discussed by Vice President Al Gore in Earth in the Balance.

developing world. Since there are large variations in fertility rates across countries (e.g. 6.4 in Kenya, 7.4 in Syria versus 3.1 in Argentina, 2.9 in Indonesia), and large movements in fertility over time, is is reasonable to expect social scientists to be able to reach a consensus on the primary determinants of fertility.

Yet two views on why fertility varies appear commonly in discussions of family planning policy. The first, the "family planning gap" view is that high fertility is in large part a consequence of inadequate contraception due to the inaccessibility or high cost of contraceptive services. This places heavy emphasis on the mechanistic role of contraception as a "direct" or "proximate" determinant of fertility. A recent article by Robey, Rutstein, and Morris (1993) reflects this common view in statements like; "Of all direct influences, the most important is family planning," and "differences in contraceptive prevalence explain about 90 percent of the variation in fertility rates," and "fertility levels have dropped most sharply where family planning has increased most dramatically." They downplay the adage, development is the best contraceptive, contending instead "that although development and social change create conditions that encourage small family size, contraceptives are the best contraceptive." According to this view, the provision or subsidization of contraceptive services offer the possibility of substantial reductions in fertility rates, independent of broader development trends.

The second, "desired children" view, is that high fertility primarily reflects desired births and that couples are roughly able to achieve their fertility targets. This view is held by most economists who have studied fertility behavior. As Becker (1991) argues "major changes [in fertility] have been caused primarily by other changes in the demand for children" and

"improvements in birth control methods are mainly an induced response to other decreases in demand for children, rather than an important cause of the decreased demand." In this view men's and women's fertility choices, which are conditioned and constrained by the social, educational, cultural and economic conditions they face, are the primary determinants of actual fertility. In this view, improving objective conditions for women -- raising their income, increasing their education, encouraging empowerment -- is the only voluntary and sustainable way to achieve the reductions in fertility necessary to reduce population growth.

The analysis in this paper demonstrates that the "desired children" view of fertility is valid. Analyses purporting to demonstrate the dominant importance of the provision of family planning are typically based on analytical errors. Using data and statistical techniques that allow us to isolate women's fertility desires independent of contraceptive costs or access, we show that to a striking extent the answer to why actual fertility differs across countries is that desired fertility differs. In countries where fertility is high, women want more children. "Excess" or "unwanted" fertility plays a minor role in explaining fertility differences. Moreover, the level of contraceptive use, measures of contraceptive availability (such as "unmet need"), or family planning effort, have little impact on fertility after controlling for fertility desires.

These conclusions are developed in six sections. The first section makes a prima facie case for the "desired children" view by showing that nearly all (roughly 90 percent) of the differences between countries in actual fertility are accounted for solely by differences in desired fertility. The second section addresses the two most important objections to using reported

desired fertility; the ex-post rationalization of births and the influence of contraceptive cost or availability on reported desires. These two problems are surmounted, empirically and econometrically. Third, data on contraceptive prevalence is used to show that although contraceptive use is an obvious proximate (or direct) determinant of fertility and hence an important correlate of fertility, contraceptive prevalence has no effect on excess fertility (or the fraction of unwanted births) and little independent effect on fertility, after controlling for fertility desires.

The fourth section shows that in spite of the mechanistic link between contraception and fertility, a very small influence of contraceptive access on fertility levels is intuitive and consistent within a choice based approach. The decision to have another child is simply too important and too costly for contraceptive costs to play a major role. In economic terms, fertility is inelastic with respect to contraceptive costs because contraceptive costs are such a small component of the childbearing costs. The fifth section assesses historical and contemporary household survey evidence which supports a finding that contraceptive access has little effect on fertility levels.

The sixth section addresses three strands of evidence often cited in support of the importance of family planning and contraceptive access; the large reported "unmet need" for contraception, cross country evidence on the importance of family planning efforts for fertility, the rapid recent changes in fertility, and the results of the deservedly famous family planning experiment in Matlab, Bangladesh. Each of these strands is able to show some statistically

significant, independent, influence on fertility. However, it is also shown that none of this evidence refutes the paper's two key contentions; that fertility is quite unresponsive to changes in contraceptive access (or family planning effort) and that family planning explains very little (at most five percent) of the large cross country differences in fertility.

This analysis indicates that the challenge of reducing fertility is the challenge of reducing women's fertility desires, not reducing "unwanted" fertility. The key question is how much of fertility desires are determined by economic influences and how much by social and cultural forces. More importantly, how and when can government policy instruments effectively influence these underlying fertility determinants? The roles and scope for policies for increased female schooling, improved maternal and child health, larger economic opportunities and higher social status for women are critical questions left to future research.

Actual Fertility and Fertility Desires

The best evidence available on total fertility rates (TFR)[3] and on the desire for children across countries is women's responses to questions about their fertility behavior and their fertility preferences in household surveys. Such surveys have been conducted to date in a large number of countries by the World Fertility Surveys (WFS) and the Demographic and Health Surveys (DHS) programs. Using these three surveys indicators of fertility preferences have been

[3] The total fertility rate is a synthetic number calculated as the number of children a woman would have during her reproductive years at current age-specific fertility rates.

derived. The first uses women's responses to a question about their ideal number of children - to conpute the "average ideal number of children" (AINC). A second measure of fertility preferences, the "desired" total fertility rate (DTFR), recalculates the total fertility rate in each country from age specific birth rates after subtracting from the number of actual births those prior births that exceed each woman's reported desired family size (Westoff, 1991). A third approach (Bongaarts, 1990) calculates the "wanted" total fertility rate (WTFR) by using answers to questions about women's future desire for children to classify births (or current pregnancies) as wanted or unwanted.[4]

Table A.1 (in the Data Appendix) presents the following data for the years available from the country WFS and DHS surveys and the Westoff (1991) and Bongaarts (1990) papers: actual TFR, the average ideal number of children (AINC), the desired total fertility rate (DTFR), and the wanted total fertility rate (WTFR). Also reported (to be discussed later) are the fraction of births that are wanted from the Bongaarts (1990) calculations and the fraction of women with four living children who want no more children from the WFS and DHS surveys. There data show the enormous differences across countries in fertility. In our sample, the range of TFR is over 6 births per woman, from a high of 8.5 in Yemen in (1979) a low of 2.2 in Thailand (in 1987). The standard deviation of TFR is 1.5. In assessing the impact of various measures on fertility keeping in mind this large range, and the large changes in fertility (of three to four births per woman) the demographic transition involves will be helpful.

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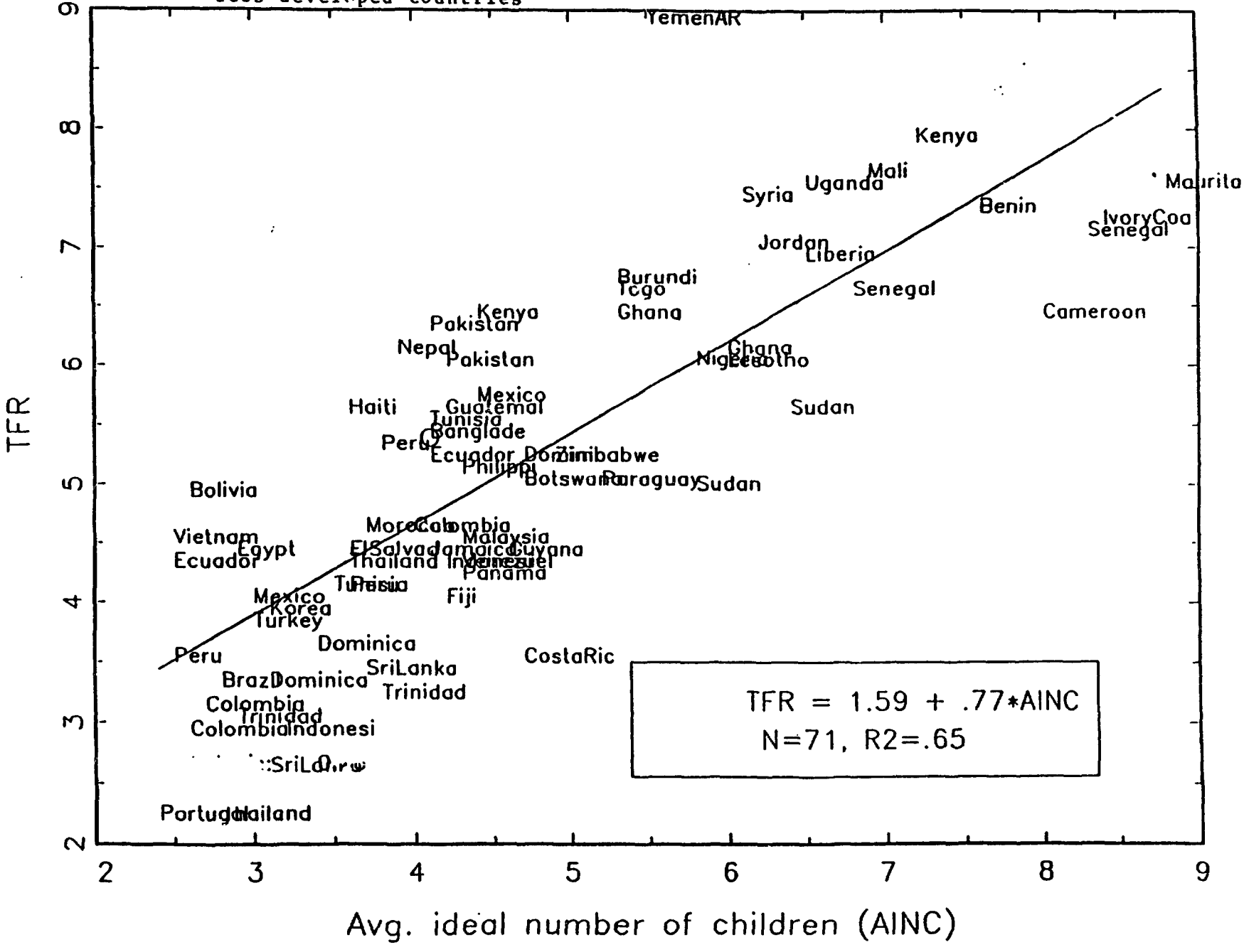
[4] The terminology for "desired" and "wanted" stems from Bongaarts, 1990 to distinguish DTFR based on desired family size and WTFR based on wanting an additional child. All three are referred to as measures of fertility desires, in spite of the potential confusion.

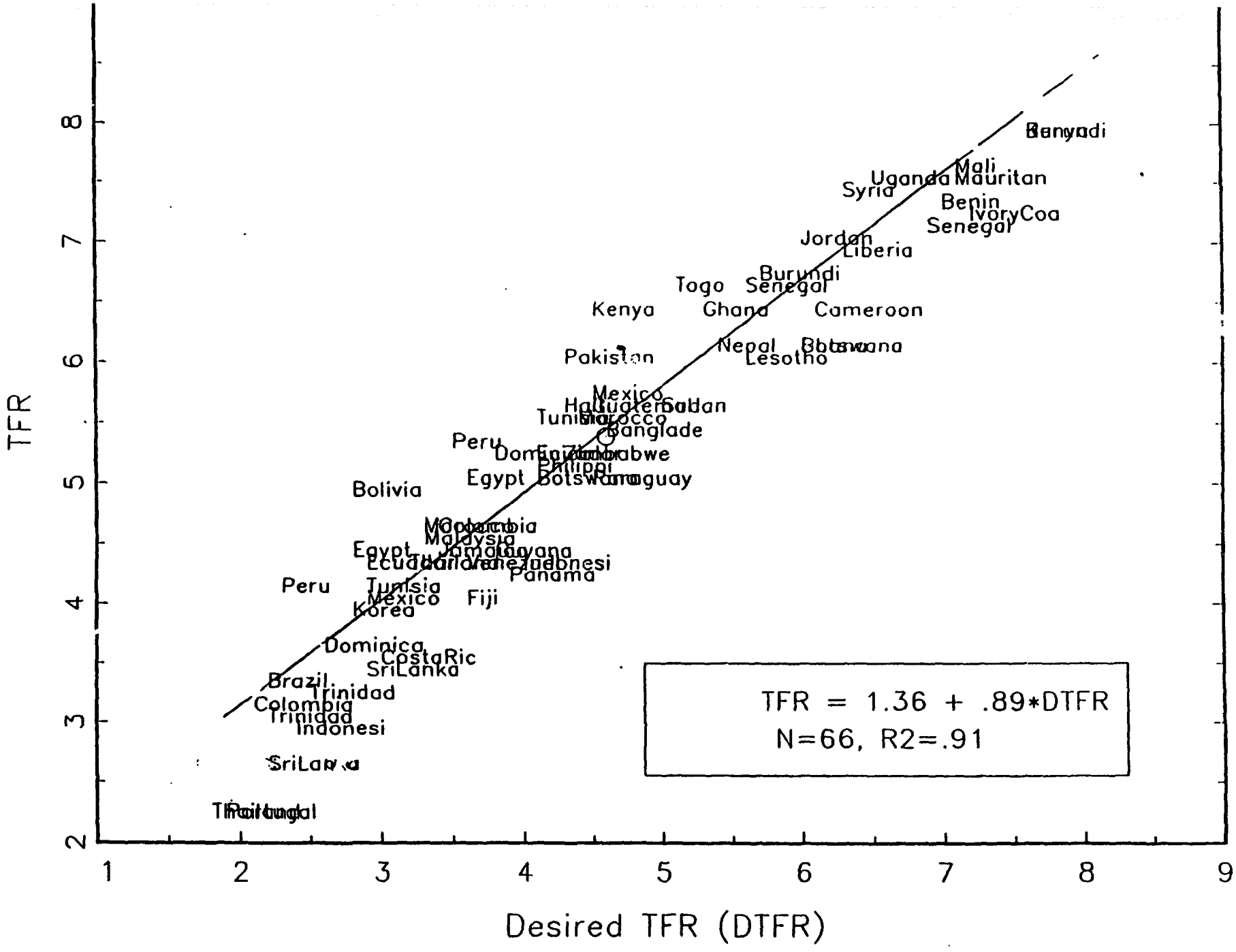
Even at a first glance it is apparent that high fertility countries generally have high desired fertility. Figure 1 shows the strong and tight relationship between actual fertility and the three measures of fertility desires. Cameroon's actual TFR in 1978 was 6.4, whereas its AINC was 8, DTFR was 6.1, and WTFR was 6. In contrast, Sri Lanka's TFR in 1987 was 2.6 while AINC was 3.1, DTFR was 2.2 and WTFR was 2.2. The differences across countries in desired fertility are very much larger than the differences for a given country between actual and desired fertility.

Table 1 reports the results of regressing actual fertility on fertility desires. There are two striking results. The fraction of cross-country fertility variation explained (the R-squared) by desires is .92 for DTFR, .89 for WTFR, and .65 for AINC. These R^2 are extremely high for cross-country regressions and imply that 90 percent of the differences in actual fertility levels across countries are associated with differences in desired fertility.[5] High fertility is explained almost completely by a high desire for children.

[5] The low R^2 of AINC primarily represents measurement error, discussed below.

