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Fertility changes in Latin America in periods of economic uncertainty

Alicia Adsera[1] and Alicia Menendez[2]
[1]Princeton University and IZA; [2]University of Chicago

We explored the relation between fertility and the business cycle in Latin America. First, we used aggregate data on fertility rates and economic performance for 18 countries. We then studied these same associations in the transitions to first, second, and third births with DHS individual data for ten countries. The results show that in general, childbearing declined during economic downturns. The decline was mainly associated with increasing unemployment rather than slowdowns in the growth of gross domestic product, although there was a positive relationship between first-birth rates and growth. While periods of unemployment may be a good time to have children because opportunity costs are lower, in fact childbearing was reduced or postponed, especially among the most recent cohorts and among urban and more educated women. The finding is consistent with the contention that, during this particular period in Latin America, income effects were dominant.

Keywords: fertility; unemployment; Latin America; economic crises; business cycle; economic growth

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Introduction

Over the past three decades fertility rates have declined sharply across Latin American countries and, in some of them, maternity has been delayed. These decades have also witnessed, in most countries, a high degree of economic and political uncertainty in the form of macroeconomic imbalances, inflation, unemployment, and changes in political regime. The economic literature refers to the decade of the 1980s as the 'lost decade' because of the adverse economic conditions and lack of growth in most Latin American countries during that time.

All of these factors are likely to have influenced key household decisions such as childbearing and health and education investments. Some of the most recent research on Latin America has highlighted the direct effect of economic shocks on such outcomes as child health in Colombia (Miller and Urdinola 2007) and human capital accumulation in Peru (Schady 2004). In the USA, investigators have concentrated on the indirect consequences of the business cycle, through its influence on fertility changes, the health status of adults and children, children's school enrolment, and time parents spend with children (Dehejia and Lleras-Muney 2004; Price 2008). Here we focus on the association between economic fluctuations and changes in fertility.

The decline in fertility in Latin America is usually seen as a component of the long-term progress in economic development in the area. Fertility decline has already been studied in great detail (see Guzman et al. 1996 and UN Population Division 2001 for an overview). We concentrate instead on fertility responses to economic fluctuations, the occurrence of which in Europe and the USA has been much studied and is the focus of an extensive literature (among many examples, for studies reporting instances of fertility being positively correlated with economic growth, see Yule 1906; Galbraith and Thomas 1941; Kirk and Thomas 1960; Silver 1965; Weir 1984; Galloway 1988; Lee 1990; Southall and Gilbert 1996; for studies reporting instances of fertility being negatively correlated with economic growth, see Butz and Ward 1979). However, there are very few published studies of those associations in Latin America and there is no consensus about the direction of the effects there. Previous analyses of the effect of short-term economic changes on demographic variables either focused on just a few

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particular countries (on Brazil, see Goldani et al. 1989 and Magno de Carvalho and Wong 1996; on Colombia, see Parrado 2000; among other sources, see chapters on Brazil, Chile, and Argentina in Tapinos et al. 1997). Some of these studies obtained mixed results (see Palloni et al. 1996), others did not cover the most acute recent Latin American economic crises (Palloni and Tienda 1992).

In the study reported in this paper we explored the relation between fertility and the business cycle, taking advantage of the existing cross-country and within-country differences in both fertility and economic conditions during a period that included the most recent acute economic crises. We undertook two types of analysis: first, a macro data analysis to estimate changes in total fertility around a common trend in data from an unbalanced panel of 18 Latin American countries for the previous three decades; second, a micro data analysis to estimate Cox proportional hazard models of transitions to first, second, and third births with individual-level data from Demographic and Health Surveys (DHS) available only for a subset of ten Latin American countries. By including a large set of countries, many of which were not covered by the DHS data (Argentina, Chile, Costa Rica, El Salvador, Honduras, Panama, Uruguay, and Venezuela) the aggregate analysis provided us with a much more complete picture of the region than any previous research on this topic. Further, it allowed us to examine the effects of macroeconomic conditions in a large set of countries with many common characteristics but also at different stages of demographic and economic development. In contrast, the micro data covered fewer countries but provided the detail and flexibility needed to help explain how economic shocks affected women of different socioeconomic status and birth cohort. We expected the impact to differ across education groups, cohorts, and geographic location. To the best of our knowledge no previous studies have attempted to investigate in detail the effect of economic fluctuations on fertility for such a complete set of Latin American countries over a long period.

The findings from the two types of analysis were consistent, which we regard as a comforting sign of the robustness of our results. Both analyses showed that periods of relatively high unemployment were associated with lower total fertility and with the postponement of first birth (and to some extent second and third births). The association with first births was stronger among more educated women, later cohorts (which probably had more access to family planning services), and those living in urban settings. The findings suggest that both individual unemployment shocks and aggregate economic uncertainty have pro-cyclical effects on fertility rates.

Changes in fertility and macroeconomic conditions in Latin America

Fertility

The decline of fertility in recent decades has been very uneven across Latin American countries. Table 1 presents levels of total fertility from 1950 to 2000 for all the countries under analysis (see the Appendix for data sources). Some countries, such as Argentina, Chile, and Uruguay, had already achieved a relatively low level of fertility by 1970. Even though fertility continued to decline in the following years, the change was modest. Pantelides (1996, 2001) notes that the onset of fertility decline in Uruguay and Argentina took place in the 1920s and 1930s, before the onset in other Latin American countries and close to the time of the transition in most European countries. Chile's fertility was the next to decline but did not start doing so until the 1960s.

In contrast, other Latin American countries achieved a rapid fertility transition over the past 40 years that was especially marked in Brazil, Nicaragua, and Mexico. The causes of the rapid Brazilian fertility decline are still under analysis. The decline was not homogeneous across regions and fertility level still varies widely across the country (Magno de Carvalho and Wong 1996; Bajraj et al. 1997; Goldani 2002). Table 1 shows that total fertility in Brazil went from 5.33 in 1970 to 2.46 (close to the levels in Chile and Uruguay) in 1995. In Mexico, the decline did not begin until the 1970s but was exceptionally fast (Tuiran et al. 2001), decreasing from 6.73 in 1970 to just fewer than three children by 1995.

Finally, total fertility was still remarkably high in many areas of Latin America in the year 2000: 4.87 in Guatemala, 4.36 in Honduras, and 4.16 in Paraguay.

Economic conditions

During the same period, Latin America also experienced multiple economic and political difficulties. Inflation, external debt crisis, income inequality, unemployment, fiscal deficits, high protectionism, and market-oriented reforms were some of the main ingredients that dominated the economic scene in the last decades. Nonetheless, these shocks did not affect all countries in the same way.

Table 1 Total fertility in 18 countries of Latin America, 1950–2000

Country	1950[1]	1960[2]	1970[3]	1980[4]	1990	1995	2000
Argentina	3.20	3.10	3.10	3.50	2.97	2.62	2.42
Bolivia	6.75	6.67	6.54	5.53	4.89	4.36	3.66
Brazil	5.93	6.06	5.33	4.09	2.56	2.46	2.13
Chile	5.10	4.81	3.28	2.47	2.55	2.24	2.07
Colombia	6.76	6.76	4.65	3.60	2.92	2.87	2.69
Costa Rica	6.21	7.29	4.94	3.63	3.17	2.83	2.52
Dominican Republic	7.22	5.30	6.67	4.33	3.33	3.16	3.00
Ecuador	6.90	7.04	6.30	4.51	3.76	3.36	3.00
El Salvador	6.06	6.81	6.62	5.34	3.84	3.62	3.38
Guatemala	7.16	6.90	6.53	6.04	5.30	5.12	4.87
Honduras	7.05	6.05	5.98	6.44	5.28	4.84	4.36
Mexico	6.17	6.62	6.73	4.57	3.33	2.95	2.66
Nicaragua			7.21	6.14	5.17	4.15	3.23
Panama	5.05	5.76	4.99	3.63	2.88	2.72	2.64
Paraguay			5.83	5.06	4.61	4.37	4.16
Peru				4.70	3.76	3.39	2.80
Uruguay		2.95	3.00	2.66	2.53	2.37	2.16
Venezuela		6.60	5.68	4.13	3.62	2.94	2.51

[1]Year is 1953 for Chile, Colombia, Costa Rica, and Honduras, 1954 for Panama, and 1955 for Mexico.
[2]Year is 1961 for Argentina, 1963 for Colombia and Uruguay.
[3]Year is 1973 for Colombia, 1971 for Nicaragua, and 1972 for Paraguay.
[4]Year is 1982 for Ecuador.
Source: See Appendix for details.

