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Economic Swings and Demographic Changes in the History of Latin America

Introduction.

A considerable amount of effort has been invested in studying the effects of short-term economic fluctuations on demographic outcomes. Although by far the most influential work pertains to conditions prevailing in pre-industrial North and Western Europe (Lee, 1981; Galloway, 1988; Weir, 1984; Richards, 1984), a growing number of studies assess the effects of short-term oscillations of economic well-being on mortality, fertility and nuptiality in developing countries (Bravo, 1992a, 1992b; Hill and Palloni, 1992; Palloni and Hill, 1992; Reher and Ortega, 1992). Most of these studies focus on the demographic responses to recent economic recessions and investigate the question of possible adverse consequences of the economic adjustment programs initiated during the last decade. Some cross sectional studies and, more rarely, detailed case studies offer persuasive arguments suggesting that such effects--particularly in the area of health--might be of significant magnitude and rather long lasting. But the evidence is murky, contradictory, and somewhat inconclusive.

In this paper we study the effects of short-term economic fluctuations on natality, nuptiality and on infant and adult mortality in Latin America. We do not study the effects of economic crises **per se** but instead assess the effects of short-term variations on indices of economic well-being. In order to increase the generalizability of our results, we broaden the focus of inquiry by including twenty or so years before World War II rather than, as is more common in the recent literature, focussing on the post-war period only. In addition to increasing the robustness of results, the expanded data base enables us to test the hypothesis of differentials in demographic responses at different moments in the history of these countries. We choose a set of eleven countries that represent, albeit imperfectly, a broad sample of demographic trajectories, styles of economic development and, to a lesser extent, political evolution.

In the first section of the paper we summarize the mechanisms through which economic crises influence selected demographic outcomes. In the second section we discuss estimation techniques, the choice of countries and the data sources. In this section we review our results, compare our estimates to those from pre-industrial Europe and contrast them with the effects of economic fluctuations that apply within the more narrow historical period elapsed between 1955 and 1990. In the third section we expand our analysis to include the study of mortality by age and causes of deaths, but doing so forces us to concentrate exclusively on the period 1955-1990.

The Relations Between Short-Term Changes in Economic Well Being and Demographic Outcomes.

Although there are important gaps in the evidence and some unsolved difficulties of interpretation (Fogel, 1986), the idea that pre-industrial mortality, fertility and nuptiality responded in significant ways to economic cycles is well established (for a summary see Lee, 1990). Increases in prices of food and other commodities and contraction of economic opportunities exert downward pressures on marriages and births and drive upward the levels of mortality, particularly of young children and the elderly. These effects operate through time trajectories involving lags and echoes that sometimes reinforce and sometimes weaken the initial responses. For the most part the evidence about these mechanisms has been drawn from Western and Northern Europe.

Demographic responses to crises induced by famines, epidemics and wars have also been verified and studied in developing countries (Dyson, 1991; Caldwell and Caldwell, 1987; Ashton et al., 1984) but far less has been done to understand the short-term reactions to economic fluctuations of lesser magnitude. Only a handful of studies assess the magnitude and direction of demographic responses in Latin America during the second half of this century (Bravo, 1992a, 1992b; Hill and Palloni, 1992; Palloni and Hill, 1992) and only one makes a serious effort to evaluate trends starting at the beginning of the century (Reher and Ortega, 1992). There is no doubt that the post-independence period of most Latin American countries was punctuated by economic recessions and upturns of variable magnitude and durations. They left clear imprints not only in the articulation of capital and labor markets--and, hence indirectly, on population distribution--on fiscal and monetary policies, and on investment decisions, but also modified the nature of class conflicts and the political alignments established to dissipate its effects (Marichal, 1989; Frieden, 1991; Maddison, 1985; Thorp, 1984). Despite a fair amount of inter-country variability in the nature and origins of economic fluctuations, some of them--including the recessions that began after 1975 and 1982 and the associated effects of structural adjustment programs--are deemed to be uniformly severe, and likely to have led to massive changes in the conditions of exposure, resistance and recovery affecting health levels and to subvert and erode, albeit transiently, established patterns of nuptiality and fertility.