Figure 1: Relationship between actual fertility and three measures of desired fertility for less developed countries




TFR
Desired TFR (DTFR)
TFR = 1.36 + .89*DTFR
N=66, R2=.91
Mali
Uganda
Syria
Benin
Senegal
Jordan
Liberia
Burundi
Togo
Kenya
Ghana
Cameroon
Nepal
Lesotho
Pakistan
Mexico
Peru
Egypt
Bolivia
Malaysia
Panama
Fiji
Korea
Dominica
SriLanka
Brazil
Trinidad
Colombia
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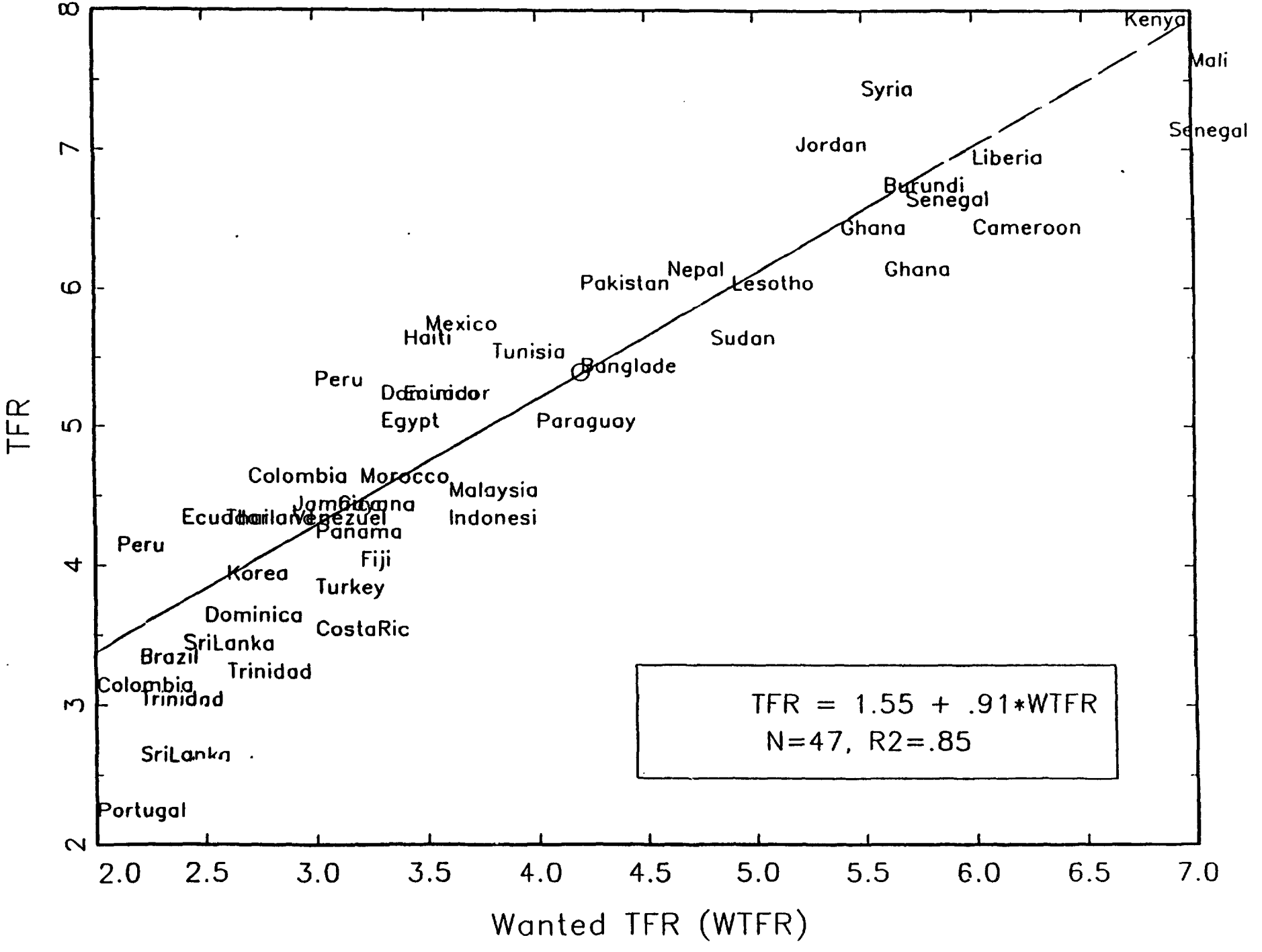
TFR
Wanted TFR (WTFR)
TFR = 1.55 + .91*WTFR
N=47, R2=.85
Kenya
Mali
Syria
Senegal
Jordan
Liberia
Burundi
Senegal
Ghana
Cameroon
Pakistan
Nepal
Lesotho
Ghana
Mexico
Haiti
Sudan
Tunisia
Banglade
Peru
Egypt
Paraguay
Colombia
Morocco
Malaysia
Indonesi
Peru
Fiji
Korea
Turkey
Dominica
CostaRic
SriLanka
Brazil
Trinidad
Colombia
Trinidad
SriLanka
Portugal
2
3
4
5
6
7
8
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0

Table 1 Regressions of the actual total fertility rate on three measures of the desired fertility rate for developed countries

Explanatory Variable	Average Ideal Number of Children (AINC)		Desired Fertility Rate (DTFR)		Wanted Fertility Rate (WTFR)	
Estimation Method*	OLS	IV	OLS	IV	OLS	IV
Coefficient (Standard Error)	.79 (.074)	.88 (0.82)	.93 (0.36)	.91 (0.42)	.95 (0.63)	.91 (0.67)
t test for $\beta = 0$	10.7	10.6	25.5	21	15.1	12.6
t for H_0 $\beta = 1$	2.72	1.37	1.92	2.06	.85	1.24
R^2	.65	.64	.92	.92	.89	.85
IV First Stage R^2	--	.84	--	.77	--	.84
Number of observations	64	64	57	57	42	42

*OLS: Ordinary Least Squares, IV: Instrumental Variables (see discussion in text).
Note: Instruments used in all three IV regressions were fraction of women not wanting more children with 2, 4, and 6 living children.

Second, the slopes of the regression lines are essentially one. This implies that actual fertility increases almost one-for-one with desired fertility. The third row of Table 1 shows tests that the coefficient is one. In general, the hypothesis that the best predictor of a country's actual fertility rate is desired fertility (plus a constant) is not rejected. Imposing the costraint that desired fertility affects actual fertility exactly one for one only lowers modestly the regression's

explanatory power.[6]

A second way to say that fertility rates reflect almost entirely desired fertility is by examining "excess fertility", defined here as the difference between actual and desired fertility. Excess fertility is neither systematically related to the level of fertility (that is, it is not higher for countries with higher fertility), nor is it an important determinant of total fertility. If actual fertility were importantly determined by both fertility desires and by excess fertility, countries with high fertility would not necessarily have high desired fertility. This would imply that the explanatory power of desired for actual fertility alone would be low and that the slope of the regression of actual fertility on desired would be less than one. In the limiting case in which fertility desires were constant across countries and differences in excess fertility were the only factor determining actual fertility, the slope and the R^2 in the regressions in Table 1 would be zero. This is emphatically rejected by the data.

Women mean what they say

In order to claim that a one-to-one and close relationship across countries between desired fertility and actual fertility implies that actual fertility is explained almost completely by the desire for children, the question of how accurately these indicators identify and measure fertility

[6] To .603, .900, .844 for AINC, DTFR and WTFR respectively. This is a heuristic equivalent to the t-tests reported in Table 1 of the null hypothesis that the coefficient equals one.

desires must be addressed.[7] Taking women's reported reproductive desires at face value is often characterized as naive and two major objections are raised; ex-post rationalization and dependence on contraceptive costs[8]. First, a woman's response to questions about desired fertility are believed to be heavily influenced by the woman's actual fertility. That is, women do not like to admit that they have children they did not want and hence retrospective questions about fertility desires will be influenced by ex-post rationalization. Second, women's reported fertility desires will not reflect only child desires but will also be affected supply of contraception, that is knowledge, availability, or cost of contraception itself would affect reported desires. Hence desired fertility could not be used to assess the effect of contraception.

In this section we show these objections do not affect the basic results. The availability of measures of fertility desires based on both retrospective and prospective questions about fertility allow us to use the combination of data to solve both problems. Since questions about future fertility desires are unaffected by ex-post rationalization they can be used to solve the ex-

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[7] In fact, one reason these reports of fertility desires have not been previously widely used is the belief they have a large amount of error. Lightbourne (1987b), for instance, points out the close correlation of actual fertility to preferences, "most of the difference in current fertility is due to lower rates of wanted fertility" but concludes "the current fertility desires reported in these surveys cannot be assumed to represent a solid floor that will halt the fertility declines."

[8] A minor objection in this context (but major in others) is that women's fertility desires are unstable over time and hence dynamic stochastic modelling is required. The reason this problem is minor is that (except for AINC) we are addressing explaining the current flow of fertility in terms of the current flow of fertility desires, not in terms of desired fertility stocks. Hence, timing and instability problems that are very serious in household models, that of explaining current flows by desired stocks, are not relevant in this aggregate data.

post rationalization problem. Conversely, since retrospective questions about wantedness of previous births are not affected by the contraceptive costs of preventing future births it is independent of contraceptive costs.

Ex-post rationalization. The average ideal number of children (AINC)[9] is simple and intuitive, but has a number of serious drawbacks as a proxy for desired reproductive behavior and is the worse indicator of fertility desires[10]. Some lead a woman's response to this question to underestimate desired fertility while others lead to an overestimate. If a woman chooses births to achieve a desired family size then child mortality will cause AINC to underestimate desired fertility. Also, as one cannot choose the gender of children born, strong gender preference (either for boys, girls, or a particular mix of each) would cause reported ideal family size to be smaller than the number of desired births.[11] A final surveying problem is that in countries where the desired number of births is large, non-numerical responses occur more

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[9] The question asked of women with children in the DHS on which this indicator is based was "If you could go back to the time you did not have any children and could choose exactly the number of children to have in your whole life, how many would that be?"

[10] One drawback of all the measures, but which will not be discussed is that generally only women are asked fertility questions. Other research (Mason and Taj, 1987) has found that husbands typically do not have systematically larger family size preferences than wives and that actual family size usually falls somewhere between husbands' and wives' preferences when they differ. For instance, in Kenya, AINC is 4.4 for all women (4.8 among married women) and 4.8 among husbands.

[11] For instance, if women have an ideal family size of 3 but also want at least one boy the average completed family size will be 3.25 and if they want one of each gender the average completed family size will be 3.5. These differences are larger than the absolute differences between AINC and TFR in countries with low fertility, but this effect will be smaller at higher levels of ideal family size.

frequently, again leaving AINC as an underestimate of desired births.[12] Due to these limitations AINC is mainly used as a comparison with the better measures; DTFR and WTFR.

A second measure of fertility preferences, the desired total fertility rate (DTFR), calculates a desired total fertility rate from desired family sizes by subtracting from the number of actual births those births which exceed each woman's reported desired family size (Westoff, 1988). A variant on this measure (Lightbourne, 1988) also deletes births if they were reported as unwanted[13]. Since there is a high degree of coherence between reports of desired family size and declaration that a birth was unwanted if it exceeds this size, these two measures are very highly correlated (.98 for the 39 countries with both meassures). DTFR is therefore essentially retrospective as it is based on answers about wantedness and excludes those past births in excess of desired family size (even if not declared unwanted). This is an improvement on AINC, but may still underestimate true desired fertility if gender preferences are strong.

Many demographers suggest that offsetting these tendencies for AINC or DTFR to underestimate desired fertility is that women's responses to questions about fertility preferences are subject to psychological ex-post rationalization, that is, women will tend to deny that their desired family size is smaller than their actual family size. It is difficult to decide how serious

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[12] Yemen is a good example because actual fertility is 8.9, AINC is 5.5 but 30 percent of women respond the number is "up to Allah." The average of numerical responses is reported.

[13] Classification as unwanted is based on the following question women were asked in the DHS: "At the time you became pregnant with [NAME OF LAST BIRTH] did you want to have that child then, did you want to wait until later, or did you want no more children at all?"

this issue is.[14] The fact often used as evidence of ex-post rationalization, that larger ideal family sizes are strongly associated with larger numbers of currently living children, is perfectly consistent with women achieving exactly their desired family size. Fortunately, we have two solutions to this problem: one empirical, finding measures of desired fertility free of rationalization of prior births, and one econometric, using statistical techniques that overcome the bias induced by this measurement error.

Bongaarts' (1990) measure of wanted fertility (WTFR) avoids the potential ex-post rationalization in AINC and DTFR of reproductive preferences by producing a measure of desired fertility and fraction of births unwanted based only on questions about future desires, not retrospective questions about past behavior. Bongaarts uses the answer to the question of whether a woman currently wants another child at some future time to classify the women's previous births (or current pregnancies) as wanted or unwanted. If a woman currently wants another child then the previous birth is classified as wanted. This "want more" fertility rate needs to be corrected to derive a "wanted" fertility rate to account for the possibility that a woman may currently want no more children as the most recent birth (or pregnancy) achieved the desired family size and for the possibility that some women may never achieve their desired family size. Bongaarts uses the household survey results from the WFS and DHS to make these adjustments and calculate the "wanted" total fertility rate (WTFR) and the fraction of births

[14] Women will, in fact, report desired family sizes less than actual. In Trinidad and Tobago, 70 percent of women with 6+ children report a lower ideal number of children, as do 72 percent of women with 6+ children in the Dominican Republic.

unwanted.[15] This measure should be free of ex-post rationalization as it is based on whether women want more children given the most recent birth, not whether the most recent birth was wanted.

The use of two different measures, one of which explicitly attempts to correct for ex-post rationalization, should avoid potentially spurious results due to rationalization of unwanted births. Since the results in Table 1 are nearly identical for DTFR and WTFR[16] it cannot be the case that simple ex-post rationalization substantially affects the present findings, as these two measures should then give different results.

Beyond the use of different empirical measures there is also an econometric solution. Even if these indicators are observed with error there is a straightforward econometric solution to this problem -- the use of instrumental variables[17]. An adequate instrument for the purpose is a variable that is correlated with the "true" desired fertility but free of ex-post rationalization. In this case we have an excellent instrument because in addition to asking women about their

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[15] See the original Bongaarts paper for the exact details of the adjustment from "want more" to "wanted" fertility rate.

[16] In fact the coefficient is slightly lower on DTFR than on WTFR. The differences for AINC for the OLS method (though not for IV) are explained below.

[17] An instrumental variables estimator can recover a consistent estimate of a linear regression parameter β, where $y = x\beta + \epsilon$, even for a variable (x) measured with error (for example, the observed x^* is $x^* = x + v$ where x is the true variable and v is an error) by projecting the observed variable x^* onto an instrument (z) and using only that component of the observed variable x^* which lies in the space of z in the estimation of the parameters. This purges the effect of the error component of the observed variable (x^*) on the estimation of the relationship.

ideal family size and wantedness of previous children, the household surveys also ask women if they want more children and these responses are tabulated by the number of living children[18]. The final column of Table A.1 (Data Appendix) reports the fraction of women with 4 living children who want no more children. This varies greatly, from only 3 percent of women in Cameroon and 3.2 percent in Côte d'Ivoire to 87.7 percent in Thailand and 89 percent in Colombia. Since these answers refer only to future desires for children they cannot be contaminated with ex-post rationalization.

Note that the instrument does not use the fraction of women at various family sizes (which would be affected by the frequency of unwanted births), only those at a given family size who want no more children. The fraction who want no more at various family sizes is correlated with desired fertility since the responses summarize the same distribution of desired family size.[19] Westoff (1990), has shown that the overall fraction of women wanting no more children in a country has high predictive power for future fertility rates.

The instrumental variables (IV) results strongly confirm the ordinary least squares (OLS)

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[18] Included in the "want no more" category are fecund women who want no more and those who are sterilized, but not those that are infertile. Sterilized women are included on the grounds that sterilization is generally voluntary and is *prima facie* evidence of wanting no more. Some of the surveys asked sterilized women if they wanted more. In the surveys, the number of sterilized women with ex-post regrets (that is, who now want more children) was typically small.

[19] Say the distribution of women by their true desired number of children is represented by a probability distribution function f(n). The fraction of women who want no more children who now have N living children is cumulative distribution F(n) up to size N, that is, the fraction of women whose desired size is less than or equal to N. These partial cumulants provide information about the mean desired fertility since they summarize the same distribution.

results that actual and desired fertility move one-for-one. In all cases, the point estimate on desired fertility is approximately .9, not overwhelmingly different from one.[20] The explanatory power is still very high with the IV estimates.

If ex-post rationalization were empirically a major factor, then the estimated IV coefficient should be smaller than the OLS estimate.[21] In fact, the IV coefficient estimate is either greater (AINC) or roughly equal (DTFR and WTFR)[22]. The fact that the coefficient estimate is substantially larger for AINC accords well with our intuition that AINC is the worst indicator of current desired fertility and suggests substantial random measurement error in AINC, hence explaining the low R-squared in OLS. Since the IV results are nearly identical using instrumental variables for all three measures the econometrics suggest that ex-post rationalization is not an important objection to using these country aggregate measures of fertility desires.

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[20] Although for DTFR the H_o: $\beta = 1$ is rejected at modest significance levels, mainly because of the very high precision. The two standard error bound around the point estimate runs only from .831 to .997.

[21] Say the true model were that actual fertility responded to desired fertility, but only weakly and the response to the question was the true desired fertility plus some fraction of the excess of actual over desired. The OLS estimate of β would overestimate the true coefficient. On the other hand, pure random measurement error would cause the OLS estimate to be biased towards zero. The IV estimate, on the other hand, would be consistent in the presence of either type of error.