Table 2 shows mean annual rates of growth in gross domestic product (GDP) per head for the second half of the last century and unemployment rates. While some countries managed to grow at more than 2.5 per cent per year (Brazil and Chile, for example), the GDP per head remained stagnant in others (Nicaragua) or even showed negative rates of growth (Venezuela). Downward cycles, where the domestic product decreases more than 10 per cent in just one year were not uncommon. In 1975 Chile experienced a reduction in GDP per head of 13.8 per cent. A similar contraction was suffered by the Peruvian economy in 1989. More recently, in 2002 and 2003, Venezuela experienced a decline of 10.5 per cent and 11.3 per cent of their GDP per head. These were not the only examples of periods of decline. However, there were also periods of high growth in a number of countries, including the following: Brazil during the first half of the 1970s, Mexico from 1978 to 1981, Argentina from 1991 to 1995, and Chile for most of the 1990s.

There was wide variation in unemployment rates between countries in the period. For example, while the Dominican Republic had high rates of unemployment, the rates were low in Mexico. There was also wide variability within countries over time. An extreme case was Argentina, where the unemployment rate increased from 5.8 per cent in 1991 to 18.8 per cent in 1995 and was still over 10 per cent until recently.

Unemployment and GDP growth tend to be negatively correlated, but not necessarily. After recent macroeconomic crises, the economic recovery in some Latin American countries did not translate into a growth in job opportunities proportionate to the scale of the recovery. In Argentina during the early 1990s, for example, record levels of unemployment coexisted with high rates of growth (Altimir and Beccaria 2002; Gonzalez-Rozada and Menendez 2006). If a country is experiencing 'jobless growth', higher growth may not result in more opportunities for everyone (UNDP 1993). The InterAmerican Development Bank reports that 'by 2000, the median unemployment rate was above 10 per cent, and as high as the rates seen in the region during the height of the debt crisis (1983–85), despite the fact that economic activity did not contract nearly as much in the late 1990s as in the 1980s' (IADB 2004, p. 15). Given the long history of marked inequality in Latin American societies and the increase of poverty levels and income disparities during the recent economic shocks in some countries, it is possible that the gains from renewed growth were unevenly distributed across different groups in society, with the highly educated (or urban population) benefiting relatively more than the less skilled (or rural dwellers).

Table 2 Economic conditions in 18 countries of Latin America, from around 1950 to 2003

	GDP per head—rate of growth					Unemployment rate					Annual inflation rate				
	Years	Mean	Std. dev.	Min	Max	Years	Mean	Std. dev.	Min	Max	Years	Mean	Std. dev.	Min	Max
Argentina	1951–2003	1.0	5.0	−11.7	9.1	1970–2004	8.3	5.5	2.0	19.6	1949–2003	183.9	518.5	−1.2	3,079.0
Bolivia	1951–2003	0.5	3.5	−12.2	5.5	1981–2003	6.9	2.1	3.1	11.6	1949–2003	270.5	1,586.6	−0.7	11,749.0
Brazil	1951–2003	2.6	3.8	−6.3	11.3	1976–2001	4.9	2.4	1.8	9.6	1960–2003	285.2	627.5	3.2	2,947.0
Chile	1951–2003	2.1	4.5	−13.9	9.0	1975–2003	9.2	4.0	4.4	19.6	1950–2003	50.4	95.7	2.5	504.0
Colombia	1951–2003	1.8	2.0	−5.6	5.4	1975–2002	11.4	3.4	7.6	20.5	1949–2003	16.1	9.1	−2.4	33.0
Costa Rica	1951–2003	1.9	3.8	−9.9	12.7	1976–2004	5.8	1.4	3.8	9.4	1951–2003	11.6	14.3	−2.8	90.1
Dom. Rep.	1951–2003	2.5	4.6	−13.8	13.7	1960–2004[1]	18.7	5.0	6.4	35.0	1949–2003	9.5	13.1	−3.9	50.5
Ecuador	1951–2003	2.1	5.4	−9.7	30.4	1974–2004[2]	8.7	2.6	4.4	15.1	1952–2003	20.2	21.4	−5.0	96.1
El Salvador	1951–2003	0.9	3.6	−11.3	8.9	1985–2004[3]	8.2	2.4	6.2	16.9	1949–2003	8.3	8.3	−4.5	31.9
Guatemala	1951–2003	1.1	2.5	−5.8	6.4	1980–2003[4]	5.9	3.6	1.5	14.0	1949–2003	7.5	8.9	−2.1	41.2
Honduras	1951–2003	0.7	3.1	−9.1	8.0	1980–2004[5]	7.8	2.2	4.0	12.1	1949–2003	7.7	7.7	−3.1	34.0
Mexico	1951–2003	2.0	3.0	−7.8	7.5	1980–2004	3.8	1.2	2.2	6.6	1949–2003	21.4	28.8	−1.5	131.0
Nicaragua	1951–2003	0.1	6.3	−28.7	12.3	1980–2003	9.7	4.8	2.3	17.8	1970–2003	814.7	2,272.3	2.8	10,205.0
Panama	1951–2003	2.2	4.1	−17.6	12.2	1970–2003[6]	11.3	3.3	5.8	16.3	1949–2003	2.0	3.5	−7.0	16.3
Paraguay	1951–2003	1.4	3.3	−5.8	7.9	1979–2003	6.8	2.7	2.2	14.7	1949–2003	17.9	19.7	−0.9	117.0
Peru	1951–2003	1.0	4.5	−14.1	10.8	1980–2004	8.2	1.4	4.8	10.1	1949–2003	242.9	1,097.1	0.2	7,481.0
Uruguay	1951–2003	0.9	4.3	−13.3	8.2	1980–2004	11.2	3.0	6.7	17.0	1949–2003	42.5	31.8	−4.4	125.0
Venezuela	1951–2003	−0.3	4.5	−11.3	7.9	1975–2004	10.0	3.6	4.6	18.0	1949–2003	16.2	21.6	−2.8	99.9

Source: GDP per head: ECLAC; inflation: IMF; unemployment: ILO, ECLAC, and Central Bank of Dominican Republic. See Appendix for details.
Missing information for: [1]1985 and 1989; [2]1976 and 1978–79; [3]1987; [4]1999–2001; [5]2000; [6]1980–81 and 1990.

Table 2 also shows summary information on inflation rates. Traditionally the South American countries, such as Argentina, Brazil, Bolivia, Chile, and Uruguay were very prone to high inflation while in other countries inflation was usually low or moderate. However, most countries in the region had annual inflation rates higher than 100 per cent at some point, and hyperinflation was suffered in others, including Argentina, Bolivia, Brazil, Peru, and Nicaragua during the 1980s and the beginning of the 1990s. In trying to reduce high inflation, Latin American countries experimented with many different stabilization policies over the years, with mixed results.