What are the exact mechanisms that link changes in economic well-being and demographic outcomes? What are the conditions under which they operate? In what follows we summarize what is known about the relations of interest. We base our description on aggregate findings reported in historical research and on several in-depth studies of the impact of severe crises.

a. **The effects on nuptiality.**

Postponement of marriages but particularly first marriages is a very common response to economic crises and recessions and is thought to be the only Malthusian mechanism of some relevance for population growth (Wrigley and Schofield, 1981). In pre-industrial Western Europe high grain prices were almost inevitably followed by a sharp fall in marriages (Galloway, 1988). It is a behavioral effect which involves economic considerations regarding the prospects for establishing a self-sufficient household. By and large, the nuptiality effect is immediate but may become protracted depending on the severity and duration of the crisis. A 'boom' in marriages usually follows during the aftermath of a crisis as postponed marriages are 'made-up' rapidly and in unusual concentrations. When the economic effects of the crisis are long-lasting, a more permanent disequilibrium in the marriage markets sets in and the making-up of postponed marriages ceases to be a feasible option. The consequence is an increase in the proportion of members of a cohort who never marry (or remarry).

A secondary mechanism through which a crisis may affect nuptiality is through an increase in adult mortality: as the prevalence of widow(er)hood inches up, there will be more opportunities for remarriages. But whether or not trends in remarriage track closely the increase in dissolved couples due to widow(er)ing will depend on the availability of occupational and economic niches and opportunities.

The most typical pattern of nuptiality response is an immediate drop in the (standardized) number of marriages, followed by a lagged increase above and beyond what is expected in normal times. Although the period of time spanned by these offsetting responses largely depends on the severity and duration of the crisis, there will be decreases in the number of marriages the first and second year after the onset of the crises followed by an increase as the impact of the crisis recedes. Under conditions where anticipatory behavior is influential, the number of marriages may begin to dip during or right before the beginning of the first symptoms of economic downturn. An analogous pattern of response (with reversed signs) should be associated with economic upturns.

b. **The effects on fertility.**

Delays in marriages alone--whether or not followed by an increase in permanent celibacy--will reduce the number of births within the year following the onset of the crisis. In societies practicing effective contraception and where anticipatory behavior and adjustments are the norm, the reduction in the number of births may occur even earlier than one or two years after the initiation of the economic downturn. In addition, postponement of higher order births, temporary separation of couples due to migration, and a reduction of coital frequency will all operate to reduce natality. These effects will be seen only one or two years after the initial effects. If the crisis compromises the health and nutritional status of currently pregnant mothers, one should expect an immediate reduction in the number of births as stillbirths and spontaneous and voluntary abortions increase in the wake of worsening economic times and as malnutrition-induced subfecundity, reduction in age at menopause, and increase in age at menarche shrink the number of new conceptions. As with marriages, the number of births tends to rebound after the crisis has passed. This is due to a higher than normal number of new couples, to delayed births that are made up and, finally, to the more favorable distribution of women by fecundity status.

But the fertility response may also move in the opposite direction, that is, the number of births can increase as a result of a crisis. This can occur if mothers abandon traditional breastfeeding practices--due to increased involvement in supplementary economic activities or as a byproduct of severe malnutrition--and if the crisis itself erodes norms that restrict sexual activity of the young, the widowed and separated spouses. This 'backward' response is unlikely to be visible in aggregate data as the factors that trigger it are generally offset by reducing forces.

In summary, the effects on fertility are less clear cut both in terms of their direction and timing. For the most part, however, one would expect a drop in the number of births a year or so after the onset of the crisis and then a gradual recovery as a reflection of the boom in marriages and of second and higher order births that were postponed in the midst of the crisis.

c. **The effects on health and mortality.**

The relation between deterioration of economic conditions and mortality is mediated by changes in exposure and resistance to diseases and by the capacity to recover from illnesses. A direct, non-mediated relation may be observable only in situations leading to outright starvation or to acute deficiencies in major nutrients and their sequelae. The mechanisms through which changes in economic conditions alter exposure, resistance and recovery vary by age and sex of the population.

Deterioration of standards of living can result in lowered nutritional intake and, if sustained long enough, to lower nutritional status. Deficiencies in nutritional status compromise immuno-competence increasing the host's susceptibility to infectious diseases, weakening the body's ability to ward off the effects of contacts with common pathogens, and disabling the mechanisms for recovery. Of particular importance are the relations between nutritional status and about ten infectious diseases, including cholera, bacterial diarrhea, measles, respiratory tuberculosis, whooping cough and some acute respiratory diseases. Young children (between 1 and 10) and the elderly are the most susceptible to the effects mediated by nutritional status. Infants who are fully breastfeeding are more protected by the cleanliness of breastmilk and the nutrients and immunities that are transferred from mother to child. However, in societies where the traditional norm of breastfeeding has been abandoned or where the crisis itself subverts traditional lactational practices, infants will also be severely hit. And among them, those who belong to the poorer groups will face higher risks.