[22] A formal Hausman (1978) test, which depends on the normalized difference of the OLS and IV coefficients, fails to reject that OLS is consistent (at least for DTFR and WTFR) while rejecting that the OLS results with AINC are consistent, likely due to measurement error since the OLS estimate is lower than IV.

Dependence of fertility desires on contraceptive access. Using these measures, fertility desires to distinguish between child desires and contraceptive supply needs to make a critical assumption, that these responses indicate what demand for children would be at zero price of contraception[23]. Hence, the second objection to the use of fertility desires is that reported desires might be determined by contraceptive access or costs. If this were the case the use of desired fertility, especially to distinguish alternative explanations of fertility would be problematic.[24] However, it is unlikely that the results are affected by the influence of contraceptive access (or cost) on women's responses for four reasons. First, the survey questions themselves are generally structured to avoid this dependence. Second experimental evidence on changing contraceptive costs suggests expressed desires are independent of contraceptive access or cost. Third, the use of retrospective data purged of desired show answers measurement error avoids this contraceptive costs problem, as past fertility decisions are unaffected by future contraceptive costs. Fourth, the cost of contraception is too small relative to the importance of the decision to play a major role.

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[23] In the demand and supply for framework for children one factor in the total demand for children is the price of contraception, which influences child demand. By having a measure of the quantity of children demanded at zero price of contraception (referred to here as desired fertility, not child demand) we can identify variation of this level as demand shifts and deviations of actual fertility from this level as the effect of supply factors. The general approach to supply and demand for children is sometimes generally referred to as the "Easterlin synthesis" (Easterlin, 1975), although this properly refers to a more specific set of hypotheses.

[24] In economic jargon, the following discussion about is the "identification" problem. Since the quantity consumed of any commodity is determined by both supply and demand factors it is generally impossible to determine from observation of outcomes alone whether supply or demand factors accounted for observed differences. However, in this case, since demand for children at zero price of contraception is well defined concept (unlike most economic goods zero price) we can use reported desires, if they are independent of supply factors, to "identify" the demand.

There are two ways in which contraceptive access could influence reported desires, either women ignorant of contraception cannot answer such questions appropriately at all, or the number of desired children is in part determined by the price of contraception women face.

Do women, even in developing countries, know enough to answer questions about fertility desires? One might argue that numerical answers are invalid because women are innumerate or do not perceive fertility to be within the sphere of their conscious control. However, WTFR is based only on a question about wanting another child, which does not require numeracy nor a speculative response about a desired lifetime total. It is difficult to argue that uneducated women, even in the absence of knowing how to avoid childbirth, would fail to understand that the question explicitly pre-supposed that it was possible. People can answer how tall they would like to be, even though they have no control over their height.

By the time of these surveys contraceptive knowledge was generally so widespread and available that cross-country differences are unlikely to be a major factor affecting reported fertility desires, even in high fertility countries. According to WFS and DHS surveys, knowledge of a modern contraceptive method was very high. For example, in Kenya in 1989, TFR was 6.4 yet 91 percent knew of a modern method; in Jordan in 1990, TFR was 5.6 yet 99 percent knew a modern method, in Ghana in 1988 TFR was 6.4 yet 76 percent knew of a modern method. Moreover, even where contraceptive knowledge is not widespread it is easy to argue that the causation runs from a low desire to regulate fertility to low knowledge of contraception, not vice versa. Particularly striking in this regard is the fact that in many high

fertility countries more women know of modern than traditional methods. Among married women in Ghana, 64 percent know of the pill, but only 33 percent know of withdrawal. In Kenya, 91 percent know of the pill but only 51 percent of withdrawal. Even in Nigeria, where knowledge of any method was only 44 percent, 41 percent knew of a modern method while only 24 percent knew of a traditional method. The fraction of women actually using the pill in these three countries is 1.9, 5.2, and 1.2 percent respectively, even with this widespread knowledge. Both this low use in spite of extensive awareness of modern methods and that knowledge of modern methods is much higher than knowledge of easy to discover, but not advertised, do-it-yourself methods[25] suggests that modern contraceptive knowledge has actually run far ahead of desires to limit fertility.

The questions elicit demand for children at zero contraceptive costs. The questions in the DHS survey about the desired number of children (for woman with children) was "If you could go back to the time you did not have any more children and choose exactly the number of children to have in your whole life, how many would that be?" The phrase "if you could choose exactly" is an attempt to eliminate the cost or difficult of actually effecting the choice. Also questions about whether a prior birth was wanted are independent of costs of contraception. Only questions about future fertility desires are potentially affected by contraceptive costs.

Secondly, the strongest experimental evidence that reported fertility desires are independent of contraceptive costs is from Family Planning and Health Services Project (FPHSP)

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[25] After all, *Coitus interruptus* has been known at least since the time of Onan.

in the Matlab region of Bangladesh. The experiment saturated a treatment area with contraceptive knowledge and availability, with trained female family planning workers visiting every household every two weeks with messages and supplies, while a comparison area was (as best as possible) left alone. From 1975 to 1990, the self-reported "ideal family size" fell from 4.4 to 3.1 in the treatment area, and by exactly the same amount, 4.5 to 3.2, in the comparison area (Koenig and others, 1992) even though contraceptive knowledge and use increased dramatically as contraceptive costs fell in the treatment area.

The third reason why reported fertility desires appear to be independent of contraception costs is that the three fertility measures of wanted fertility largely agree (the correlations across countries are above .9)[26] and the results presented above are broadly the same with each. Therefore, arguing that these desired measures are seriously affected by systematic incorporation of contraception costs into expressed desire must argue that this is equally true of each measure (and of reported unwanted births), which, given the different reference timing and structures of the question, seems highly implausible. Moreover, given our results in the previous section showing the DTFR was not compromised by ex-post rationalization allows us to use the retrospective data of DTFR as an instrumental variable to purge prospective fertility of contraceptive costs. Doing so raises the WTFR coefficient to .96 -- indistinguishable from one[27] -- and leaves the basic results unchanged.

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[26] The bivariate correlations are: AINC and DTFR .956, AINC and WTFR .923, DTFR and WTFR .974.

[27] The overlapping sample for DTFR and WTFR is slightly different from that in table 1, the OLS coefficient on WTFR is .91 in the smaller sample.

Fourth, it is unlikely that desired fertility is importantly affected by contraceptive costs simply because the costs are small relative to other factors in the decision. We will return to this in the fourth section.

Excess Fertility, Total Fertility, and Contraceptive Prevalence

Since actual fertility can be explained almost completely by fertility desires, which are independent of contraceptive availability or cost, these results place a tight upper bound on the importance for fertility of factors which affect the difference between desired and actual fertility without changing desires. Even if all of the cross-country variation in fertility not explained by desires were attributable to contraceptive access (which would be extraordinary indeed, leaving no room to gender preference, measurement error, etc.), it would account for at most 10 percent of cross-country fertility differences.

What then is the role of availability of cheap, effective contraception in determining fertility? Is it not obvious that contraception is an important factor in fertility? After all, the probability of pregnancy can be defined as the frequency of coitus times the chance of conception per coital act. Therefore, a reduction in fertility must be due to either a reduction in coital frequency or a decrease in the probability of conceiving per coital act, and certainly one important determinant of the latter probability is the effectiveness of contraception.

But there is a clear and important distinction between contraception as a proximate

determinant of fertility and contraceptive access as an independent, causal determinant of fertility. Indeed, the present cross-country evidence shows (as many others have found) that contraceptive prevalence (the fraction of women of reproductive age using contraception) is strongly negatively correlated with fertility. However, this empirical fact could be the result of any one of three mechanisms; increased contraceptive availability affects desired fertility, increased contraceptive availability leads to lower fertility because the gap between desired and actual fertility is lower, or changes in fertility desires lead to changes in contraceptive prevalence as people use more contraception to achieve their fertility targets. In all three cases, contraception is a proximate fertility determinant. But access to contraception in the first two cases would also be an independent, causal determinant. As the previous section ruled out the first possibility this section will examine the possibility that contraceptive access lowers fertility by lowering the gap between desired and actual fertility.

Since actual fertility increases roughly one-for-one with desired fertility the difference between actual and desired fertility is a relatively good measure of "excess fertility." By combining the three derived measures of excess fertility (TFR-AINC, TFR-DTFR, TFR-WTFR) with the fraction of births that are unwanted, we have four semi-independent indicators of excess fertility.[28]

Actual use of contraception depends on both the demand and the supply, so contraceptive

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[28] The fraction unwanted is not self-reported but calculated by Bongaarts and is not independent of WTFR, it largely agrees with reported unwantedness.

prevalence is not, by itself, an indicator of contraceptive access. However, if it were the case that cheaper or more widely available contraception led to substantially less excess fertility then one would expect the absolute amount by which fertility targets were missed would decrease with contraceptive prevalence. This is clearly not the case. Table 2 regresses each of the four measures of excess fertility on both total and modern contraceptive prevalence (CPV) reported in the WFS and DHS surveys. There is no statistically or practically significant, negative effect of CPV on the magnitude of excess fertility.

Intriguingly, independent data on the percentage of pregnancies or births self-reported as unwanted shows that the fraction of fertility that is unwanted is higher in many developed, low fertility countries (for example, France 16, United States 10, Hungary 14, Finland 10 percent United Nations 1987) than in many poor, high fertility, countries (for example, Ghana 4.2, Uganda 4.6, Sudan 3.8, Pakistan 13 percent). In our sample the fraction of fertility that is excess or unwanted is not strongly positively correlated with the level of fertility. The highest fraction of wanted births by the Bongaarts measure are in high fertility countries like Senegal (TFR of 6.6, 91 percent wanted) and Cameroon (TFR of 6.4, 94 percent wanted). The fraction of unwanted births actually increases with contraceptive prevalence. The data, moreover, suggests the percentage of fertility that is excess actually increases with contraceptive use[29].

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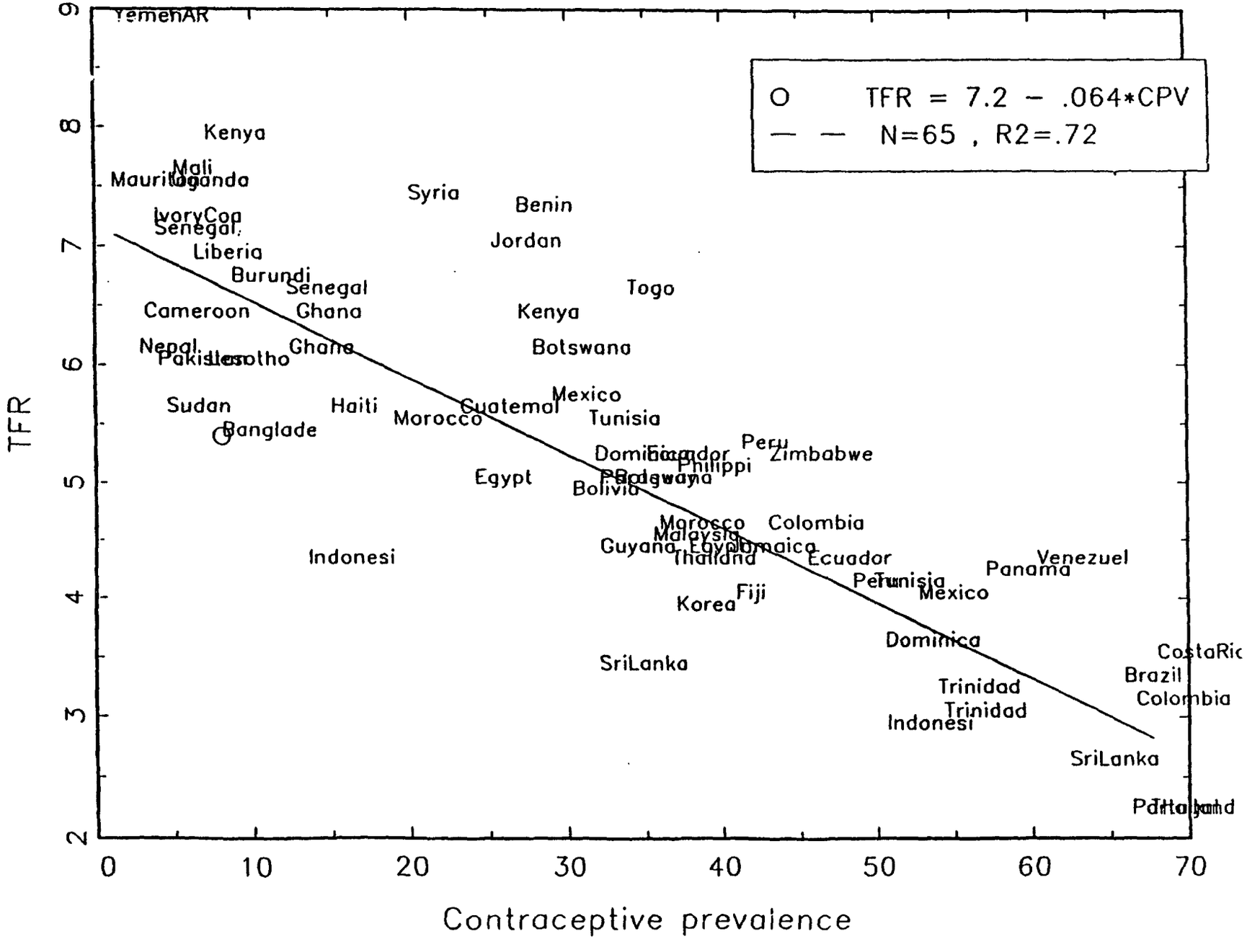
[29] If the regressions were run in percentage deviations for the other excess fertility measures (that is, the dependent variable were (TFR-TFR*)/TFR, where TFR* is desired) then the sign on contraceptive prevalence is (except for AINC) positive and statistically quite significant so that percentage excess fertility increases with contraceptive prevalence. This probably is just an artifact of the fact that it is harder to hit lower fertility targets because more years of effective protection are needed. If the absolute deviation is invariant with respect to CPV the percentage deviation is inverse.

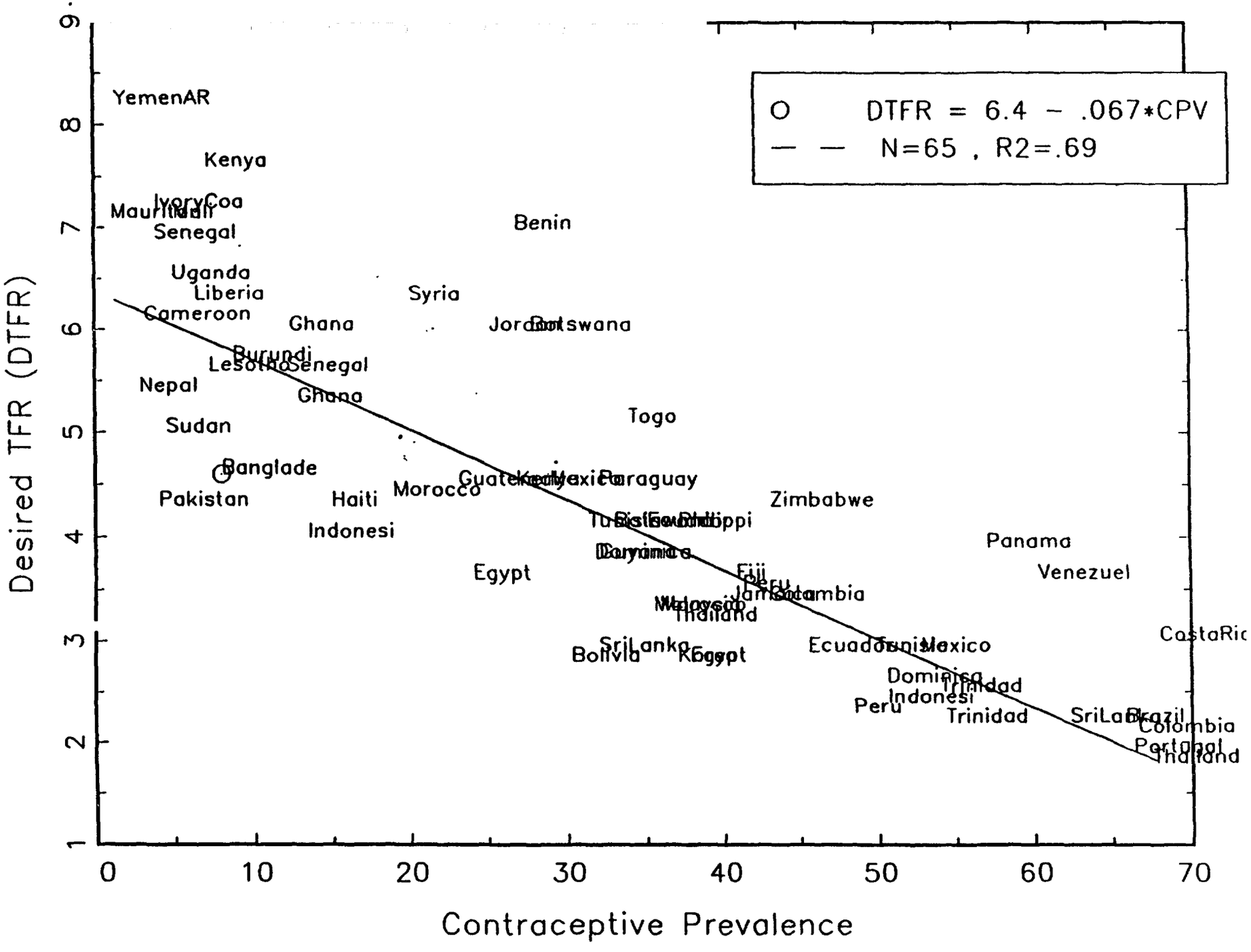
Table 2 Relationship between contraceptive prevalence (CPV) and excess fertility