Analytical framework

The basic microeconomic model of fertility (Willis 1973; Becker 1991) identifies a broad set of factors that influence the number of children a woman will have until the end of her fertile years. Amongst the most relevant are the household's preferences for the number and quality of children, household members' employment decisions, access to family planning, and infant mortality. Declines in infant mortality, larger investments per child (Becker 1960, 1991), and both parents in the labour force (Butz and Ward 1979; Becker 1991; Galor and Weil 1996) reduce the desired number of children. Increases in the availability of attractive consumer goods and an accentuation of individual autonomy strengthen this trend (Lesthaeghe and Surkyn 1988; Bumpass 1990; Surkyn and Lesthaeghe 2004). The decrease over the last decades in the cost and availability of contraception facilitated the move towards smaller families and the postponement of motherhood (Goldin and Katz 2002 for the USA; Weinberger 1996 for Latin America; Goldani 2002 for Brazil; Pantelides 2001 for Argentina; Parrado 2000 for Venezuela and Colombia; UN Population Division 2001 and Miller 2007 for Colombia; Tuiran et al. 2001 for Mexico).

Fertility and unemployment

In the study reported in this paper we explored whether differences in the economic environment in which childbearing decisions are made are related to changes in fertility. In particular we studied whether fertility responds to economic shocks and whether economic booms are accompanied by marked falls or marked increases in fertility. Within the standard microeconomic model of fertility, temporary unemployment shocks reduce the opportunity cost of women's time without affecting long-term income in an important way. Therefore, the substitution effect prevails over any income effect from temporary decreases in earnings. The associated fall in opportunity costs (in terms of forgone wages) means that unemployment is a good time for childbearing (Butz and Ward 1979; Ward and Butz 1980; Schultz 1985; Galor and Weil 1996). However, in periods of structural or permanent unemployment—probably associated with a sharp adjustment in expected income and increased uncertainty—income effects outweigh the lower opportunity costs and fertility is positively correlated with the state of the economy (Yule 1906; Silver 1965; Ben-Porath 1973; Becker 1960, 1991; Adsera 2005).

There are other ways in which changes in the availability of employment and fertility may be related. First, wage effects may influence decisions about employment. Maternity may require a short or partial withdrawal from the labour force, and high unemployment may become an obstacle to a subsequent return. Women may alter the timing of their births if labour market experience is very significant for their earnings profile. If wages increase with experience and child-related expenditures are relatively fixed, women may postpone childbearing to accumulate human capital early in their career to improve their prospects of higher wage increases, better benefits, and more rewarding employment later (Heckman and Willis 1976). On the other hand, efficient markets in working capital would temper that result by allowing people to borrow more easily in order to smooth the cycle (Vijverberg 1984).

A persistent spell of unemployment may have a large negative impact on household permanent income (income effect). This may make childbearing unattractive, not only to those directly affected by unemployment but also to those to whom it constitutes a threat and who wish to be employed in the future. This is bound to affect both the timing of fertility and completed fertility. Delay in producing the first birth often leads women to have fewer children than they intended because fecundity decreases with age (Morgan 2003). However, the effect of a reduction in income on the total number of children would be reduced if a substantial shift from large families to fewer children of higher quality had previously occurred. A link of the kind envisaged between high unemployment and fertility was found for the 1930s depression in both the USA and the UK (Galbraith and Thomas 1941; Kirk 1946; Becker 1991; Murphy 1992). Similarly, during the

last two decades, the postponement and associated reduction of fertility occurred in European countries where unemployment was prevalent and persistent (particularly among women) such as those in Southern Europe (Adsera 2004, 2005). Even those economies which had lower levels of unemployment, such as Norway, displayed these trends (Kravdal 2002). In an adverse labour market, parents may choose to invest more in their children (increasing their 'quality') to improve their future prospects at the cost of reducing their number (Easterlin 1973; Becker et al. 1990).

Long periods of unemployment may also have negative consequences in the marriage market. If women and their potential spouses suffer a reduction of income, they may be hampered in their ability to buy or rent a home, to be economically independent, and to afford a wedding party. They may also lose some of their appeal as potential partners. As a result, household formation and, consequentially, childbearing may be postponed. This mechanism has been studied in a number of countries, including England and Wales (Yule 1906; Southall and Gilbert 1996); the USA (Galbraith and Thomas 1941; Silver 1965), and Latin American countries (Palloni and Tienda 1992; Palloni et al. 1996; Bravo 1997; Ortega and Reher 1997; Rios-Neto and Magno de Carvalho 1997). The indirect impact of the economic crises on births through delayed union formation may be weaker in countries where new family units are more likely to form within an extended household rather than requiring separate housing (Palloni et al. 1996) and economic independence. Since the analysis we undertook included all women from the time they turned age 12, it picked up both the direct and the indirect effects, through marriage, of changing economic conditions.

Fertility responses to economic shocks may vary during the life cycle and by education level. Previous analyses with US data have found differences in the way women of different educational background within a cohort respond to changes in unemployment. Perry (2003) shows that college-educated women have pro-cyclical fertility (i.e., their fertility behaviour is positively associated with the state of the labour market), whereas those with high school or less education reduce fertility when labour market conditions improve. Dehejia and Lleras-Muney (2004) show that race and education are jointly associated with variation in fertility over the cycle. They find low-skilled black women are less likely to give birth during recessions and low-skilled white women more likely to do so. Several of the mechanisms above that explain the association between fertility and the business cycle can operate with unusual intensity for women of certain educational backgrounds, and as a result, different economic opportunities. Women with little education may face more severe credit constraints than others in their cohort in a country with highly imperfect capital markets. Also, the degree of skill depreciation and resulting change in prospective lifetime income while outside the labour market may differ across educational backgrounds. The skills of highly educated women who expect to access more formal jobs may be at a higher risk than those of others. Responses to economic shocks can also differ by age. For example, older women, who are usually more established in the labour market than their younger counterparts can to a greater degree protect themselves from unemployment oscillations.

Fertility and economic growth

The relation between fertility and economic growth can also be either pro-cyclical (i.e., positively correlated or countercyclical (negatively correlated). Healthy growth rates lead to optimism and may reduce credit constraints but may also be accompanied by better labour market opportunities, which increase the opportunity cost of childbearing. Previous analyses show pro-cyclical fertility in Brazil and Chile during the twentieth century (Bravo 1997; Rios-Neto and Magno de Carvalho 1997). Ortega and Reher (1997) observe a pro-cyclical fertility response to changes in GDP in Chile and Argentina from the 1930s, with some gradual weakening of the relationship until the 1970s and a strengthening of it thereafter. However, Palloni et al. (1996) find greater heterogeneity of responses in a sample of eleven Latin American countries.

It is particularly important to take into account the foreign debt crisis of the 1980s when evaluating the relationship between fertility and economic stability in Latin American economies during this period. Some researchers find that the rate of first marriages declined and the fall in fertility accelerated in Brazil during the early 1980s when the country underwent the debt crisis (Goldani et al. 1989). To evaluate the effect of the crisis, we included period dummies in our analysis.

Macro-level analysis

Methods and data

We used data from a panel of 18 Latin American countries to study how different labour market and economic shocks appeared to affect fertility rates over three decades. The countries were: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. We obtained total fertility series from the *UN Demographic Yearbook*, which uses data reported by countries from their vital statistics. When data from the *UN Demographic Yearbook* were missing, we used the series in the International Database (IDB) of the US Bureau of the Census. The Appendix contains information on missing observations and on the method employed by the IDB. Since some of the series in the IDB are estimated, there is a risk of over-smoothing for some countries. We believe this has the potential to bias the results towards a finding that total fertility did not respond to economic fluctuations. If so, our results would constitute the lower bound of the true impact. For the period of estimation, mean total fertility in these countries was 3.5, with a standard deviation of 1.0, a minimum of 2.0, and a maximum of 6.7.

To measure the state of the business cycle at each point in time we used information on changes in unemployment rates and in growth rates in GDP per head in previous years as well as dummy variables for periods of external debt crisis. We also included a series of changes in consumer prices, country dummies, and a linear time trend to control for other existing economic conditions.