The effects of deterioration of nutritional status alone may be confounded and are frequently exacerbated by conditions associated with sanitation, delivery of health services, personal hygiene, and poor housing. Individual and family reactions to the crisis could and oftentimes do aggravate levels of crowding and multiply exposure to diseases as several families share the same household, food, clothing and shelter. Deterioration of infrastructure (piped water, sewage, garbage disposal) as state, provincial or national governments cut social expenditures, will compound the increased exposure to infectious diseases. Finally, as health subsidies and services are reduced or eliminated, prenatal care and basic preventative and curative services will be considerably more difficult to obtain from the public sector. Consequently, one would expect mortality responses to be enhanced when the downturn is sharp and sustained enough to inflict damage on sanitation and public health, the continuity of public work programs, food assistance and subsidies, and the integrity of social welfare and preventative and curative health services. The magnitude and duration of the morbidity and mortality effects will vary depending on the severity of the crisis but also as a function of the resilience of programs supported by government institutions and the size of the population covered by them. Where a large fraction of the population depends on these services and where they are more vulnerable to downsizing of government budgets, the effects on mortality should be correspondingly stronger. That the mortality response to the crisis may be mediated by centralized institutions is not a unique feature of developing countries. Indeed, there is evidence that in some pre-industrial societies central governments were at least partially successful in cushioning the impact of shortages and were able to smooth oscillations in inventories through anticipatory corrective interventions (Fogel, 1989).

The outcome of individual behavior adjustments and of the erosion of public programs will be first felt by young children and the elderly and should be most evident in the increased incidence of diseases of the intestinal tract, respiratory tuberculosis and acute respiratory ailments. Impoverished prenatal care and weakened preventative services will take its toll among infants and very young children. Note that reduced prenatal care could also result in increased rates of pregnancy loss and stillbirths. If selection effects operate, increased rates of pregnancy loss and stillbirths will be accompanied by a reduction in the average level of frailty of the newborn, and the potential levels of neonatal mortality will be lower than during normal times.

Unlike those associated with nuptiality and natality, the timing and direction of the expected effects on morbidity and mortality are difficult to pin down with precision. First, effects operating through nutrition should lag by at least one year, except under wretched conditions. Shorter lags should be expected for infant and early child mortality if the patterns of breastfeeding are disrupted. And finally, effects on neo and postneonatal mortality should be observable within a year or two of the onset of the crisis. Second, increases in respiratory ailments are more likely to take place after one year and recrudescence of respiratory tuberculosis may take longer than one or two years, except where its prevalence is already high and/or where there are sharp increases in new cases. Adolescents, younger adults and the elderly will be the groups most affected by these conditions.

As in the case of nuptiality and natality, we expect to find echoes in the mortality response. An increase in mortality may be followed by an immediate decrease as the population composition by susceptibility is sharply altered by exposure to excess mortality (Lee, 1990). Echoes should be more visible in the most vulnerable age groups (infants and children) and in societies that experienced recent improvements in survivorship since it is there where the frailty composition has a higher variance (Palloni and Hill, 1992). Another mechanism through which a negative echo in mortality could occur applies to infant mortality. As the crisis reduces natality it will alter the composition of births by risk factors such as parity (lower proportion of first births), mother's age (lower proportion of births to younger mothers) and birth interval (lower proportion born after very short birth intervals). This could exert nontrivial downward pressure on the levels of infant and early child mortality and will partially off-set mortality increases. Thus, a year or so after a crisis we expect to find higher than normal mortality alternating with lower than normal mortality in a wave-like pattern which is progressively dampened as normal conditions are restored.

d. **Contingencies that affect the changes of nuptiality, natality, morbidity and mortality.**

The relations discussed above may apply in general but they involve important simplifications that obscure the fine details of observed responses. Variability in the duration of crises and in the social conditions characterizing a society or social group are two important sources of variation in the magnitude of demographic responses. Not all economic downturns or upturns will have the same effects even though they may be reflected in similar **observed** variability of economic indicators. Recessions that have their origins in international crises and that lead to draconian reorganization of patterns of consumption, massive loss of purchase power, and significant cuts in government spending will hit more severely the urban working class and lower white collar groups than those whose earnings depend on rural wage labor or on labor markets associated with primary export sectors. On the other hand, economic downturns that are more localized and associated with sagging demand for exports could have a less serious, immediate, and general impact. As shown elsewhere (Marichal, 1989), the recessions that began in the early eighties in Latin America belong to the former class, whereas the recession of the 1930's and the one that took place around World War II belong to the latter class. A related though distinct factor that affects the magnitude of the response is the duration of the downturn (upturn). Protracted crises are more likely to exhaust potential reserves and inventories or to outlast the shielding effect of public interventions. Longer exposure times are also more likely to trigger effects that are detected only when certain thresholds are exceeded (for example, the effects of malnutrition on mortality).