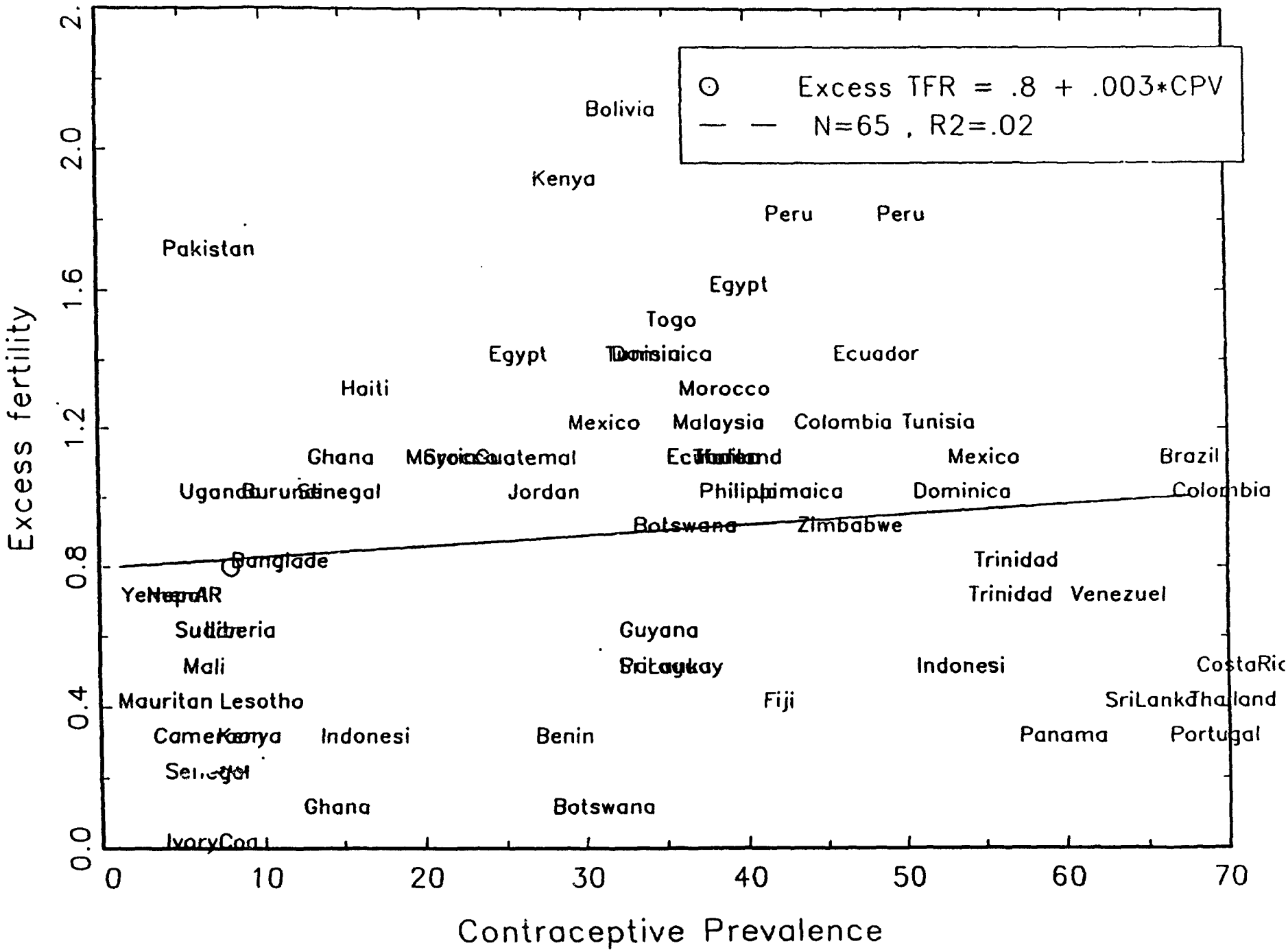
Dependent Variable	Total Contraceptive Prevalence		Modern Contraceptive Prevalence		*N*
	Coefficient (*t*)	R^2	Coefficient (*t*)	R^2	
TFR - Average ideal family size	-.005 (.94)	.013	-.0078 (1.24)	.022	71
TFR - Desired TFR	.003 (1.02)	.016	.0017 (.50)	.004	65
TFR - Wanted TFR	-.0005 (.13)	.000	.0004 (.08)	.000	47
Fraction of births unwanted	.002 (2.85)	.153	.0025 (3.05)	.172	47

Figure 2 illustrates the correlations between TFR, CPV and desired fertility (DTFR). CPV is strongly negatively related to actual fertility (the R-squared is .72 in this sample). But CPV is also strongly negatively related to desired fertility, even though DTFR is independent of access. Moreover, CPV has no relation at all with excess fertility (the difference of actual and desired). The data are inconsistent with higher CPV lending to lower absolute (or percentage) excess fertility.

Figure 2: Relationship between contraceptive prevalence and actual, desired, and excess fertility




O DTFR = 6.4 - .067*CPV
— — N=65 , R2=.69
Desired TFR (DTFR)
Contraceptive Prevalence
1
2
3
4
5
6
7
8
9
0
10
20
30
40
50
60
70
YemenAR
Kenya
IvoryCoa
Mauritani
Senegal
Uganda
Liberia
Cameroon
Ghana
Burundi
Lesotho
Senegal
Nepal
Ghana
Sudan
Banglade
Pakistan
Haiti
Indonesi
Morocco
Syria
Benin
Jordan
Botswana
Togo
Paraguay
Zimbabwe
Egypt
Fiji
Panama
Venezuel
Thailand
SriLanka
Bolivia
Ecuador
Mexico
Dominica
Trinidad
Peru
Indonesi
Trinidad
SriLanka
Brazil
Colombia
Portugal
Thailand
CostaRic


Excess TFR = .8 + .003*CPV
N=65 , R2=.02
Excess fertility
Contraceptive Prevalence
0.0
0.4
0.8
1.2
1.6
2.0
2.
0
10
20
30
40
50
60
70
Bolivia
Kenya
Peru
Peru
Pakistan
Egypt
Togo
Egypt
Ecuador
Haiti
Morocco
Mexico
Malaysia
Colombia
Tunisia
Ghana
Mexico
Brazil
Jordan
Dominica
Botswana
Zimbabwe
Trinidad
Trinidad
Venezuel
Guyana
Indonesi
CostaRic
Mali
Mauritan
Lesotho
Fiji
SriLankd
Thailand
Indonesi
Benin
Panama
Portugal
Ghana
Botswana

If, instead of excess fertility, we regress the TFR on fertility desires and add contraceptive prevalence, we can ask what additional explanatory power contraceptive prevalence gives over and above desired fertility[30]. Table 3 shows the magnitude of the impact of CPV, although statistically significant, is extremely small. An exogenous 10 percentage point increase in modern contraceptive prevalence, holding desires (DTFR) fixed would reduce actual fertility only by .17.

In a 1977 survey, Haiti's desired fertility was 4.3, while modern CPV was only 4.7 percent; whereas Zimbabwe's desired fertility was also 4.3 (in 1989), but modern CPV was 36.2 percent. If somehow Haiti's modern CPV could be raised to Zimbabwe's level, holding desires constant, by how much would fertility fall? The regression estimates suggest that this extremely large, eight-fold, expansion in CPV would reduce fertility by only about .5, half a birth per woman's lifetime, just 10 percent. This small simulated effect the regression estimates is plausible, as fertility in Haiti was actually only about .4 of a birth higher than Zimbabwe's fertility (TFR of 5.6 versus 5.2), despite the large difference in modern contraceptive use.

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[30] This is more fair to contraceptive prevalence as the regressions in Table 3 impose than the coefficient on desired fertility is one. The incremental R^2 is still appropriate, given the identification assumption (discussed extensively above), that contraceptive supply does not affect reported fertility desires.

Table 3: Regressions of actual fertility rate on measures of desired fertility and contraceptive precedence or family planning offset

	With and without Contraceptive Prevalence				With and without Family Planning Effort			
	DTFR		WTFR		DTFR		WTFR	
Desired or Wanted Fertility	.894 (25.3)	.742 (13.5)	.912 (16.07)	.772 (0.55)	.877 (25.8)	.802 (16.99)	.887 (16.11)	.753 (11.7)
Modern Contraceptive Prevalence		-.017 (3.41)		-.014 (1.94)				
Family Planning Effort						-.007 (2.21)		-.012 (3.31)
R^2 (Unadjusted)	.910	.925	.852	.863	.914	.920	.855	.885
N	65	65	47	47	65	65	46	46

Note: All regressions are OLS. Absolute values of t-statistics are in parenthesis.

This small estimated impact is in sharp contrast to common statements like "a 15 [percentage point] increase in the of contraception prevalence decreases fertility by nearby one child per woman" (Family Health International, 1990). Actually, the numbers behind the different statements agree, just the cause and effect are exactly reversed. The simple bivariate relationship between TFR and modern CPV does indeed suggest that increasing CPV by 15 percentage points would reduce TFR by about a birth per woman (e.g. 15*(-.071)=1.06)[31].

[31] Fifteen percentage points is quite a large increase, the average modern CPV for developing countries (in this sample, which includes various dates) is only 23 percent, and the standard deviation is 17 percent.

However, using the estimates of the DTFR-modern CPV relationship in reverse we find a 1 birth per woman decline in DTFR would cause about a 15 percentage point increase in modern CPV (e.g. (1/-0.073)=13.7) [32]. But a 15 percentage point increase in modern CPV holding desired fertility constant (for instance would be caused by a shift in contraceptive access) leads to only a decline in TFR of only .25 births (e.g. .017*15=.25). Failing to account for the cause of the shift in CPV in bivariate relationships leads to an overestimate of the independent effect of contraception by multiple of at least four. Nothing useful at all can be inferred from a strong cross sectional relationship between contraceptive use and fertility alone about the effect of expanding access on fertility.

Although CPV is an important proximate (or direct) determinant of fertility rates, after controlling for variations in desired fertility contraceptive prevalence has an empirically small effect and explains only 1-2 percent of cross-country fertility variation. When modern (total) CPV is added to the fertility regression the (unadjusted) R^2 increases by only .015 (.011) with DTFR and .011 (.022) with WTFR. Variations of CPV explain at most 2 percent of fertility variations, after controlling for desires. Contraception is not important as a causal or independent determinant of fertility. Contraceptive use is higher where fertility is lower primarily because desired fertility is lower, which leads to both lower fertility and higher contraceptive demand and hence use.

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[32] These numbers are slightly different than those in figure 2 because this uses modern CPV, while the figure uses total CPV. The numbers for modern CPV are larger than for total CPV.

Prevalence does not measure access. Some have gone beyond prevalence and argued for the important role of contraceptive access and a large influence of family planning on fertility using quantitative subjective indicators of the strength of country's family planning effort (FPE) developed by Lapham and Maudlin (Lapham and Maudlin, 1984). They rate numerically the strength of each countries family planning program along thirty different dimensions, including several dimensions of contraceptive access. These FPE indicators have been used in empirical work to assess the impact of family planning programs on fertility. Robey, et al (1993) cite this research as proving "independently of the effect of social and economic changes -- family planning played a significant role in reducing fertility ...." Many believe "Lapham and Maudlin's analysis shows that .... the independent effect of program effort is somewhat greater than that of socioeconomic development" (editorial in International Family Planning Perspectives, 1984).

However studies relating fertility to family planning activity and development (Lapham and Maudlin, 1984, Bongaarts, Maudlin and Phillips, 1990, Maudlin and Ross, 1991, Bongaarts, 1992) suffer from three (fatal) flaws in empirical implementation. They limit the indicator of development to a single index, which causes two problems. First, this aggregation of various economic or social indicators -- such as per capita income and infant mortality -- into a single index imposes on the empirical results that each element of the development index affect fertility exactly the same[33]. Imposing this false constraint on the data increases the portion of fertility

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[33] For instance, if one has an index of development that consists of three elements, say per capita income (Y), infant mortality (M), and literacy (L) with weights α_y, α_m, α_l , then DI

not explained by "development" and hence the fraction which is potentially explained by FPE. Second, the use of a development index excludes all other social indicators not in the index importantly, female schooling. This will also inflate the amount of fertility explained by FPE. Third, these studies generally ignore the potential endogeneity, that is that FPE responds to changed fertility desires and not vice versa. With the combination of these three effects it would be possible to find with empirical data an arbitrarily large effect to FPE, even controlling for a development index, even if the true effect of an exogenous increase in FPE were zero[34].

These flaws are not hypothetical, as the results are completely different if desired fertility or its socioeconomic determinants are controlled for properly. If FPE is added to fertility regressions which control for desired fertility (as above with adding contraceptive prevalence)

$= \alpha_y Y + \alpha_m M + \alpha_l L$. Entering this into an equation for fertility with a variable representing family planning efforts FPE would be: $TFR = \beta DI + \delta FPE + \epsilon$. . This form imposes that income and infant mortality have numerically exactly the same impact on fertility.

[34] As a simple, hypothetical example: the true model was that fertility was determined by income (Y) positively and female education (FE) negatively and a random term: $TFR = \beta_1 Y + \beta_2 FE + \epsilon$. Say the "development index" gave equal weight to income and female edcuation, $DI = \alpha_0 * Y + \alpha_1 * FE$. If FPE were related positively to female education, $FPE = \delta * FE + \eta$ then a regression of TFR on the development index and FPE can produce large and significant negative effects for FPE (with the size determined by the error terms and cross correlations of Y and FE), in spite of the fact that, by construction, FPE has no independent impact on TFR at all in this hypothetical example.

the estimated impact of FPE is statistically significant, but quite small[35]. The coefficient on FPE is -.007 (t-statistics 2.21) using DTFR and -.012 (3.31) using WTFR. This implies that a move from zero FPE to the mean level of country effort, holding desired fertility fixed, would reduce fertility by only between .22 and .37 births per woman (e.g. -.007*31.4=.22)[36]. Even in the absolute extreme case of moving a country from no family planning program at all (zero FPE) to the largest FPE in the sample (80 percent of the maximum) would reduce fertility by only .56 and 1 births, a very small fraction of the differences in actual fertility. As with contraceptive prevalence, the incremental explanatory power of FPE in both regressions was very low, .006 (DTFR) and .03 (WTFR), hence FPE explains at most 3 percent of fertility variations.

Although desired fertility is independent of contraceptive access (and from the Matlab evidence family planning effort) the assertion is still more problematic with respect to overall family planning effort, which includes information dissemination and encouragement of small families. However, two recent studies (Schultz, 1993, and Subbarao and Raney, 1993) show once the effects of the various socio-economic variables are not artificially constrained and

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[35] Since the FPE numbers are available only for 1972, 1982 and 1989 and the dates of the surveys are fixed various ways of matching FPE to surveys were tried (e.g. using the closet year, using the average FPE). The use of the closest FPE score preceding the survey data is used because it gave results most favorable to FPE. For instance, using the closest FPE score gave smaller coefficients, -.003 and -.009 using DTFR or WTFR.

[36] The FPE indicators are expressed as a fraction of the maximum effort, so the scale is 0 to 100. The mean level of effort in our sample is 31.4.

endogeneity is accounted for the empirical estimates of FPE effect are small (even possibly zero)[37]. This is consistent with the view that fertility desires are largely determined by socioeconomic forces other than family planning and that fertility desires determine fertility.