The Appendix provides details of all sources of data and of the periods to which the data refer. GDP data were obtained from the Economic Commission for Latin America and the Caribbean (ECLAC). Data on unemployment rates were obtained from a combination of sources that included ECLAC, International Labour Organization (ILO), and the Central Bank of the Dominican Republic. Price data were those in the International Financial Statistics published by the International Monetary Fund (IMF).

Most macroeconomic data were available from the late 1950s until 2003. However, information on unemployment rates was generally only available starting in the 1970s or 1980s and there were gaps in the data for some countries. We included all the main covariates in our estimations and were therefore able to cover a period of only 25–30 years per country (see the Appendix and Table 2 for the precise period in each case).

Haussman tests indicated that random-effects models were inconsistent. Alternative specifications (not shown here) included either country-specific trends or year dummies. The models were also estimated using either GLS or panel-consistent standard errors (not shown here), and produced results similar to the ones presented here.

Variables such as total fertility and unemployment rates tend to have autocorrelation trends, which may create spurious correlations. To avoid this problem we used rates of change ($\ln x_t - \ln x_{t-1}$) in the series. Some missing values in our series precluded us from using filters like the Hodrick–Prescott (HP) filter, but other approaches (not shown here), such as first differences, partial first differences, error correction models, or de-trended series yielded similar results to those presented below. We used lagged macroeconomic variables in a way that corresponded to the timing of economic circumstances that might affect fertility decisions.

Any analysis of the association between demographic behaviour and aggregate measures of economic performance must recognize that those measures conflate both individual and aggregate shocks. The coefficient of aggregate measures of unemployment, for example, captures both the negative shocks at the individual level and the increased uncertainty from aggregate economic performance.

Results

Table 3 presents four specifications of the estimates of changes in total fertility for major covariates lagged 1 year or 2 years. The results are fairly similar across columns.

Changes in unemployment are negatively and significantly associated with changes in fertility rates in our cross-country regressions. The change in unemployment lagged 1 year is significant on its own (column (2)). The coefficient indicates an elasticity of 0.010, which implies that an increase of one standard deviation (4.37) in the mean unemployment rate (8.73) would reduce total fertility by 0.5 per cent.

While the 1-year lag of change in unemployment is significant, lags of higher order are not. The high serial correlation in the unemployment series introduces multicollinearity in the estimates. When

Table 3 The effects of unemployment and growth in GDP per head on total fertility in Latin America from around 1950 to 2003

	(1) Δln TFR	(2) Δln TFR	(3) Δln TFR	(4) Δln TFR
Δln unemployment ($t-1$)	−0.011	−0.010	−0.010	
	(−2.07)	(−2.04)	(−1.88)	
Δln unemployment ($t-2$)	−0.006		−0.005	
	(−1.19)		(−1.01)	
Growth in GDP per head ($t-1$)	0.000	0.000	−0.000	0.000
	(0.23)	(0.36)	(−0.20)	(1.34)
Growth in GDP per head ($t-2$)	−0.000		−0.000	−0.000
	(−0.70)		(−0.96)	(−0.29)
Debt crisis 1983–84			−0.010	
			(−1.97)	
Joint significance Δln unemployment ($t-1$) and ($t-2$) (p-value)	2.78		2.20	
	(0.063)		(0.112)	
Observations	373	394	373	373
Number of countries	18	18	18	18

Notes: The dependent variable is the change in log of total fertility. Models include the inflation rate lagged by 1 year and 2 years, country dummies, and a time trend; t-statistics in parentheses.
Source: As for Tables 1 and 2.

changes in unemployment are lagged by both 1 and 2 years the changes are jointly significant and imply an elasticity of around −0.016 in column (1) or (3). In estimates not included here, additional unemployment lags were not significantly different from zero and their inclusion did not change our results.

In column (3) we included a dummy variable for the most acute years of the Latin American debt. The coefficient on the dummy is negative and significant, indicating a possibly temporary slowdown of fertility during that period. Note that this variable suggests an effect of the debt crisis on fertility decisions even when controlling for changes in unemployment and growth rates. This result is consistent with previous findings for Brazil (Goldani et al. 1989).

In general growth rates are not statistically significant in the estimates of Table 3. When we excluded unemployment but kept the sample limited to the period for which unemployment data were available (column (4)), the coefficient for the lag of GDP growth by 1 year is positive but not significant. Previous results in the literature are mixed. While some find a positive response to economic growth (e.g., Bravo 1997 for Chile; Ortega and Reher 1997 for Chile and Argentina), others find heterogeneous and muted responses (e.g., Hill and Palloni 1992; Palloni et al. 1996).

The associations of unemployment and growth rates with changes in total fertility that we show in Table 3 imply a prevalence of income effects over substitution effects in childbearing decisions. These aggregate results suggest an impact of the economic cycle on fertility decisions, but they may mask distinctive responses among subgroups of the population. We turn in the next section to our main analysis, for which we used individual-level data to analyse whether unemployment and economic growth affect women in different ways over their life cycle and across cohorts and educational groups.

Micro-level analysis

Method and data

We used the latest DHS data available at the time of the study from ten of the countries in our sample to analyse the relationship between changing aggregate economic conditions and the spacing of children for over 100,000 women (DHS are not produced for all 18 countries in the previous aggregate analysis). The countries (and survey years) used for the estimates were Bolivia (1998), Brazil (1996), Colombia (2000), Dominican Republic (2002), Ecuador (1987), Guatemala (1998), Mexico (1987), Nicaragua (2001), Peru (2000), and Paraguay (1990).

The transitions to the first three births were estimated separately, using Cox proportional hazard models. We drew fertility histories from the information on birth dates of women and their children in the DHS of each country. The dependent variable in all estimates was the period (measured in years) to a

birth from either the previous birth or from age 12 in the case of a first birth. We chose to start exposure to first birth at age 12 given the high frequency of teenage childbearing we observed in some of the countries. The mean age at first birth in the DHS was 20 years and 75 per cent of the women were mothers by age 23.

For each woman i, in country c, and year y who entered a state (e.g., first birth) at time $t=0$, the (instantaneous) hazard ratio function at $t>0$ was assumed to take the proportional hazards form:

$$\lambda_{icyt} = \lambda_0(t)\exp(x'_{icyt}\beta + m_{c(y-1)}\delta + T + C) \qquad (1)$$

where $\lambda_0(t)$ is the baseline hazard function; exp(.) is the exponential function; x_{it} is a vector of covariates summarizing observed differences between individuals; $m_{c(y-1)}$ is a vector of lagged aggregate economic conditions in country c; and T is a time trend. Given that economic conditions within each country offered substantial variation over time, we included country fixed effects, C, and analysed within-country changes in fertility as a response to changing economic conditions. Country fixed effects took care of unobservable cross-country differences. We used a grouped robust variance as estimated by Lin and Wei (1989) and clustered the errors within region-year in each country.

We allowed the non-parametric baseline hazard to vary for each birth cohort to take into account differences between generations, such as changes in values, access to information and family planning, and to distinguish these from variation in economic conditions. Women were divided in five groups according to their birth year: 1930s–1940s; 1950s; 1960s; 1970s; and 1980s. Estimates are presented as hazard ratios, using common time trends and country-specific time trends.

In addition to the country time-varying macroeconomic variables used in the first set of estimates, the models contained individual characteristics for each woman, such as years of education, place of residence whether urban or rural, and access to electricity in her dwelling. Information on the woman's previous fertility history, such as age at first birth, sex of previous children, and months elapsed between births was included for births of each parity.

Results

Table 4 presents the estimated proportional hazard models of the transition to the first birth. We present different models that include unemployment rates not lagged, and lagged by 2 and 4 years, GDP growth per head, and a debt crisis dummy. The first four columns include a common time trend while columns (5)–(8) reproduce the same models using country-specific time trends.