Using data across countries and over time and controlling for female and male education separately and other factors[38] Schultz (1993) has four findings. First, in a reduced form equation (with child mortality excluded as potentially endogenous) the largest estimates of the FPE impact are found. Even here the statistically significant estimate is empirically quite small, -.019 (only slightly large than our highest). Moving from no family program at all (FPE equal zero) at all to the average level of FPE would decrease fertility by only about .65 births[39]. Second, the fraction of fertility variation explained by differences in FPE was less than 5 percent[40]. Third, after controlling for the potential endogeniety of FPE (that is, that is caused

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[37] Earlier studies found this suggestions of this same effect, as for instance Lapham and Maudlin, 1985 find that FPE "explains" ninety percent of contraceptive prevalence as a bivariate regressor but when socioeconomic effects are controlled for separately (although without separating male and female education) the incremental explanatory power of program effort is about seven percent.

[38] Also in the regression are GDP per adult, urbanization, fraction of male labor force in agriculture, religion dummies (Catholic, Muslim, Protestant), and child mortality.

[39] Subbarao and Raney 1993 also find in a cross-country regression explaining 1985 TFR, after controlling for the 1970 male and female secondary enrollment, GDP per capita, urbanization, and population per physician, the effect of increasing FPE by one unit was -.021, striking similar to the Schultz reduced form OLS results.

[40] This low additional explanatory power is not surprising, given the high level of predictive ability of socioeconomic variables alone, especially once male and female education are distinguished. For instance, Barro and Lee (1993b) using GDP per capita, mortality variables, and their new data on male and female education stocks, explain (log) fertility with R-squared values of .90 across countries, and even .63 in for changes from 1965 to 1985.

by rather than causes, changing fertility desires) the estimate of FPE is positive, but statistically insignificant. Fourth, the time series variation using fixed effects estimates finds no empirically significant effect for FPE at all.

Supply and Demand for Contraception, Child Costs, and Fertility

The apparent paradox about the importance of the "supply" of contraception on fertility stems from linguistic confusion about the term "supply." Since in the demographer's terms (Bongaarts, 1978), contraception is an important proximate determinant of fertility (in a mechanical sense the probability of a birth in any given period is the product of coital frequency, natural fecundity, and contraceptive efficacy), this is at times taken as evidence that expanding the "supply" of contraception is an important condition for reducing fertility. However, this confuses an expansion of the "supply" of contraception -- the entire schedule of the amount of contraception that would be available at various prices -- with an expansion in the "quantity supplied" of contraception -- the amount supplied at a given price. The finding that contraceptive use (quantity supplied) increases as fertility declines does not imply that contraceptive supply (usually referred to as "access" or "availability") is an important causal determinant of fertility declines.

A large increase in contraceptive prevalence may be the result of a movement along a given supply curve of contraception as demand for contraception shifts due to changed demand for children caused by factors independent of contraception (for example, increased women's

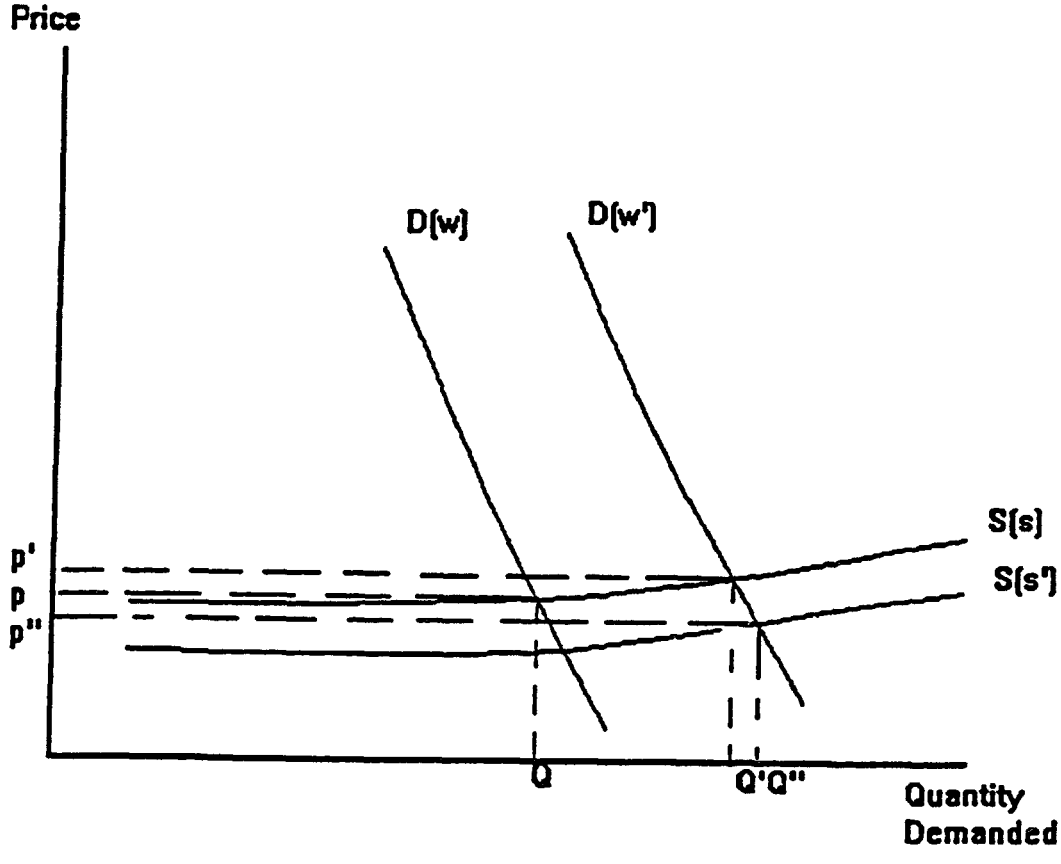
education, household income or child mortality). In this case, a high correlation of contraceptive prevalence (the quantity supplied of contraception) with fertility is the result of shifts in the derived demand for contraceptives, not shifts of the supply curve itself. The impact of an exogenous fall in the price of contraceptive services (where the price includes the total direct costs to the user, including travel, inconvenience, service quality, method suitability, etc.) caused by a shift of the entire supply relation is determined by the elasticity of the demand for contraception. If the demand for contraception is inelastic with respect to the cost of contraception (as we argue below is the case intuitively and empirically) then a shift of the supply relation would have very little effect on the use of contraception (and *a fortiori* on fertility).

This implies that all cross-country or household calculations that show strong statistical relationships between contraceptive use and lower fertility that do not adequately control for shifting demand are simply not to the point in assessing the implications of a shift in the supply of contraceptives. Any correlation, no matter how perfect, between contraceptive use and fertility may simply represent movements of quantity supplied.

Figure 3 illustrates this point with a hypothetical demand-supply diagram. Suppose that the demand for contraception is entirely derived from the demand for limiting childbearing and that depends only (for simplicity) on women's wages (w). Also suppose that the supply of contraception is private but receives a per unit subsidy from the government of s. If women's wages rise from w to w' then the demand for contraception shifts and total contraceptive

prevalence (quantity supplied which equals quantity demanded) increases from Q to Q' in a movement along the given supply curve.

Figure 3 Illustration of the effect of shifts in the supply and demand for contraception



Note: See discussion in the text.

If, on the other hand, the government increases the per unit subsidy on contraception, that would shift the supply relation from s to s'. In this diagram, lower contraceptive costs induced by the subsidy only induces a small increase in quantity demanded (from Q' to Q'') because it is assumed to be inelastic.

Is the available evidence consistent with this view -- an elastic supply of contraception and an inelastic demand for contraception, and more especially an inelastic demand for children with respect to contraceptive costs? Demand for children must be inelastic with respect to total contraception costs (which again subsumes price, information, access, and availability) both because demand for children is relatively price inelastic and because contraception costs are a very small fraction of total child costs. The marginal cost of avoiding the birth of a child is generally trivial compared to the marginal cost of having a child. Table 4 presents various estimates of the monetary cost of avoiding a single birth through the use of various forms of contraception in developing countries. These costs depend on the cost per couple per year and number of years of use to avert a birth. The full costs are somewhat difficult to pin down as we neither want public cost per user (which may overstate the marginal cost) nor prices paid by users (which often include a substantial subsidy element). The range of estimates is large, but a fair guess of the cost range for the pill (a relatively expensive temporary method typically chosen to space, not limit births, and hence a high side estimate) would be $30-$100 per birth avoided. For ending reproduction, sterilization is a much cheaper option as it avoids all future births. Its cost per year of protection is low, ranging from $8.9 from $2.9. A very high-side estimate of the typical total direct contraceptive cost per avoided birth for a woman would be $50 per birth avoided.[41]

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[41] Even these numbers must be a substantial overestimate of the minimum monetary cost of achieving a given level of fertility. Any given target level of family size can be achieved with post-partum amenorrhea and abstinence combined with rhythm to space and sterilization to terminate. Moreover, all of these cost estimates of course ignore the difficult and delicate issue that there exists a backstop effective method to avoid conception with zero monetary cost: abstinence. The true cost of this method would require a calculation of the benefits foregone from coital abstinence. This is not zero and not infinite, but narrowing the range further is

Table 4 Estimates of the cost of avoiding a birth in developing countries

Study	Country/Region	Method	Per couple year protection	Per averted birth
A) Molyneaux and Diman (1991)	Indonesia	Pill	$14 $11.2 (insertion)	$49
B) World Bank (1992)	SSA ME&NA LAC Asia	Pill Pill Pill Pill	$27 $43 $48 $14	$94.5 $150 $168 $49
C) Cochrane and Sai (1991)	Sri Lanka Pakistan Jordan Nepal	per user per user per user per user	$9.2 $22 $31 $80	$31 $71 $88 $330
D) Schwartz, and others (1989)	Philippines Thailand Jamaica	pill pill pill	$8.3 $8.5 $8.3	$29 $30 $29
E) Cochrane, Hammer, and others (1990)	Morocco Indonesia	Sterilization Sterilization	$8.9 $2.9	- -
F) Schearer (1983)	20 Median Countries 14 Median Countries	pill sterilization	$33.5 $12.25	- -

Notes: A) Reports commercial prices (which are several multiples the public sector price), B) reports summaries from surveys of commercial prices, C) reports public family planning expenditures per user, D) reports mean prices paid by users, E) reports cost to the user, F) reports unsubsidized commercial prices, sterilization assumes 15 years of use. All costs have been translated to 1992 prices.

A child is well known to be tremendously more costly because a birth generally obligates the parents to incur a stream of large annual expenses. While measuring the total cost of a child

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problematical.

with precision is impossible, we can fix some orders of magnitude. Table 5 presents various estimates of just the direct money expenditures for maintaining a child expressed as a fraction of adult consumption or household income. These are derived from "equivalence scales" and represent roughly the additional income a household would need in order to maintain its consumption of non-child goods after adding an additional child. A child costs between 30-50 percent of per adult consumption.

In addition to these direct monetary expenditures of a child, there are the substantial opportunity costs from the time allocated to child care, which may be as high as the direct costs (Lindert, 1980, Joshi, 1990). For example, evidence from the rural United States in the early twentieth century suggests women spent 10 hours per week caring for young children. Women aged 15-39 in a Javanese village spend 8.9 hours weekly on child care plus another 17.2 on household food preparation and 10 on other household maintenance (amounts which are also likely to be higher with a larger family). Women aged 15-39 in a Nepalese village spend an estimated 8.9, 15.4 and 6.7 hours on the same three activities. There are some economies of scale to children in both monetary and time costs, and older children do help with household tasks, factors which make higher order births less costly. But these economies of scale are probably played out quite rapidly and the time costs of caring for higher order children are still substantial. These are only the direct time costs and likely understate the impact of children on women time use allocation and also do not account for changes in women's productivity in other activities, due to pregnancy or lactation.

Table 5 Direct cost of a child as a fraction of adult expenditure or household income

Study	Country	Year of Study	Fraction of				
			Adult Consumption	Household Income			
				General	1st	2nd	3rd
Deaton and Muellbauer (1986)	Sri Lanka Indonesia	1969-70 1978	30-40% 30-40%				
Henderson (1950)	Great Britain/ low income	1938			41%	29%	
Espenshade and Calhoun (1986)	USA/low income	1972			40%	18%	17%
Glewwe (1987a and 1987b)	Côte d'Ivoire Peru	1985 1985-6	33% 33%				
Chongvatana and others (1982)	Thailand (Bangkok)	1978		19.2%			

Suppose that, on the basis of these estimates, the direct monetary costs are 20 percent of household income and all other indirect costs (including costs not typically measured such as maternal mortality risks) are half of that amount. Total annual costs of an additional child would be 30 percent of annual household money income[42]. To calculate the lifetime cost of additional child these annual costs need to be summed. Tables 6 and 7 show the discounted value of direct and total costs for various levels of annual household income (and various discount rates). Even for the poorest economies with average household income of $1,500[43], the total discounted cost (at 5 percent) of a child is over $5,000. This is two orders of magnitude (100 times) larger than the cost of avoiding one additional child. This ratio is even higher for higher levels of

[42] It will be noted that the indirect costs are non-monetary and hence 30 percent of money income does not imply 30 percent of total income, inclusive of male and female non labor market time.

[43] For instance, a country with per capita personal income of $300 and average household size of 5 has an average household income of $1,500. For instance, average household consumption expenditure in Ghana in 1987-88 was $1,680 when per capita GDP was around $400.

household income.[44]

Table 6 Estimated lifetime child costs for various levels of household income

Average household income	Direct	Total child costs
$1,500	$3,450	$5,250
$3,000	$6,900	$10,500
$6,000	$13,800	$21,060

Measuring either the cost of avoiding a birth or the costs of a child are very difficult, both conceptually and empirically, and both of these estimates are subject to a wide margin of error. Nevertheless, it is very difficult to gainsay differences of two orders of magnitude or larger. The cost of avoiding a child is very small relative to the cost of having and raising a child.

Table 7 Child cost as a multiple of household income for various assumptions about cost, discount rate

	Fraction of Income		
Discount Rate	15%	20%	30%
3%	2.1	2.8	4.1
5%	1.75	2.3	3.5
10%	1.2	1.6	2.5

[44] Although of course this raises the difficulty with defining "child costs" (see Birdsall, Cochrane, and van der Gaag, 1987). Presumably parents at higher levels of income could raise a child for the same money cost as could lower income parents (although that might require feeding the child much less well than the adults). However, in contemplating an additional child parents can be expected to anticipate actual conventional expenditures for parents similarly placed, not the minimum feasible cost of raising a child to maturity.

Obviously there is a counterbalancing large flow of benefits to parents generated by an additional child, as evidenced by the simple fact that people express strong desires for children. The decision to have another child is based on comparing total (gross) costs of childbearing to the total (gross) benefits to find the net cost (or benefit) of an additional child. Even if the net cost of a child is very low, and does not rise with family size so that larger family sizes are desirable, this does not imply that the gross costs are small, only that the gross benefits are large. For instance, if children work for income or help with household chores (child feeding, water, or firewood gathering), this raises the benefits relative to costs and hence raises the net, but not the gross, cost.

One of the benefits of childbearing is avoiding contraception costs. If gross benefits are large relative to contraceptive costs, then even very large percentage differences in contraceptive costs would lead to small changes in the gross benefits of a child. This would lead one to expect that the demand for children would be very inelastic, or unresponsive, with respect to contraceptive costs, simply because they are a small fraction of total costs. An analogy would be to think of households' decisions to purchase a major consumer durable, such as an automobile. There is a large flow of gross costs (purchase price, gas, repairs, motor oil, etc.) balanced against a large flow of the benefits from the services the automobile provides. People purchase cars as long as the net benefit per dollar is greater than that from other goods, which implies that the net benefit at the optimal consumption level is very much smaller than either the gross cost or gross benefit. One could ask, how many additional cars would people buy if motor

oil were free?[45] Not many. Of course, this is not to say that people make decisions about children the way they do about cars, but the principle -- that small components of cost have small affects -- is the same.

Some would argue the cost of contraception is irrelevant for many couples since they can't afford it. However, being so poor as to not afford contraception would also imply, *a fortiori*, that another unwanted child isn't affordable either. Moreover, if costs per couple year of protection are $15.50, then even for a household of four at an international poverty line of $1 per person per day (see World Development Report 1990), contraception would cost 1 percent of household income. While this is a burden, 1 to 3 percent is roughly the same percentage of income that low income households in poor countries devote to expenditures on tobacco.