In the basic model that includes 1-year and 2-year lags in unemployment rate (columns (1) and (5)), last year's unemployment is associated with a lower hazard to a first birth. Unemployment rate lagged by 2 years is not significant on its own, but both lags are jointly significant. We simulated the proportion of women who had become mothers by age 25, using the model in column (1) and by changing the unemployment rate, while keeping all other variables at the mean. Around 73.7 per cent of women in a country are mothers by age 25 if we assume that the 1-year and 2-year lags in unemployment rate are equal to 5 per cent. The figure is only 71.6 per cent if the unemployment rate is 12 per cent.

To further understand the dynamics of this relationship, whether long or short term, we included the country's unemployment rate lagged by 1, 2, 3, and 4 years in a model of transition to motherhood in columns (2) and (6). The estimates confirm a short-term negative association of fertility with unemployment but also show a rebound in first births when the unemployment rate is lagged by 4 years. This finding seems to imply that though an unemployment hike may temporarily depress first births, it only partly reduces the final number.

An extra point in the growth rate of GDP per head increases hazard rates of a first birth by between 6 and 10 per cent. In columns (3) and (7), where unemployment is excluded from the model, the coefficients of income growth per head remain at very similar levels. Women expecting a period of income growth seem more likely to become mothers, *ceteris paribus*.

We checked whether transitions to maternity were sensitive to particularly acute economic changes, and the results are shown in columns (4) and (8). We introduced a dummy for the years (1983 and 1984) when the debt crisis in Latin America was most severe. Birth rates are lower during periods of debt crises. Unemployment continues to be negatively associated with first-birth rates whereas economic booms boost them.

Table 5 shows transitions to higher parities. We present the most parsimonious model with unemployment lagged by 1 year and 2 years. As was the case with first births, we find that the effect of unemployment is negative and statistically significant. However, GDP growth does not echo the positive effect we found for the first-birth estimates.

Table 4 Estimated hazard ratios from Cox proportional hazards models for transitions to first child (from age 12) in ten Latin American countries, selected years

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Woman								
Years of education	0.912	0.912	0.912	0.912	0.912	0.911	0.912	0.912
	(75.60)	(70.36)	(75.56)	(75.59)	(75.90)	(70.74)	(77.11)	(75.89)
Rural	0.992	0.992	0.992	0.992	0.992	0.992	0.990	0.992
	(0.58)	(0.57)	(0.58)	(0.58)	(0.62)	(0.58)	(0.80)	(0.63)
Access to electricity	0.914	0.903	0.914	0.914	0.918	0.907	0.918	0.918
	(5.93)	(5.13)	(5.89)	(5.94)	(5.61)	(5.94)	(5.66)	(5.62)
Country								
Unemployment ($t-1$)	0.990	0.990		0.990	0.992	0.992		0.992
	(3.32)	(3.22)		(3.34)	(2.54)	(2.58)		(2.57)
Unemployment ($t-2$)	0.998	0.993		0.998	0.997	0.995		0.997
	(0.73)	(1.76)		(0.68)	(0.97)	(1.29)		(0.84)
Unemployment ($t-3$)		0.997				0.996		
		(0.87)				(1.17)		
Unemployment ($t-4$)		1.011				1.009		
		(3.82)				(3.03)		
Growth in GDP per head ($t-1$)	1.006	1.008	1.007	1.006	1.008	1.010	1.009	1.006
	(4.01)	(4.63)	(4.85)	(3.33)	(5.05)	(5.98)	(6.13)	(3.67)
Growth in GDP per head ($t-2$)	0.999	0.998	1.001	0.999	1.000	1.002	1.001	0.999
	(0.48)	(1.31)	(0.81)	(0.54)	(0.34)	(0.88)	(0.69)	(0.49)
Debt crisis 1983–84				0.965				0.922
				(1.80)				(4.05)
Trend	Common	Common	Common	Common	Country	Country	Country	Country
Joint significance unemployment ($t-1$) and ($t-2$) (p-value)	38.25 (0.000)	33.27 (0.000)	–	37.83 (0.000)	18.93 (0.000)	33.53 (0.000)	—	18.14 (0.000)
Observations	705,921	620,970	705,921	705,921	705,921	620,970	721,439	705,921

The dependent variable is the number of years to a birth from age 12. Models stratified by women's birth cohort (1930s–1940s; 1950s; 1960s; 1970s; and 1980s). Models include the inflation rate lagged by 1 year and 2 years, country dummies, time trend, age at first birth (for second and third births), months between first and second birth (for third birth), and sex of previous children.

Errors allow for correlation in unobservables between observations from the same region-year. Robust t-statistics in parentheses.

Source: Demographic and Health Surveys for Bolivia (1998), Brazil (1996), Colombia (2000), Dominican Republic (2002), Ecuador (1987), Guatemala (1998), Mexico (1987), Nicaragua (2001), Peru (2000), and Paraguay (1990).

As expected, estimates in Tables 4 and 5 indicate that the level of women's formal education is significantly and negatively associated with transition to first birth. Interestingly, this negative association between education and birth rates is also present in models for second birth. This is not what has been found for OECD countries. In these countries researchers have found a positive association between education and second and third births (Kravdal 2001; Adsera 2010). This may be partly the result of not adjusting for the differential selectivity of earlier parity transitions when estimating parities separately (Kravdal 2001). One reason why a positive relationship is not found for Latin American countries may be that the childcare options and their associated costs, as well as the labour market, are very different from those available to women in richer nations. An alternative explanation is that the less educated in Latin America are having births much closer together than are the more educated, owing to lack of access to adequate family planning services (Weinberger 1996).

Rural residence is not related to transitions to first birth, but shows a large positive and significant association with higher-order births. Access to electricity, used as a rough measure of wealth, is associated with longer time to a birth, particularly in the case of high-order births.

Table 5 Estimated hazard ratios from Cox proportional hazards models of transitions to second and third births in ten Latin American countries

	Second birth	Third birth
Woman		
Years of education	0.973	0.959
	(19.19)	(22.48)
Rural	1.163	1.158
	(11.78)	(8.83)
Access to electricity	0.871	0.838
	(9.59)	(10.31)
Country		
Unemployment ($t - 1$)	0.985	0.989
	(5.33)	(3.16)
Unemployment ($t - 2$)	1.002	1.003
	(0.78)	(0.98)
Growth in GDP per head ($t - 1$)	1.002	0.999
	(1.33)	(0.57)
Growth in GDP per head ($t - 2$)	0.996	1.002
	(2.60)	(1.43)
Joint significance unemployment ($t - 1$) and ($t - 2$) (p-value)	55.75	16.11
	(0.000)	(0.000)
Observations	212,651	204,621

The dependent variable is the number of years to a birth from the previous birth. Models stratified by women's birth cohort (1930s–1940s; 1950s; 1960s; 1970s; and 1980s). Models include the inflation rate lagged by 1 year and 2 years, country dummies, time trend, age at first birth (for second and third births), months between first and second birth (for third birth), and sex of previous children.
Errors allow for correlation in unobservables between observations from the same region-year. Robust t-statistics in parentheses.
Source: As for Table 4.

Finally, we estimated the basic model of transitions, with unemployment rate lagged by 1 and 2 years, up to the tenth birth to simulate birth histories for different levels of unemployment. We used a woman with a constant set of characteristics (i.e., Colombian, urban, with access to electricity, 7 years of education) and kept the country conditions constant at the mean of the period (i.e., GDP growth at 0.5 per cent; inflation at 25 per cent) in order to establish a baseline. Increasing the unemployment rate from 5 to 12 per cent reduces completed fertility from 4.34 to 4.1 births and the proportion of women with at least three children from 73 to 68.5 per cent.

In the following subsections we present the models for different education groups, birth cohorts, and places of residence.