This intuition about responsiveness of childbearing to contraceptive costs derived from comparing relative cost shares, hence that child demand will be inelastic, accords well with the few empirical estimates of the price elasticity of the demand for contraceptives. A review of such estimates cited in a recent report finds that estimated elasticities for individual modes of contraception are quite low. Schwartz and others (1989) show a price elasticity of the demand for the pill of -.003 in the Philippines, -.08 in Jamaica, and -.09 in Thailand. These elasticities

[45] The cost in the United States of an automobile per 10,000 miles in 1989 was estimated at $3,820 (Statistical Abstract of the United States, 1991). Assuming three oil changes for every 10,000 miles and $15 per oil change (only $5 of which is for oil), this suggests that motor oil is about the same fraction of cost (1 in 100) as is the cost of contraception in the gross cost of a child.

of particular methods overestimate the elasticity of total contraceptive use to price changes as they include the effect of substitution between contraceptive methods (for example, switching from the pill to IUD). A study in Indonesia (Molyneaux and Diman, 1991) finds the net price elasticity of all contraceptive use with respect to pill prices is only -.02, a fifth their estimated pill use elasticity of -.11. This implies that a 100 percent increase in pill prices would only reduce modern contraceptive use by 2 percent. The Indonesia study estimated that a doubling of all contraceptive method prices would reduce use by just 3 percentage points, from 43 to 40 percent.

Even these small responses of contraceptive use responses overstate the elasticity of fertility to contraceptive prices if some of this effect is a shift from modern to non-modern method use. Among the alternatives to modern contraceptives are less effective forms of contraception (for example, rhythm, withdrawal) and more effective (but psychologically more costly) forms of avoiding births (for example, delayed marriage, long post-partum abstinence) so that even the small price elasticity of modern contraceptive use must substantially overstate the responsiveness of fertility to contraceptive costs.

Schultz (1993) also includes the price of oral contraceptives in a regression that links fertility with various determinants[46] in a sample of LDCs and finds it small and (barely) statistically significant. The implied elasticity of fertility with respect to (pill) contraception

[46] The regressors were: women's wages, men's wages, GDP per adult, urbanization, child mortality rates, year dummy variables and three variables for the fraction of population whether Catholic, Protestant, Muslim.

costs is .05 (higher prices raise fertility). With these estimates reducing the price of oral contraceptives from the mean of $38 per year to zero would decrease fertility by less than 5 percent, about .26 births.

This small relative component of contraceptive costs in the total costs and benefits of a child is of course relevant to the early discussion of whether desired fertility is determined by contraceptive costs. The fact that contraceptive costs are not the major element in the child bearing decision reenforces all of the above arguments that individuals can and have correctly answered survey questions about how many children they would have if contraception were perfect and free.

The question of the supply of contraception is altogether more difficult to address empirically, as in many countries the market has been dominated by government or government regulation. However, since the costs and benefits of contraception are primarily private[47] and there are no significant economies of scale in provision, it is not clear why the private market would not adequately meet the effective demand for contraception, as it does with so many other goods[48]. While there are information gaps and people must learn of the benefits of contraception in order to have demand, this is certainly not unique to contraception and is a

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[47] While there are some arguments that children produce negative externalities, so that their social costs are greater than private costs, this effect is small relative to the enormous private costs discussed above.

[48] As one observer pointed out, if Coke can be in every village in Africa then so could condoms.

probelm solved with the introduction of any new product or service. Especially since most contraceptives are internationally tradable (except, of course, for components or procedures which require clinical services) it is difficult to see why, in the absence of governmental barriers and active opposition, the supply of contraception would not be elastic.

Historical and Household Evidence on Contraceptive Access

Almost by definition the historical evidence suggests that modern contraceptive access was not a necessary condition for lowering fertility. Many societies were able to achieve rates of fertility substantially below those currently observed in developing countries well before the advent of any modern means of birth control. While crude birth rates are not directly comparable because of differences in demographic structure, it is striking that crude birth rates around 1800 in European countries (about 31 births per 1,000) were roughly equal to those in lower-middle income countries today (30 births per 1,000) and a quarter lower than that of the low income countries (38 births per 1,000) (Table 8). The lack of any modern means of contraception did not prevent eighteenth century European peasants from achieving levels of fertility lower than those observed today in many developing countries with non-contraceptive practices (e.g. high age at marriage) playing a role. The very uneven progress of the fertility revolution both within countries in Europe and across European countries suggests that shifts in contraceptive technology or availability were not a major factor in the fertility revolution.[49]

[49] The historical, especially European, fertility record was early on used as an argument against the importance of contraception in the demographic transition and is cited as an argument by Becker, 1991. However, the fact modern contraception was not necessary historically does

Table 8 Crude birth rates (births per 1,000 population) in Europe, circa 1800 and in selected developing countries or regions, 1990

Europe, circa 1800		Developing country or region, 1990	
Denmark	29.9	Nigeria	43
France	32.9	Bolivia	36
Germany[1]	39.5	Algeria	36
Norway	27.2	India	30
Sweden	28.7	China	22
UK[1]	30.3	Average low income (excluding China, India)	38
Average	30.6	Average for lower-middle income	30

1. United Kingdom, 1838; Germany, 1817.
Source: Mitchell, 1978 and World Development Report 1992.

A great deal of household evidence is also consistent with the view that fertility variations are not due to natural fecundity differences and that cost of contraception or proximity to contraceptive outlets are not large determinants of fertility, after controlling for fertility desires.[50] Rosenzweig and Schultz (1987), use birth histories of Malaysian women to disentangle the relative influence on completed family size of estimated couple fecundity. If fertility control were impossible (or very expensive) then each couple's natural fecundity should

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not imply it will not be an independent factor if introduced, which is a stronger statement that our evidence suggests.

[50] This is not intended as a review of the literature. This section simply shows that the reported cross-national results are not sharply at odds with the household literature. The literature on the impact of family planning programs, more broadly taken than just contraception, is discussed in a subsequent article.

explain a large fraction of couple's actual fertility differences. In contrast, their estimates of couple's fecundity, although a statistically significant determinant, explains only 2 percent of the total variability of fertility. This is even a smaller fraction than they found (Rosenzweig and Schultz, 1985) in the United States, where they find 10 percent of fertility is explained by fecundity.

Gertler and Molyneaux (1992) use Indonesian household survey data on fertility combined with district and subdistrict level data on economic conditions, schooling, and family planning program efforts to explain the large (25 percent) decline in fertility from 1982 to 1987. They find that as a proximate determinant increased contraceptive use explains 75 percent of the fertility decline. However, after accounting for changes in demand for contraception, their estimate is that exogenous variation in family planning inputs accounts for only 4-8 percent of fertility decline, and point estimates of the magnitude of the impact are small and not significantly different from zero.[51] Similarly, Pitt, Rosenzweig, and Gibbons (1993) using Indonesian data over time at the subdistrict (kecamatan) level find that after controlling for program placement, no statistically significant effect of family planning clinic placement on fertility. These papers are confirmation with household data that very strong associations between changes in contraceptive prevalence and fertility change are perfectly consistent with a very small, or even zero, effect of supply shifts of contraception on fertility.

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[51] In their weighted fixed effects estimates of fertility change their four measures of sub-district level family planning effort (monthly family planning worker visits, village contraceptive distribution centers, number of health clinics, numbers of family planning field workers) were individually and jointly not statistically significant.

In a series of papers Cochrane and Guilkey (1991, 1992a and 1992b) estimate the effect of contraceptive access or family planning effort after accounting for fertility demand in Zimbabwe, Tunisia, and Colombia. In Zimbabwe, they find that although receipt of a family planning message has some effect on women wanting to space their children, neither receipt of a family planning message nor the presence of a community based distributor (CBD) has any significant effect on the fraction of women wanting no more children. They also find that of seven indicators of family planning access only one (presence of a CBD) had even a modest effect on the use of modern contraception, given fertility intentions.[52] In Colombia, none of the family planning access variables[53] were significant in reduced form regressions for contraceptive use. In structural equations explaining contraceptive use, either in total or for individual methods (pill, IUD, traditional), none of the access variables were significant at the 5 percent level. However, the effect of fertility intentions was large and strongly significant. For Tunisia, they find moderately more positive results for the impact of access on use, as methods available and having received a message are both significant determinants of contraceptive use, although these are still much less important than fertility intentions[54].

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[52] The seven indicators of family planning access used were five locational variables (the presence within 5 kilometers of a family planning clinic, a hospital, a mission, a health clinic, or a pharmacy) and two additional variables (the receipt of a family planning message and the presence of a CBD).

[53] The seven access variables were: number of methods available, receipt of a family planning message and the presence within 5 kilometers of various sources of supply (doctor, two different types of clinics, a hospital or a pharmacy).

[54] The estimates for the influence of access must be considered an upper bound access as having received a message is treated as exogenous even though certainly a woman with stronger desire to control fertility, even for a given level of expressed fertility intention, is more likely to seek out and recall having received a message.

There is also some household evidence of an experimental nature bearing on this issue. The Contraceptive Distribution Project in 1975 divided the Matlab region of Bangladesh[55] randomly into villages in the treatment area, in which households received contraceptives (pills or condoms) free -- delivered to the door, and a comparison area with only the regular government program. The findings from this attempt to bring about a large reduction in contraceptive costs in the treatment area were that, in the second project year, the total fertility rate was 1.8 percent higher in the treatment area, in spite of the expanded access (Stinson and others, 1982).

Some household evidence, survey and experimental, is consistent with the findings from the cross national data that although contraception and its expansion is an important proximate determinant of fertility, this is almost exclusively due to shifts in the demand for children which shift the demand for contraception. Very little of household variation in fertility, either in cross-section or over time, is attributable to variations in the supply of contraception.

Evidence to the contrary

The evidence so far shows that high fertility is largely desired and is not primarily a consequence of the difficulty or expense of controlling fertility. How does this evidence square with the evidence often cited to support a large role for contraceptive access and family planning

[55] This was prior to the more extensive experiment FPHSP described above and discussed in more detail below that began in October of 1977.

programs? We will examine three strands of this evidence; the existence of a large "unmet need" for contraception, the ongoing fertility change in developing countries, and finally the evidence from the widely cited experiment in Matlab, Bangladesh.

"Unmet need" There is a large (and widely cited) body of evidence that a substantial "unmet need"[56] for contraception exists. This might suggest that fertility rates are affected by a lack of available contraception. However, the finding that contraceptive access is unimportant as a determinant of total fertility is consistent with these findings of "unmet need" for contraception. The figures for "unmet need" assume that every woman who reports herself as not wanting a child immediately and not currently using contraception is in "need" of modern contraception. Besides its conceptual drawbacks (see below) this construct vastly overstates the potential effect of improved contraceptive provision.

The level of "unmet need" or other measures of contraceptive access are not empirically important determinants of fertility. Calculations of the fertility reductions from reducing "unmet need" are generally based on idealized assumptions about the effect on fertility, for instance that all women would then meet their spacing and limiting fertility targets exactly[57]. In order to

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[56] "Unmet need" is left in quotations as in the current discussion it is a reference to a specific concept used in discussions of family planning programs, not a use, of the term.

[57] This is an important distinction between the approach in this paper and many calculations done claiming to demonstrate the importance of access. We focus on the cross country variation in fertility or excess fertility, comparing these in countries at various levels of access, FPE, or "unmet need." We do not assume that excess fertility can be eliminated entirely. Econometrically speaking, we examine the impact of shifts along a regression line (the slope) across countries, rather than shifting the line for all countries (changing the constant). We do

calculate the actual effects of changes in "unmet need," table 9 reports coefficient and the incremental R^2 from including various measures of contraceptive availability -- "unmet need", percentage of demand satisfied, and proportion of exposed women who do not want more children but are not using contraception -- in the regression explaining total fertility after including desired fertility (DTFR)[58]. Only between 4 percent and 6.5 percent of the fertility variation is accounted for by variations in "unmet need" or variants on that measure[59]. Calculations below suggest that "unmet need" could be reduced by improved contraceptive access by only about one-third. By these estimates, even reducing "unmet need" by one-third (about one standard deviation) by eliminating all access related "unmet need" would reduce fertility by less than half a birth.

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not make hypothetical calculations as to what fertility would be if all mistimed or unwanted births are eliminated because since that never happens in any country, it is simply irrelevant.

[58] The "unmet need" is only available for DHS countries so the sample sizes are much smaller.

[59] The fraction of variation explained (the R^2) is a function of the variation in the independent variable and the magnitude of the impact of variations. In this case, the small fraction of variation explained is not due to low variability of unmet need, but simply because the estimated impact is small.

Table 9 Estimates of the relationship between various measures of "unmet need" for contraception on actual fertility, controlling for fertility desires (DTFR)

	Coefficient	t-stat	N	Incremental R2
"Unmet need"	.056	6.8	25	.056
Percentage of total contraceptive demand satisfied	-.036	4.4	25	.039
Percentage of currently married fecund women not wanting more children not using contraception	.141	8.91	25	.064

The cross-country estimates in table 9 together with reference the figures on "unmet need" in table 10 can illustrate the impact of a very large reduction in "unmet need". In Ghana, if "unmet need" were reduced by a third, from 35 percent to 23 percent, or 12 percentage points (which is actually more the total estimated access related non-use of 7 percent), this would reduce fertility only from 6.4 to 5.7. This result is intuitively quite plausible as Ghana's DTFR is 5.4 and 90 percent of births are wanted.[60] The evidence of substantial "unmet need" for contraception is thus compatible with a practically quite small (although statistically quite significant) effect of contraceptive access on fertility.

The combination of very high t-statistics with a low fraction of the total variation explained highlights an important point in interpreting the statistical results shown in Table 9.

[60] Since .9 * 6.4 = 5.7, this implies that all unwanted births would be eliminated, which suggests that even this modest reduction in TFR is likely to be an overestimate or that such a reduction in "unmet need" is not feasible.

The fact that the point estimate is a small absolute number with a high t-statistic implies very precise estimates, which means that not only can we rule out zero effect (that is, reject the t-test) but we can also rule out anything much larger than the empirically small estimated effect as well. For instance, while the point estimate of the effect of decreasing unmet need by a third of the average (eight percentage points) is a reduction in TFR of .46, even if we add two standard deviations to the point estimate, the simulated fertility effect of the same reduction in "unmet need" is an only slightly higher. .58 births.[61]

The evidence of large "unmet need" for family planning (Westoff and Ochoa, 1991) is often cited in discussions of the effect on population growth of increased provision of family planning services (UN, 1991, World Bank, 1993b), but given the evidence above how large is the potential?

First, it must be recognized that the assumptions "unmet need" reflects women who want family planning services or that unmet need could be zero under some access conditions are both false. Although general usage ranks "needs" higher in the hierarchy of want than "demands" or "desires" in calculating "unmet need" all women not wanting a child immediately who report not using contraception (even for reasons other than cost or availability, for example, infrequent sexual activity, don't like the side effects or have religious objections) are classified as "needing" contraception. In Sub-Saharan Africa, only 37 percent of those with "unmet need" intend to use contraception, even though 85 percent know of a modern method. Therefore, women who have

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[61] For example, .056+2*(.00828)=.0725 and .0725*8=.58.

no demonstrated demand nor expressed desire for family planning are reported as "needing" it. "Unmet need" does not reflect just women who want contraceptives (supply need) but also those women who require motivation to want what they need. This usage is consistent only with either a very broad, or very paternalistic, definition of "need."

This is important because the fraction of women not using family planning because of access, the supply portion of "unmet need", is quite small. In many of the surveys, typically only one-quarter to one-third of women who report that they "would not be happy if they were to become pregnant in the next few weeks" who are not using contraception report contraceptive supply or access (taken broadly to include knowledge, availability, or cost) as the major reason for not using family planning[62]. Since access is not the issue for much of "unmet need" even costless availability of contraception would not drive "unmet need" down very far, a point confirmed by the existence of substantial "unmet need" even in countries with excellent access (table 10).

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[62] See the footnote in Table 10 for the exact survey questions. It can be legitimately argued that this understates the importance of access. Access may not be named as the primary reason althouth is a factor. Also, better access could reduce or change other reasons for non-use, like like fear of side effects.

Table 10 Estimates of "unmet need", demand satisfied, and access related nonuse, selected developing countries, 1985-91

Country	Survey	Year	"Unmet Need"	Percentage of "demand" satisfied	Percentage spacing demand satisfied	Currently fecund married women who don't want more children who are not using contraception	Percentage of women not using contraception due to access	
							Definition 1	Definition 2
Sub-Saharan Africa								
Botswana	DHS	1988	26.9	53.6	46.4	6.5	3.6	
Burundi	DHS	1987	25.1	25.8	24.7	5.1		
Ghana	DHS	1988	35.2	26.8	23.4	7	7.0	
Kenya	DHS	1989	38	41.5	27.7	11.5	14.1	
Liberia	DHS	1986	32.8	16.4	15.4	4.6	2.5	
Mali	DHS	1987	22.9	17	18.9	4.3		
Nigeria	DHS	1990	-	-	-	-		6.3
Sudan	DHS	1990	-	-	-	-	2.6	
Togo	DHS	1988	40.1	23.2	22	8.5		
Uganda	DHS	1989	27.2	15.2	9.5	5.2	11.4	
Zimbabwe	DHS	1989	21.7	66.5	73.1	8.1	3.8	
Asia								
Indonesia	DHS	1987	16	73.8	62.5	5		11.1
Pakistan	DHS	1991	-	-	-	-		7.5
Sri Lanka	DHS	1987	12.3	81.3	60.9	4.1	1.8	
Thailand	DHS	1987	11.1	85	72.9	4.3	0.3	
Middle East and North Africa								

Egypt	DHS	1988	25.2	58.4	35.8	9.8		
Morocco	DHS	1987	22.1	59.1	48.1	6.5		
Tunisia	DHS	1988	19.7	70	54.2	5.8		
Latin America and the Caribbean								
Bolivia	DHS	1989	35.7	43.4	37.1	15.2	11.4	
Brazil	DHS	1986	12.8	81.6	74	5.7		
Colombia	DHS	1986	13.5	80.1	69.7	6.2		
Dominican Republic	DHS	1986	19.4	69.9	46.2	6.3	0.6	
Ecuador	DHS	1987	24.2	62.5	48.7	10.5		0.2
El Salvador	DHS	1985	26	64.1	36.3	8.1		
Guatemala	DHS	1987	29.4	43.3	23.1	9		
Mexico	DHS	1987	24.1	66.7	52.1	9.3		
Peru	DHS	1991	-	-	-	-		0.9
Peru	DHS	1986	27.7	58.8	51.6	13.1	6.0	
Trinidad and Tobago	DHS	1987	16.1	74.2	66.1	6.7		

Note on Access: The fraction of women not using due to access has two definitions, depending on the question in the DHS. Definition 1 results from first asking women: "If you became pregnant in the next few weeks, would you feel happy, unhappy, or would it not matter very much?" then, of those that do not respond "happy" asking "What is the main reason that you are not using a method to avoid pregnancy?" In the list of 13 possible responses is: "lack of knowledge", "access/availability", and "costs too much." The fraction not using due to access is of all currently married women the fraction unhappy if pregnant and not using due to one of these three reasons. Definition 2 is the result of asking women who are not using and do not intend to use: " What is the main reason you do not intend to use a method?" In addition to the three access reasons "Wants children" is a possible (and generally most frequent) answer.

A second reason why "unmet need" does not have the large fertility consequences one might expect is that a substantial portion of "unmet need" consists of women who are currently pregnant (or amenorrheic) whose pregnancy or most recent birth was either mistimed or unwanted. These temporarily infecund women account for between one-third and one-half of all "unmet need" in Sub-Saharan African countries. The "unmet need" also include a substantial fraction of women with demand for spacing, that is, who want more children but not immediately.[63] While including these two groups are relevant, table 10 reports the total "unmet need" alongside the most relevant group for determining total completed fertility levels, the fraction of currently married fecund women wanting no more children who are not using contraception. The fraction of all "unmet need" that consists of this group is typically less than a third of all "unmet need", with a median fraction of only 6.5 percent. For instance, in Uganda, 27 percent of women are said to have "unmet need" but only 5 percent of married fecund women want no more children and are not using contraception. While both the question of the fertility impact of spacing and the question of the appropriate treatment of pregnant and amenorrheic women are difficult, it is nonetheless interesting to note that large "unmet need" figures are consistent with very small numbers of fecund women wishing to limit not using contraception.

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[63] Increased use of contraception for spacing also may have some effect on fertility, but if spacing left total fertility desires unchanged then although immediate uptake of contraception would initially lower observed TFR (as women early in reproductive careers began to space) over time this difference would be eroded as older women began having the children that were spaced previously (perhaps not completely due to infecundity before reaching the desired number of children). The question of how to measure the fertility affects of avoided births due to spacing which may occur later is difficult, but it is clear meeting limiters demand is of more relevance for fertility.

Fertility change. Some argue that the magnitude and rapidity of the fertility transition in developing countries compared to the historical transition in the now developed countries is a strong argument for the importance of family planning programs. Robey et al (1993) argue "The differences between fertility declines in developing countries today and those seen in Europe may best be explained by differences in the approach to family planning." If contraception or improved family planning were driving fertility declines, they should be accompanied by a reduction in excess fertility.

But the impressive declines in fertility observed are due almost entirely to equally impressive declines in desired fertility, not by reductions in excess fertility, as would be expected if expansion of contraceptive access were driving fertility declines. Only seventeen countries have complete survey data at two points in time[64]. In that sub-sample the actual fertility decline observed was 1.08 births. Desired fertility (DTFR) fell by a larger amount, 1.32 births[65]. Excess fertility, the difference between TFR and DTFR, decreased in only 6 of the countries while rising in eleven. Even in those six countries where a closer match between actual and desired fertility contributed to lower fertility, it was generally by a small amount. Only in Thailand did the reduction in excess fertility account for more than a quarter of the fertility decline. Even in Mexico, where fertility fell by 1.7 births between 1976 and 1987, desired fertility fell by 1.6, while excess fertility reductions accounted for only .1 births. Since

[64] Neither the timing nor the span between the two surveys is uniform across countries. The period covered is between 7 and 12 years.

[65] These are the averages, the median falls in TFR and DTFR are exactly the same, at 1.2.

DTFR is not affected by contraceptive access, the increased excess fertility observed in eleven of these countries with declining fertility suggests that decreases in desired fertility lead and cause subsequent increases in contraceptive use and reductions in actual fertility, rather than vice versa.

Moreover, most of the intuitive appeal of an argument based on the speed of the current demographic transition is lost once it is recognized that differences in family planning are just one small aspect of differences between today and Europe's historical transition. In many developing countries which experienced rapid fertility decline everything happened faster than for the now developed countries; mortality fell faster, incomes rose faster, education expanded more rapidly. Compare for instance Thailand with the United Kingdom. According to WFS and DHS data Thailand's TFR fell from 4.3 in 1975 to 2.2 in 1987, a fifty percent fall (to near replacement levels) in just twelve years. By comparison Great Britain's fertility transition was very long, with crude birth rates (admittedly a crude proxy) falling fifty percent only over the course of fifty years. However, infant mortality in Thailand fell 60 percent in 25 years, from roughly 100 the early 1960's to around 40 by 1985 (United Nations, 1992). On the other hand, from a level of 160 in 1800 British infant mortality took 120 years to fall sixty percent (and did not reach 40 until after 1945)[66]. Thailand's real per capita income has tripled in the thirty years since 1960, whereas it took British per capita national income almost ninety years to triple

[66] British infant mortality and crude birth rates are for England and Wales and are taken from Mitchell, 1978.

information, discussed family planning needs and offered a variety of contraceptive services (the pill, condoms, IUDs, injectables). The other half of the Matlab region received no additional family planning services beyond the usual availability of government services.

The project began in October 1977 and achieved almost immediately a large increase in the contraceptive prevalence rate and a decrease in the fertility rate. Within 18 months contraceptive prevalence in the treatment area rose from 7 percent to 33 percent (Phillips et al, 1988) and by 1990 estimates were that contraceptive prevalence in the treatment area was 57 percent compared to 27 percent in the comparison area (Koenig, et al, 1992). Fertility rates also fell in the treatment area relative to the comparison area. By 1980 the total fertility in the treatment area had fallen 24 percent compared to the comparison area (5.1 versus 6.7), a gap of 1.6 births that has been roughly maintained since[68].

This project proves that family planning activity can have a role in the determination of fertility. Does this experiment refute either of our paper's main contentions; that the responsiveness of fertility to incremental changes in family planning activity is small, and that

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[68] The fact that contraceptive prevalence increased by much more than fertility fell is due to greatly increased contraceptive use in the treatment area for spacing, marked by three striking facts. First, in 1990 the use of permanent contraceptive methods (female or male sterilization), those preferred by limiters, was actually higher in the comparison area (9.9 percent) than in the treatment area (8.8 percent). Similarly, the use of contraception among women wanting no more children barely increased in the treatment area from 1977 to 1984, from 45.6 percent to 49 percent while of those wanting more children use almost quadrupled over the same period, from 6.8 percent to 26.3 percent. Third, only 12.4 percent of the increased contraceptive use can be attributed to increased use among limiters while 57 percent is due to increased use by spacers ((Koenig et al. 1992, Koenig, et al, 1987)

(between 1855 and 1939)[67]. Similarly, the expansion of education has happened extraordinarily rapidly in Thailand, the proportion of adult women with no schooling dropped from 60 percent to just 20 percent in just twenty five years (Barro and Lee, 1993).

Similarly rapid improvements in mortality, income and education are true of other rapid fertility transition cases (e.g. Indonesia, Korea, Taiwan (China)). Therefore on mere speed alone it is impossible to attribute any effect to modern contraceptives and their availability. Studies of the underlying causes of rapid fertility transition in these case reveal that attributing all (or in some cases, even a substantial fraction) of the fertility decline or its speed to family planning programs per se vastly overstates the program effect (Schultz, 1987 and 1992, Hernandez, 1984).

What about the Matlab data?. Perhaps the most famous controlled experiment examining the effects of family planning activities on contraceptive use and fertility is the Family Planning and Health Services Project (FPHSP) carried out in a research station of the International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B) in the Matlab region of Bangladesh. This project provided half of the villages in the region (the treatment area) with very intensive family planning services, including visits every two weeks to each currently married, fecund women by a full-time project employee (generally a married, contracepting, well-educated, female village resident from an influential family). This family planning worker presented

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[67] According to national income figures in Deane and Cole, 1967. Needless to say there is some uncertainty, Maddison, 1991, reports GDP per person less than doubled between 1870 and 1938.

very little of cross country differences or changes in fertility are (or are likely to be) explained by differences in contraceptive access or family planning programs? No. The fertility changes were large not because fertility was particularly responsive but because the effort was massive and expensive. This program expense makes it unlikely that this degree of effort will be replicated at a national scale in Bangladesh, or anywhere.

The FPHSP experiment took "contracepting" costs from about as high as they could possibly be and drove them to about as low as they possibly be, substantially cheaper than free. The price of contracepting has at least six components: the money cost of the contraceptive service, the search costs of acquiring information about contraception and where to purchase it, the time and travel costs to obtain contraception, the "variety constraint" cost[69], the side effects of contraceptive use, and, the psychic costs of using contraception in the face of perceived social or familial disapproval. Prior to the experiment many of these costs were very high. The Matlab region is predominantly Muslim and most women observe "purdah" involving substantial restriction on women's movements outside the home, making both the costs of acquiring information and the costs of obtaining contraceptives dramatically higher than in most other cultures. Moreover, in 1984 42 per of women in the treatment area perceived disapproval from their husbands or others (DeGraff, 1991).

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[69] This is the cost to the user of not getting exactly the variety he/she prefers. This cost is recognized is the economics literature on product differentiation. This may account for a significant fraction of the additional contraceptive use, as most of the additional use in the treatment area has been of injectables, while in the comparison area the use is predominantly the pill and sterilization (Caldwell and Caldwell, 1992).

The program reduced all of these costs to as low a level as possible. Contraceptives were provided free avoiding money costs. Contraception was delivered to the home (except when requiring a clinic) avoiding travel and time costs. A broad variety of methods were offered and used[70]. The recruitment of educated village women to provide continuous (fortnightly) contact and support was a deliberate attempt to overcome both the costs of obtaining contraception in a traditional society and social and familial disapproval[71] and to reduce the suffering from side effects. Even for goods provided "free", the user bears all but the money costs, the FPHSP made contracepting much cheaper than free.

Given the tremendous decline in contracepting costs and truly amazing sustained effort (an 35 year old woman would by now have received over 300 visits from a family planning worker) a fertility decline of 1.5 births (or about 25 percent) in Matlab seems perfectly consistent with all the other evidence (the close link of desired and actual fertility, lack of contraceptive prevalence effect on excess fertility, small independent impact of family planning effort, low contraceptive price elasticities, limited effect of "unmet need" measures) that fertility is substantially inelastic with respect to costs of contraceptive access or family planning effort. We are not arguing fertility is invariant with respect to the cost of contraception, just that it is

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[70] Only 21 percent of women in 1990 used the pill. One lesson of the prior contraceptive supply saturation experiment in Matlab (Contraceptive Distributive Project) may be the deep unpopularity of the pill, especially as opposed to injectables. Also the Matlab data show a relatively high rate of switching from one method to another as consumers try a method and become dissatisfied, indicating a potentially large variety preference problem.

[71] This may be successful. DeGraff (1991) reports that a woman in the who perceives disapproval from her husband or others is 51 percentage points less likely to use contraception in the treatment area but 88 percentage points less likely in the comparison area.

sufficiently inelastic to make cost variations an unlikely source for explaining or causing major demographic changes.

This fertility reduction came at a sufficiently high cost to make it not replicable either at national scale or world-wide. Table 11 presents estimates of the cost of the program. The total costs include many costs not directly related to the project (such as data collection, international technical assistance, and non-service related overheads). While it can be argued these costs should be discounted, the role of international technical assistance was likely important in the success of the project and may be critical to replicability. Even taking the "core service" costs, they amount to over eight dollars per woman, which in Bangladesh is 5 percent of GDP.

Table 10: Costs of the Matlab (FPHSP) experiment and Bangladesh goverment expenditures on family planning in 1985 (in 1992 $).

	Cost ('000)	Cost per woman	Cost per woman aged 15-49 (% of GDP per capita)
Total cost	$386.255	$17.27	10.0%
"Core service" cost	$188.718	$8.44	4.9%
Public expenditures in Bangladesh	$45,400	$3.38	1.8%

Notes: Based on Simmons, Balk, and Faiz, 1991 and Nag, 1992. Number of women 15-49 in treatment area is 22,370. Per capita GDP in 1985 was $150. All 1985 dollar figures were transformed to current (1993) dollars by the US CPI.

The core service program cost alone is thirty-five times average public expenditure levels on family planning per married woman of reproductive age for four components of family

planning (contraception, staff training, IEC, and compensation payments) in Asian countries (Sanderson and Tan, 1993)[72]. Bangladesh has by far the highest family planning expenditures in Asia for these four components[73], at .41 percent of GDP and total expenditures on family planning are 1.8% of GDP per MWRA, about a third the Matlab "core service" program cost. Worldwide total expenditures on family planning (public and private) are about .6 percent of GDP per capita per woman of childbearing age (World Bank, 1993)[74]. If the Matlab level of spending (as a fraction of GDP[75]) were to be achieved worldwide family planning expenditures would need rise to over $40 billion, an eight to ten fold increase over current levels.

How much did costs decline? While the "core service" cost reflects the cost of delivering the additional services, even thought the additional costs of the total project were not spent directly on the project they reflect the better design and implementation of this project, which may be reflected in lower contracepting costs to users for a given expenditure. Taking the total

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[72] Sanderson and Tan (table 4.2) show public family planning related expenditures per MWRA for these components for ten Asian countries (excluding China). The average level is .14 percent of GDP per capita. The staff costs are excluded because of the difficultyl of accounting for differences across countries in the allocation between family planning and other activities.

[73] It is worth noting external funding is 60 percent of Bangladesh's total public spending on family planning programs, also the highest in Asia.

[74] World Bank, 1993 (table 4) estimates between 4 and 5 billion (in 1988 dollars for family planning expenditures in 1990 (they use $4 billion). Taking $5 billion (to be generous) combined with 1.04 billion women of reproductive age and the average developing country GDP per capita of $840 (from the World Development Report, 1992).