Differences across education groups. We divided our sample into two groups of women: those with less than 7 years of schooling (around 40 per cent of the sample), and those with 7 or more years. We obtained separate results for the highly educated group: those with more than 12 years of schooling (less than 15 per cent of the sample). Table 6 presents the distributions of educational attainment across countries for the women included in the sample. Two important details may be noted in these data. First, in some countries, such as Paraguay and Guatemala, over two-thirds of adult women had less than 7 years of education. Second, in some countries, such as Bolivia and Peru, educational inequalities are particularly large: around 15 per cent of the population has at least some post-secondary education, but around 40 per cent have less than 7 years of schooling. Fertility behaviour is very different across education groups. Simulations of transitions to first birth, evaluated at the means, indicate that more than 50 per cent of women with less than 7 years of education are mothers at age 19. In contrast, women with more than a high school education only reach similar levels at around 27 years of age.

Table 7 presents the hazard ratio estimates for different education groups. In column (1), we observe that the unemployment rate lagged by 2 years is negatively associated with transitions to motherhood among the less educated, and that the effects of 1-year and 2-year lags are jointly significant as well. In additional estimates (not shown) we observe that birth rates rebound after four periods.

Among women with 7 or more years of schooling, the association between education and fertility is stronger and more contemporaneous, because only the previous year's unemployment is associated with delays in childbearing. Within this group, women

Table 6 Distribution of women by educational attainment in ten countries of Latin America, selected years

	Years of education		
Country (DHS year)	Less than 7	7 or more	13 or more
Bolivia (1998)	46	54	14
Brazil (1996)	55	45	5
Colombia (2000)	42	58	11
Dominican Rep. (2002)	36	64	13
Ecuador (1987)	55	45	9
Guatemala (1998)	82	18	2
Mexico (1987)	56	44	7
Nicaragua (2001)	60	40	7
Paraguay (1990)	67	33	5
Peru (2000)	39	61	16

Source: As for Table 4.

Table 7 Estimated hazard ratios from Cox proportional hazards models of transitions to first, second, and third child by mother's education in ten countries of Latin America

	First birth			Second birth			Third birth		
Years of education	0–6	7+	13+	0–6	7+	13+	0–6	7+	13+
Woman									
Years of education	0.962	0.856	0.883	0.989	0.969	0.970	0.962	0.966	0.972
	(11.85)	(54.82)	(10.24)	(3.57)	(9.90)	(2.16)	(10.42)	(7.20)	(1.40)
Rural	0.965	1.040	1.195	1.131	1.176	1.192	1.131	1.174	1.371
	(2.12)	(1.93)	(3.25)	(8.10)	(7.17)	(2.91)	(6.38)	(5.13)	(3.18)
Access to electricity	0.910	0.801	0.795	0.889	0.846	0.885	0.857	0.738	0.913
	(5.30)	(7.45)	(2.39)	(7.24)	(5.16)	(1.13)	(8.26)	(7.35)	(0.54)
Country									
Unemployment ($t - 1$)	0.998	0.983	0.980	0.986	0.985	0.992	0.995	0.980	0.972
	(0.65)	(3.78)	(2.04)	(3.99)	(3.10)	(0.73)	(1.21)	(2.92)	(1.57)
Unemployment ($t - 2$)	0.992	1.000	1.001	1.000	1.002	1.006	0.995	1.016	1.037
	(2.08)	(0.05)	(0.08)	(0.09)	(0.35)	(0.55)	(1.30)	(2.51)	(2.14)
Growth in GDP per head ($t - 1$)	1.007	1.006	1.003	1.001	1.005	1.012	1.000	0.998	0.999
	(3.48)	(2.64)	(0.66)	(0.36)	(1.83)	(2.26)	(0.83)	(0.70)	(0.07)
Growth in GDP per head ($t - 2$)	1.000	1.000	1.000	0.997	0.997	0.996	1.000	1.007	1.010
	(0.21)	(0.21)	(0.08)	(1.76)	(1.54)	(0.87)	(0.17)	(2.41)	(1.49)
Joint significance unemployment ($t - 1$) and ($t - 2$)	17.04	35.53	10.04	38.50	20.23	0.54	14.23	8.61	4.66
(p-value)	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)	(0.763)	(0.000)	(0.013)	(0.097)
Observations	260,923	444,998	124,224	100,930	111,721	27,752	104,367	100,254	23,632

The dependent variable is the number of years to a birth from either age 12 or the previous birth. Models stratified by women's birth cohort (1930s–1940s; 1950s; 1960s; 1970s; and 1980s). Models include the inflation rate lagged by 1 year and 2 years, country dummies, time trend, age at first birth (for second and third births), months between first and second birth (for third birth), and sex of previous children.

Errors allow for correlation in unobservables between observations from the same region-year. Robust t-statistics in parentheses.

Source: As for Table 4.

with at least some tertiary education and facing an adverse market seem to postpone motherhood most (column (3)). Simulations show that more educated women delay motherhood more than less educated women when unemployment increases. For example, for an assumed unemployment rate of 5 per cent, 52.4 per cent of women with fewer than 7 years of education have at least one child by age 19. Unemployment rates of 12 per cent reduce this share by 2 percentage points to 50.4 per cent. For highly educated women, unemployment has a larger effect. With an unemployment rate of 5 per cent, almost 56 per cent have a baby by age 27. However, if the unemployment rate is 12 per cent the percentage goes down to 52.1 per cent.

For second and third births, the relative strength of these associations across education groups is reversed to a certain degree. For the less educated, the negative coefficient of lagged unemployment in the models for second birth is sizable, and the coefficients of 1-year and 2-year lags in unemployment rate are jointly significant for the third birth. For the pooled group of women with more than 6 years of education, unemployment hikes are associated with later second births but the 2-year combined relationship is null or ambiguous with respect to the third birth. When we restrict the estimates to women with tertiary education we do not find any significant association between joblessness and prevalence of higher parity births.

Possibly those with more than a secondary education expect to be able to get a good job that matches their skills and are concerned both about the signal maternity might send to potential employers and about the depreciation of their skills while out of the labour force. In the long term, wages of low-skilled women may not depend much on experience, but earlier years in the labour market may be important for future increases in the wages of women with more than a secondary education (Card and DiNardo 2002; Connolly and Gottschalk 2006). If so, this may explain the postponement of motherhood during recessions. Once the more educated women find more stable and protected positions, their skills might protect them against downturns.

Periods of positive economic growth significantly boost the fertility of both the less educated and those with secondary and tertiary education when these groups are pooled. On the other hand, we do not find any significant relationship between economic growth and first-birth rates when we restrict the sample to women with post-secondary education.

In contrast, the coefficients of growth rates for the second and third births are only significant and positive among the most educated. If we assume that the benefits of growth may be unevenly distributed, particularly in the very unequal Latin American societies, it is not surprising that growth boosts the fertility of the more educated.

So far we have supposed that women are active participants in the labour market. However, if women are not active participants, the same procyclicality can result from shocks to the household income through the spouse's labour market situation. The arguments laid out before can apply to the spouse's income if there is a high degree of assortative mating in these unequal societies. The fact that more educated women are more sensitive to unemployment in the early stages of childbearing than later in their life cycle may be related to their spouses' opportunities and ambitions when first entering the market.

In simulations we found that completed fertility for those with 7 or more years of education was 3.01 children, assuming a 5-per-cent unemployment rate. If the unemployment rate were 12 per cent, *ceteris paribus*, completed fertility would go down to 2.77 and the proportion of women with at least three children would decrease from 55.6 to 47.2 per cent. Conversely, simulated changes in completed fertility among those with fewer than 7 years of education were small and the proportion with at least three children only decreased from 81.8 to 78.2 per cent.

Differences across cohorts. The surveys we used spanned many cohorts of women, from those who had just turned 12 years of age to those who had already passed their childbearing years at the time of the interview. Over the years represented by the cohorts, access to information and to health services and family planning, and the role of women in the labour market steadily changed in most of the countries. Younger cohorts may have lived through more economic turbulences than older cohorts but possibly have better ways of regulating their fertility (see Miller 2007 for the Colombian case). Unfortunately DHS do not collect retrospective information on access to and knowledge of family planning.