[75] The fraction of GDP is relevant because the major costs of the service are personnel, whose costs rise roughly one for one with GDP. A more sophisticated calculation could assume equal costs for international traded components, but would come with much the same figures.

cost decline to women versus the government program to be somewhere between 2.5 and 5 times the expenditure levels elsewhere in Bangladesh. Calculating a crude elasticity with a 25 percent fall in fertility suggests an elasticity of fertility with respect to contracepting costs of between -16 and -.063[76]. This number is certainly consistent with other results, as seen when expressed in elasticity form. From table 3 the elasticity (at the means) of fertility with respect to FPE is between -.04 [(.007)+(31/5)] and -.074, with the elasticity with respect to CPV is -.074 or -061. These are not of course directly comparble as we do not know the elasticity of FPE and CPV themsleves with respect to expenditures. The fertility elasticity with pill prices of -.05 and the overall price elasticities of contraceptive use of around -.1 are also broadly consistent. A calculation assuming constancy in percentage changes with elasticities of -.1 suggests an exgoenous doubling of family planning expenditures in low income countries excluding China would reduce fertility by about one half a birth per woman[77].

Put another way, the cost per birth averted by the program was $180 in 1987 and 120 ercent of Bangladesh's GDP per capita[78]. At this cost as a fraction of GDP ber both averted

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[76] This is just the crude calculation of the ratio of the percentage fall in fertility (25 percent) to the fall in costs (between 150 and 400 percent).

[77] Taking the percentage increase times the elasticity times the actual fertility gives the figure (e.g. (100)*(.1)*(5)/100 = .5). We take 5 as the typical TFR of low income countries he unweighted average is 5.9, population weighted average is 4.5, the median is actually over

[78] This points up an important distinction between costs to a couple of avoiding a birth that is unwanted and the costs through public action of averting a birth. Use of the former to estimate the latter is often done, but is completely erroneous conceptually and can be wrong empirically by orders of magnitude. The contraceptive cost of avoiding a birth cannot even be an approximation to the costs of averting addtional births through family planning expenditures.

a doubling of family planning expenditures would reduce the rate of natural increase by one tenth of one percentage point (a decline in the CBR from 30 to 29)[79]. These are crude calculations, most fertility reduction would happen in the poorer of the countries rather than equiproprtionately by population so the average dollar cost would be lower. Nevertheless even the most optimistic assumptions about the likely course of family planning expenditures, independent variations (as opposed to increases in response to increased demand) are unlikely to play a major role in reducing fertility levels, if the Matlab costs are any guide[80].

Conclusion

The conclusion that follows from the evidence and analysis presented is that because fertility is principally determined by child desires, contraceptive access (or cost) or family planning effort more generally are not a dominant, or typically even a major, factor in determining fertility differences.[81] In conclusion, we would like to add five final comments.

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[79] Again, a very crude calculation based on a reduction of the CBR from 30 to 29 with a 1990 developing country population of 4,145 million implies 4.1 million births averted with 1990 GDP in developing countries of $1010 implies at 120 percent of GDP per birth averted implies increased expenditures by $5 billion.

[80] Interestingly, the Simmons, Balk, Faiz 1991 article argues the Matlab program was more cost effective than the regular government program in cost per birth averted. This appears to be mainly because the government program is so ineffective in averting births. However, if this is the case then the assumptions about cost per birth averted are optimistic and hence the costs of fertility reduction would be even higher at more typical levels of program effectiveness.

[81] We do find in some instances of a statistically significant effect of contraception, but the impact is always empirically small when judged by practical impact or explanatory power. Optimists may point to the 3-5 percent that contraceptive supply does explain, as opposed to our pessimistic emphasis on the 95-97 percent it does not.

These comments do not follow directly from the evidence presented here but are more speculative as to broader implications and suggestive of future research.

First, some might argue that we are attacking a straw man, since no one really believes that the cost and availability of contraceptives is important for fertility. As for what is popularly believed, we can do no better than quote Paul Kennedy's recent book (Kennedy, 1993) in which he summarizes his view of the settled conventional wisdom on family planning:

> "A detailed proposal for dealing with the demographic explosion in developing countries would simply repeat what numerous studies by international agencies have pointed out: that the only practical way to ensure a decrease in fertility rates, and thus in population growth, is to introduce cheap and reliable forms of birth control."

We could not have invented a clearer and more articulate statement of the view we argue is wrong.

Second, among experts in the field, there has evolved a more subtle view. Decades of promoting contraception have convinced many that supply is not the only problem. Some would argue that what we are saying is already well-known, that is, to achieve fertility reductions, one must change desires and improve contraceptive access. But we suggest the evidence presented here shows that it is fertility desires and not contraceptive access that matters.[82] A low level of desired fertility appears to be both necessary and sufficient for low fertility. Desire to

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[82] Of course, it is always true that changing fertility desires and increased contraceptive access cause fertility reductions in the trivial sense that gin and tonic make you drunk.

regulate fertility calls forth the requisite level of contraception, either from the private or government sources. In contrast, an improvement in contraceptive access (as distinguished from contraceptive use) is neither sufficient nor necessary for large fertility reductions. In economist's terms, the fact that the quantity of contraception supplied to users must increase does not imply that supply must shift. Of course, if the government pursues policies that interfere with contraceptive access and thereby make the supply of contraception less responsive to increased demand, then this will attenuate the fertility reductions from changing desires for children.

Third, since we are asserting that the proposition that contraception is important for fertility is both a widely held belief and is demonstrably false, we owe the reader some explanation as to how this came to be. Contraception is an obviously important proximate determinant of fertility. Fertility rates and contraceptive use are strongly negatively associated across countries, across households, and over time. Hence, it is easy to conclude that variations in contraceptive access cause variations in fertility. The temptation to infer causation from association is strong, often overwhelming. In addition, there are conditions in which access could be a more important determinant: if the supply of additional contraception were not flexible to meet additional demand or the government imposed conditions that would make access critical. Again, usually these conditions are not the case. Finally, if, as many believe, population growth is one of the most serious challenges facing humankind, it is tempting to hope that something relatively cheap and easy like subsidizing contraceptive services could solve the problem.

Fourth, even if contraceptive access has a small effect on fertility, this is certainly no reason for governments to limit the availability of contraception, and there may yet be valid reasons for a subsidy. Just because family planning is of marginal relevance for population change does not mean it does not have other beneficial impacts. Moreover, a reduction in the focus of family planning programs on population growth will allow greater attentiveness in the design of contraceptive supply to other considerations, such as child and maternal health, the timing of first births, and the prevention of sexually transmitted diseases.

Undoubtedly the expanded availability of modern contraception has greatly improved human welfare. As detailed in the World Development Report 1993, there are important health benefits to contraception through better timing and spacing of births, independent of any reduction in overall fertility. Evidence suggests that, *ceteris paribus*, children born too early or too close together face an increased risk of mortality. Better and cheaper access to contraception, especially of temporary and reversible methods, may allow women to gain these health benefits for themselves and their children. In many countries, preventing early first births would not only improve maternal and child health at first birth but also allows women to gain valuable educational and labor force experience before beginning child rearing. The experience of the U.S. shows that even if the number of total births is not a concern, the timing of the first birth can have important, lifelong, socioeconomic implications for mothers.

The examination of actual and desired fertility did not allow us to distinguish between ways in which unwanted births are avoided. Modern contraception has also made it possible for people to meet their fertility goals without resorting to abortions. For instance, in the former Soviet Union fertility is limited through widespread recourse to abortions, partially due to the greater availability of abortions than modern contraceptives.

Historical fertility transitions often involved reduced coital frequency (for example, late age of marriage, low rates of marriage, prolonged postpartum abstinence, etc.). In the developing countries the use of non-contraceptive fertility limitation has been less and this is a major benefit of modern contraception. For instance, the birth rate in Sweden and Finland in 1875 was 30.5 and 37 respectively, partly because mean age at marriage for women was 27.1 and 25.6 (Kumar, 1971) whereas contemporary Egypt or Peru have similar crude birth rates with a median age at marriage of 18.5 and 21.2 respectively. In Mexico, fertility has fallen from 6.3 in 1973 to 3.8 in 1986 while age at marriage has barely risen. In the 1987 DHS survey in Mexico, women with a secondary education reported having sexual relations 40 percent more frequently than women with no schooling 6.1 versus 4.3 per month), even though their fertility was less than half (2.5 versus 6.1). In Taiwan (China), coital frequency increased during the same period in which fertility fell dramatically from 4.8 to 2.8 (Sun, Lin, and Freedman, 1978) and similar increases were observed in the U.S. in the 1960s (Trussell and Westoff, 1980). Coital frequency is generally higher in households using contraception. Many recent surveys have asked whether women have been "sexually active" in the previous four weeks. In Peru, 53 percent of those using no contraceptive method had been sexually active as against 95 percent

of those using the pill; 47 percent and 91 percent in Colombia; and 59 percent and 86 percent in Nigeria.

The emergence of AIDS and the expansion in the sexually transmitted diseases (STDs) generally introduce new complications into decisions about contraceptive mix. Some methods particularly cost effective for fertility limitation (e.g. female or male sterilization) have no effect on disease transmission. Condoms, while generally thought ineffective for fertility limitation, have important secondary health benefits for women in inhibiting STD transmission.

Fifth and finally, we have focused only on the importance of desired fertility in explaining fertility variations and the relatively small independent role of contraceptive access (or family planning more generally). This does not imply that for a variety of economic and environmental reasons a reduction of in population growth rates may be desirable, and even in some circumstances critical. However, since many women in developing countries currently perceive they are better off with large families the best (and perhaps the only palatable) way to reduce fertility is to change the economic and social conditions that make large families desirable. Reducing fertility is best seen as a broad problem of improving women's economic condition, women (and children's) health, and women's role and status in society. That is a task altogether more difficult, but with more promise, than manipulating contraceptive supply.

In particular, although this paper has not focused on the determinants of desired fertility, expansion in female education appears to be key to fertility reductions. Cross national evidence

which separates the two shows much stronger effects of female than male education in reducing fertility (Schultz, 1993, Subbarao and Raney, 1993, Barro and Lee, 1993b). Household evidence shows the importance of female education, particularly primary completion and beyond, for reducing fertility and through reduced fertility desires. Summers (1992) shows, for example, that increasing female education through expanded access in Pakistan would be an important and cost effective means of reducing fertility.

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Data Appendix

Table A.1 Actual fertility and various measures of fertility demand

Country	Survey	Year	TFR	Average ideal number of Children (AINC)	Desired TFR (DTFR)	Wanted TFR (WTFR)	Percentage of all births that are wanted (Bongaarts)	Percentage of women with 4 living children who want no more
Africa								
Benin	WFS	1982	7.3	7.8	7	-	-	12.1
Botswana	WFS	1980	6.1	-	6	-	-	-
Botswana	DHS	1988	5	4.7	4.1	-	-	29.8
Burundi	WFS	1978	7.9	-	7.6	-	-	-
Burundi	DHS	1987	6.7	5.3	5.7	5.6	87	25.2
Cameroon	WFS	1978	6.4	8	6.1	6	94	3
Ghana	WFS	1980	6.2	6	6	5.6	91	15
Ghana	DHS	1988	6.4	5.3	5.3	5.4	9	25.1
Ivory Coa..	WFS	1981	7.2	8.4	7.2	-	-	3.2
Kenya	WFS	1978	7.9	7.2	7.6	6.7	86	16.1
Kenya	DHS	1989	6.4	4.4	4.5	-	-	49
Lesotho	WFS	1977	6	6	5.6	4.9	84	26.6
Liberia	DHS	1986	6.5	6.0	6.3	6	9	23
Mali	DHS	1987	7.01	6.9	7.1	7	93	26.3
Mauritania	WFS	1974	7.5	8.8	7.1	-	-	26.3
Nigeria	DHS	1990	6.01	5.8	-	-	-	16.7
Senegal	WFS	1978	7.1	8.3	6.9	6.9	99	9.0
Senegal	DHS	1986	6.6	6.8	5.6	5.7	91	18.8

Sudan	WFS	1979	5.4	6.2	5	4.8	89	16.1
Sudan	DHS	1990	4.6	5.8	-	-	-	23.3
Togo	DHS	1988	6.6	5.3	5.1	-	-	26.6
Uganda	DHS	1989	7.5	6.5	6.5	-	-	17.9
Zimbabwe	DHS	1988	5.2	4.9	4.3	-	-	31.8
Asia								
Bangladesh	WFS	1976	5.4	4.1	4.6	4.2	79	76.7
Fiji	WFS	1974	4.1	4.2	3.6	3.2	8	66.7
Indonesia	WFS	1976	4.3	4.8	4	3.6	85	57
Indonesia	DHS	1987	3.3	3.2	2.4	-	-	79.2
Korea	WFS	1974	3.6	3.2	2.8	2.6	7	92
Malaysia	WFS	1974	4.2	4.4	3.3	3.6	85	51.9
Nepal	WFS	1976	6.8	3.0	5.4	4.6	77	58
Pakistan	WFS	1976	6	4.2	4.3	4.2	75	69
Pakistan	DHS	1991	6.3	4.1	-	-	-	51.6
Philippines	WFS	1978	5.0	4.4	4.1	-	-	68
Sri Lanka	WFS	1975	3.4	3.8	2.9	2.4	72	87
Sri Lanka	DHS	1987	2.7	3.1	2.2	2.2	84	92.6
Thailand	WFS	1975	4.3	3.7	3.2	2.6	64	81.3
Thailand	DHS	1987	2.2	2.8	1.8	-	-	87.7
Vietnam	DHS	1988	4.5	2.5	-	-	-	80.6
Europe, Middle East, and North Africa								
Egypt	WFS	1980	5	-	3.6	3.3	7	75.3
Egypt	DHS	1988	4.4	2.9	2.8	-	-	82.1

Jordan	WFS	1976	7.3	6.3	6	5.2	77	38.3
Morocco	WFS	1980	5.5	-	4.4	-	-	44.7
Morocco	DHS	1987	4.6	3.7	3.3	3.2	76	58.8
Portugal	WFS	1980	2.4	2.3	1.9	2	95	96.2
Syria	WFS	1978	7.5	6.1	6.3	5.5	78	44.5
Tunisia	WFS	1978	5.5	4.1	4.1	3.8	74	-
Tunisia	DHS	1988	4.1	3.5	2.9	-	-	78
Turkey	WFS	1978	4.3	3.03	-	3	79	82.6
Yemen AR	WFS	1979	8.5	5.5	8.2	-	-	24.7
Latin America and the Caribbean								
Bolivia	DHS	1989	4.9	2.6	2.8	-	-	85.8
Brazil	DHS	1986	3.3	2.8	2.2	2.2	71	86.9
Colombia	WFS	1976	4.6	4	3.4	2.7	62	79
Colombia	DHS	1986	3.1	2.7	2.1	2	68	89.8
Colombia	DHS	1990	2.9	2.6	-	-	-	89.3
Costa Rica	WFS	1976	3.5	4.7	3	3	88	68.4
Dominican Republic	WFS	1975	5.2	4.7	3.8	3.3	68	69.6
Dominican Republic	DHS	1986	3.6	3.4	2.6	2.5	75	87.6
Dominican Republic	DHS	1991	3.3	3.1	-	-	-	95.9
Ecuador	WFS	1979	5.3	3.0	4.1	3.4	69	68
Ecuador	DHS	1987	4.3	2.5	2.9	2.4	6	80.7
El Salvador	DHS	1985	4.4	3.6	-	-	-	77.9
Guatemala	DHS	1987[8]	5.6	4.2	4.5	-	-	62.1
Guyana	WFS	1975	4.4	4.6	3.8	3.1	74	60

Haiti	WFS	1977	5.6	3.6	4.3	3.4	65	68
Jamaica	WFS	1976	3.7	4.2	3.4	2.9	71	54
Mexico	WFS	1976	5.7	4.4	4.5	3.5	65	69.4
Mexico	DHS	1987	4	3	2.9	-	-	84.8
Panama	WFS	1976	4.2	4.3	3.9	3	75	81.7
Paraguay	WFS	1979	5	5.2	4.5	4	83	41.2
Peru	WFS	1978	5.3	3.8	3.5	3	61	74.2
Peru	DHS	1986	4.1	3.6	2.3	2.1	56	85.9
Peru	DHS	1991	3.5	2.5	-	-	-	89.1
Trinidad & Tobago	WFS	1977	2.5	3.8	2.5	2.6	87	74.8
Trinidad & Tobago	DHS	1987	3	2.9	2.2	2.2	75	86.5
Venezuela	WFS	1977	4.3	4.2	3.6	2.9	68	74.3

Source: Various country Demographic and Health Survey or World Fertility Survey reports, Westoff (1988) and Bongaarts (1990).

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