Table 8 presents models of the transitions to the first three births separately for women born before 1960 and for those born in 1960 and later. We tried different dates from 1959 to 1965 to partition the data and obtained similar results. We find that the childbearing decisions of younger cohorts seem to follow economic cycles more closely than those of older ones. Higher unemployment periods are

significantly associated with delays to the first three births among those born in 1960 or later, and economic booms have the opposite effects. The coefficient of GDP growth per head lagged by 1 year is significant, positive, and sizable for the first two births, and the coefficients of 1-year and 2-year lags are jointly significant in the model for third births. The hazard ratio indicates substantial delay of births in the presence of high unemployment even for the third birth. In simulations of the transition to the first birth among those born in 1960 or later we find that 49.5 per cent of women are mothers at age 21 if unemployment rate is 5 per cent, but that this proportion decreases to 46.7 if the rate increases to 12 per cent. Similarly, simulated completed fertility drops from 4.14 to 3.89 children and the proportion of women with at least three children falls from 72.8 to 67.5 per cent.

On the other hand, the transitions to a first birth and to a second birth are unrelated to changes in unemployment or growth for women born before 1960. Moreover, their transition to third births appears to be countercyclical in relation to unemployment shocks but ambiguous in the presence of economic booms.

In the models in Table 8, rural residence is not related to the transition to first birth for younger cohorts and is negative for older women. However, it shows a positive and significant association with higher-order births for both cohort groups. Both access to electricity and years of education are associated with lower birth rates. However, the size of the coefficients and the *t*-statistics are smaller for those born before 1960. This is probably related to the lower prevalence of family planning among women of older cohorts as well as to the smaller sample size of this group.

Rural vs. urban. Fertility transition has often been conceived as a diffusion process that starts in urban settings and moves to rural areas over time (UN Population Division 2001). Whether women live in a rural or an urban setting probably affects access to family planning and constrains childbearing decisions in much the same way as

Table 8 Estimated hazard ratios from Cox proportional hazards models of transitions to first, second, and third birth by mother's birth cohort (born before or after 1960) in ten countries of Latin America

	First birth		Second birth		Third birth	
	1960+	Before 1960	1960+	Before 1960	1960+	Before 1960
Woman						
Years of education	0.904	0.953	0.964	0.995	0.954	0.965
	(77.35)	(16.39)	(22.16)	(1.74)	(21.11)	(10.98)
Rural	1.001	0.904	1.153	1.186	1.149	1.188
	(0.03)	(2.81)	(9.99)	(5.74)	(7.09)	(5.84)
Electricity	0.930	0.961	0.876	0.894	0.830	0.849
	(4.48)	(0.83)	(8.50)	(3.02)	(9.61)	(4.72)
Country						
Unemployment ($t-1$)	0.986	1.001	0.983	0.996	0.987	1.016
	(3.89)	(0.20)	(4.73)	(0.686)	(2.88)	(2.44)
Unemployment ($t-2$)	1.002	0.993	1.002	0.999	1.002	1.011
	(0.64)	(1.15)	(0.44)	(0.131)	(0.41)	(1.76)
Growth in GDP per head ($t-1$)	1.008	0.997	1.005	0.999	1.003	0.996
	(4.69)	(0.69)	(2.86)	(0.246)	(1.32)	(1.09)
Growth in GDP per head ($t-2$)	0.999	1.001	0.998	0.996	1.004	1.007
	(0.58)	(0.17)	(1.33)	(1.12)	(1.75)	(2.13)
Joint significance unemployment ($t-1$) and ($t-2$) (p-value)	36.50 (0.000)	1.35 (0.509)	60.60 (0.000)	0.76 (0.683)	21.43 (0.000)	20.81 (0.000)
Observations	633,697	72,224	165,187	47,464	135,792	68,829

The dependent variable is the number of years to a birth from either age 12 or the previous birth. Models include the inflation rate lagged by 1 year and 2 years, country dummies, time trend, age at first birth (for second and third births), months between first and second birth (for third birth), and sex of previous children.
Errors allow for correlation in unobservables between observations from the same region-year. Robust *t*-statistics in parentheses.
Source: As for Table 4.

differences in educational background and birth cohort. Additionally, children in rural areas are more likely to have an important role as economic contributors to household well-being and to become a source of support to their parents in old age. Finally, economic fluctuations may affect urban and rural groups differently. Marichal (1989) notes that the Latin American recessions during the early 1980s may have had more of an adverse effect on the urban working class—whose incomes suffered massively and were more dependent on government spending—than on rural workers. Table 9 presents the estimated model of transitions to different parities separately for women living in the city and for those in a rural setting. Urban women seem more responsive to changes in unemployment than those living in a rural area. In particular, the estimated hazard ratios for the unemployment rate lagged by 1 year in the transitions to any of the first three births are significantly less that one among those in urban settings and smaller in size than those for women in rural areas. For the latter, only the unemployment rate lagged by 2 years is negative and significant in the transition to first births (though coefficients of both lags are also jointly significant). In transitions to higher parities the unemployment rate lagged by 1 year significantly reduces the hazard ratio. Simulations from column (2) in Table 9 indicate that 69.3 per cent of urban women are mothers by age 25 if unemployment is 5 per cent, but only 66 per cent are mothers when unemployment is 12 per cent.

The picture is more ambiguous for changes in economic growth, but, in general, economic expansions are associated with earlier motherhood for all women.

Years of education seem to account for a larger portion of the variance in the transition to motherhood among urban dwellers than among women in rural areas. This is not surprising as the heterogeneity in the educational spectrum is probably much larger in cities than elsewhere.

Simulations of birth histories showed that, if unemployment rose from 5 to 12 per cent, completed fertility for urban women would fall

Table 9 Estimated hazard ratios from Cox proportional hazards models of transitions to first, second, and third birth by mother's place of residence (rural or urban) in ten countries of Latin America

	First birth		Second birth		Third birth	
	Rural	Urban	Rural	Urban	Rural	Urban
Woman						
Years of education	0.925	0.906	0.978	0.972	0.966	0.957
	(35.03)	(69.22)	(9.56)	(16.13)	(10.74)	(18.29)
Electricity	0.952	0.768	0.883	0.825	0.848	0.790
	(2.70)	(8.35)	(7.55)	(5.98)	(8.48)	(6.49)
Country						
Unemployment ($t - 1$)	0.999	0.986	0.988	0.983	0.991	0.988
	(0.14)	(3.66)	(2.87)	(4.43)	(2.00)	(2.46)
Unemployment ($t - 2$)	0.990	1.001	1.002	1.001	1.003	1.003
	(2.24)	(0.31)	(0.58)	(0.31)	(0.62)	(0.69)
Growth in GDP per head ($t - 1$)	1.008	1.006	1.004	1.001	1.002	0.997
	(3.26)	(2.80)	(1.73)	(0.53)	(0.66)	(1.17)
Growth in GDP per head ($t - 2$)	1.001	0.999	0.998	0.995	1.000	1.004
	(0.25)	(0.59)	(1.11)	(2.48)	(0.11)	(1.53)
Joint significance unemployment ($t - 1$) and ($t - 2$) (p-value)	14.28 (0.000)	28.54 (0.000)	15.59 (0.000)	41.48 (0.000)	6.35 (0.042)	10.26 (0.006)
Observations	229,626	476,295	70,386	142,265	67,621	137,000

The dependent variable is the number of years to a birth from either age 12 or the previous birth. Models stratified by women's birth cohort (1930s–1940s; 1950s; 1960s; 1970s; and 1980s). Models include the inflation rate lagged by 1 year and 2 years, country dummies, time trend, age at first birth (for second and third births), months between first and second birth (for third birth), and sex of previous children.

Errors allow for correlation in unobservables between observations from the same region-year. Robust t-statistics in parentheses.

Source: As for Table 4.

from 4.11 to 3.81 children, whereas it would only fall from 5.29 to 5.13 for women in rural areas. Under similar circumstances, the proportion of women with at least three children would decline from 70.9 to 66.2 per cent in cities but only from 78.1 to 75.1 per cent in rural areas.

During recent decades, Latin America not only underwent important economic changes but also dramatic fluctuations in political stability. To account for political uncertainty we introduced controls for political stability, civil war, and transitions to democracy in separate estimates (results available upon request). All results in the paper were robust to their inclusion.

Conclusions

In the study reported in this paper we explored whether economic shocks affect fertility in Latin America. Using aggregate data, we found a positive association between the business cycle and changes in total fertility. We found consistent results when we conducted a separate analysis using women's individual data. In general, birth rates were lower during downturns. This behaviour was mainly associated with increasing unemployment, although we found a positive and significant relationship between economic growth and first births using individual data. Economic growth also boosted rates of second and third births among the most educated. High unemployment is, in general, coupled with low rates of growth. However, the Latin American experience of the last 50 years contains periods of high growth with increasing unemployment and also episodes of stagnation with relatively low unemployment.

Even though periods of unemployment may be a good time in which to have children, because opportunity costs are low, we found that in fact motherhood was reduced or postponed, especially among the most recent cohorts. This behaviour is consistent with the idea that in the circumstances of Latin America, income effects are dominant when unemployment goes up.

The relationship between fertility rates and unemployment was not homogeneous across groups of women. Using individual-level DHS data, we found a strong association between adverse economic circumstances and delayed motherhood among women who were urban, more educated, and came from younger cohorts. The association between unemployment and the transition to second or third births was, on the other hand, somewhat stronger for the least educated and for recent cohorts, while no large differences were observed by place of residence.

Whether these associations were specific to the severity of the economic turbulences that Latin American countries have undergone during the last decades remains to be seen. Our results point to more responsive childbearing behaviour in women of recent cohorts. As easy access to family planning is extended to the entire population and as increasingly educated Latin American women aim to secure more stable jobs, childbearing patterns may become even more tied to the economic fortunes of a country. However, whether women's response remains mostly pro-cyclical, as observed here, or countercyclical, may hinge on the severity and persistence of the economic shocks these countries undergo in the future.

Notes

1 Alicia Adsera is at the Woodrow Wilson School and Office of Population Research, 347 Wallace Hall, Princeton University, Princeton, NJ 08544, USA and at IZA (Bonn). E-mail: adsera@princeton.edu. Alicia Menendez is at the Irving B. Harris Graduate School of Public Policy Studies and Population Research Center, University of Chicago.

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Appendix: Data sources and details

Total fertility

United Nations: *Demographic Yearbook, Historical Supplement 1948–1997* (DYB Special Issue 1997).
United Nations: *Demographic Yearbook: Focusing on Natality* (DYB Special Issue 1999).
United Nations: *Demographic Yearbook*, various years.
US Bureau of the Census, International Database (IDB). Methods applied to fertility data can be found on http://www.census.gov/ipc/www/idb/estandproj.pdf#fertdbe
The *UN Demographic Yearbook* uses data reported by countries from their vital statistics whenever available. For some countries the data correspond to registration year as indicated in the publication. When data from the *UN Demographic Yearbook* were unavailable we used the series in the IDB US Bureau of the Census. The following are the years for which complete economic aggregate data are available for a country but total fertility is not: Argentina (1971, 1973–74), Chile (1993), Dominican Republic (1961–62, 1965–67, 1971–72, 1974–76, 1978–79), Ecuador (1974, 1976–77, 1979–81, 1985–89), Honduras (1982, 1984–86), Panama (1985, 1987), Uruguay (1981–84),Venezuela (1981–84, 1988–89). Data were not imputed where they were missing.

Unemployment

Argentina (1970–2004). The ILO LABORSTA database, which is based on labour force surveys. National Institute of Census and Statistics, INDEC.
Bolivia (1981–2003). The CEPAL BADEINSO database based on official statistics (Urban).
Brazil (1976–2001). The ILO LABORSTA database, which is based on a monthly employment survey [Pesquisa mensal de emprego]. Brazilian Institute of Geography and Statistics (IBGE). Missing years: 1980, 1991, 1994, and 2000.
Chile (1975–2003). The ILO LABORSTA database, which is based on the national employment survey [Encuesta nacional de empleo]. Department of Household Statistics, National Statistical Institute (INE).
Colombia (1975–2002). The ILO LABORSTA database, which is based on the Continuous Household Survey [Encuesta continua de hogares]. National Administrative Department of Statistics (DANE).
Costa Rica (1976–2004). The ILO LABORSTA database, which is based on the Multi-Purpose Household Survey, Employment Module [Encuesta de hogares de propósitos múltiples, módulo de empleo]. General Directorate of Statistics and Census, Ministry of Economy, Industry and Trade (DGEC Dominican Republic (1960)–2004). Banco central de la Republica Dominicana, Departamento de cuentas nacionales y estadisticas economicas, Division de encuestas.
Ecuador (1974–2004). The ILO LABORSTA database and the CEPAL BADEINSO database, which are both based on the Periodic Survey of Employment, Unemployment and Underemployment in Urban Areas of Ecuador [Encuesta periódica sobre empleo, desempleo y subempleo en el área urbana del Ecuador]. National Institute of Employment, Ministry of Labour and Human Resources (INEM).
El Salvador (1978–2003). The ILO LABORSTA database, which is based on the Labor Force Survey (Urban).
Guatemala (1980–2004). The CEPAL BADEINSO database, which is based on official statistics. Missing years: 1990 and 1999–2001.
Honduras (1980–2003). The CEPAL BADEINSO database, which is based on official statistics. Missing year: 2000 (Urban).
Mexico (1980–2003). The CEPAL BADEINSO database, which is based on official statistics.
Nicaragua (1980–2004). The CEPAL BADEINSO database, which is based on official statistics.

Panama (1970–2003). The ILO LABORSTA database, which is based on the Continuous Household Survey [Encuesta continua de hogares]. Population and Housing Section, Directorate of Statistics and Censuses. Missing years: 1980–81 and 1990.
Paraguay (1979–2003). ILO LABORSTA database and CEPAL BADEINSO database both based on Household Survey—Labour Force [Encuesta de hogares—Mano de obra]. General Directorate of Statistics and Census, Ministry of Finance (DGEC).
Peru (1980–2003). The CEPAL BADEINSO database, which is based on the Specialized Employment Level Survey [Encuesta especializada de niveles de empleo]. National Directorate of Censuses and Surveys (DNCE), National Institute of Statistics and Informatics (INEI) (Lima Metropolitan Area).
Uruguay (1980–2004). The CEPAL BADEINSO database, which is based on official statistics from the Continuous Household Survey.
Venezuela (1975–2002). The ILO LABORSTA database, which is based on the Household Sample Survey [Encuesta de hogares]. Central Office of Statistics and Information Processing [Oficina Central de Estadística e Informática].
The ILO, LABORSTA database: http://laborsta.ilo.org/
The CEPAL, BADEINSO database: http://www.eclac.org/cgi-bin/getprod.asp?xml=/deype/noticias/BaseDatos/9/14869/P14869.xml&xsl=/deype/tpl/p13f.xsl&base=/deype/tpl/top-bottom.xslTechnical Note: http://websie.eclac.cl/sisgen/SisGen_MuestraFicha.asp?indicador=127&id_estudio=5
Date were not imputed where they were missing.

Gross domestic product

All countries (1951–2003): GDP growth rate per head. The CEPAL BADEINSO database, which is based on official country statistics. Corresponds to GDP at constant market prices in dollars for 1995.

Inflation rate

All countries (1949–2003): inflation rate was computed as annual change in consumer price index. *Source*: International Financial Statistics (IFS) published by the International Monetary Fund and based on official country statistics. Starting year for Brazil is 1960, for Chile 1950, for Costa Rica 1951, for Ecuador 1952, for Nicaragua 1970.