The presence (absence) of social institutions and the cultural norms that regulate the exchange and circulation of goods and persons will also intervene to modify demographic responses. First, the extent to which economic crises and recessions affect individual decisions to marry is in all likelihood dependent on the degree to which marriage is associated with household formation. In societies where a new couple is expected to establish co-residence in the paternal (maternal) household, the economic constraints on union formation may be of lesser magnitude than in societies--such as pre-industrial Northern and Western Europe--where couple formation and household creation were one and the same phenomenon (Hajnal, 1982). Thus, the prevailing system of cost-benefit allocation associated with marriage will have important influences on whether the nuptiality response is acute, or nonexistent.

Second, as in the case of marriage, the existence of social institutions and cultural norms may depress or exacerbate the magnitude of the fertility response. In societies with easy access to contraception and where its routine use is an accepted practice, the contraction of the number of births could be larger than in societies where the fertility response is only dependent on biological mechanisms related to nutrition and lactation or behavioral mechanisms that are highly dependent on spouse separation or abstinence. Furthermore, if the cost of childbearing is spread within extended households, the depressive effects of an economic downturn may well be less than when it is absorbed by couples.

Third, morbidity and mortality will respond differently depending on conditions of exposure, nutritional status, dietary habits, and past mortality changes. In societies with higher prevalence of respiratory tuberculosis or diarrhea, for example, we would expect a higher rate of increase in associated conditions during economic reversals. Similarly, where the norm of universal and long breastfeeding has been abandoned, the upward pressure on infant (but particularly post-neonatal) mortality will be stronger. Finally, one would expect a substantially smaller impact in countries that have experienced long-lasting changes in mortality conditions due to medical interventions, changes in parental behaviors, and in the establishment of strong public health programs. This is because in these societies the attitudes toward death and health care and the stock of knowledge and techniques that are available will not be undermined by transient economic setbacks.

Just as the presence (absence) of some social institutions may alter the nature of demographic responses, so can the relative position of a group in a social hierarchy reinforce or buffer the shocks triggered by a crisis. Some groups will be more insulated from its main effects, others will be able to adapt and accommodate through more or less efficient survival strategies and, finally, others will resist erosion of standards of living by mobilizing political pressure and successful bargaining. Gauging the nature of these differentials is a difficult task since it requires data by social groups which are generally unavailable. The issue is important, however, and should be kept in mind in our discussion: the aggregate measures that we are frequently constrained to use conceal what can be formidable amounts of variability in the dynamics of social groups. This is as true today as it was during preindustrial times (Fogel, 1986).

In what follows we discuss the methods and data to test some of the many conjectures formulated above. Falsification of hypotheses is not an easy task with the data at hand and in some cases--group differential responses--it is outright impossible.

Methods, Data, and Results

a. **Methods.**

To obtain the effects of short-term variations on economic well-being on demographic outcomes we employ distributed lag models similar to those formulated by Lee (1981) and Galloway (1988) in their study of England and Wales and other European countries. The most elementary model can be written as follows:

$$y_t = \alpha + \beta X + \delta Z + \varepsilon_t \qquad (1)$$

where y_t is a detrended demographic outcome evaluated at year t, X is a vector of detrended lagged socioeconomic indicators including x_t, $x_{t-1}, \ldots x_{t-n}$, Z is a vector of (possibly detrended) control variables also including lagged values, α is a constant, and β and δ are vectors of coefficients. Finally, ε_t is an error term following a predefined autoregressive process. Although we experimented with other formulations, a first order autoregressive process provides the most parsimonious description of the data. In vector X we include values for lags 0 up to lag 4. Effects beyond lag 4 were found to be of negligible importance. As is known, the estimated effects contained in vector β can be conveniently (though only approximately) interpreted as elasticities of demographic outcomes relative to the indicator(s) of well-being. Adding the values β_{t-j} contained in vector β yields an estimate of the **net** proportional change in the demographic outcomes that occurs in response to a unit proportional change of the indicator of economic well-being.

To increase efficiency we introduce several modifications to model (1). These modifications also enable us to test some fairly straightforward hypotheses about conditions that modify demographic responses.

a.1) *Detrending.*

To obtain detrended values for our series we apply local least squares, a technique that provides a robust fit to the data without imposing a global functional form and without costly losses of degrees of freedom (as with the more conventional 11-year moving average). The local least square fit reproduces successive portions of the data using a variable bandwidth or fraction of all data points employed to fit a single point (Cleveland, 1979). A bandwidth that is too short assigns too much weight to observations that are too close to the point being fitted and hence can attribute unduly high influence to deviations from long run trends that occur in neighboring points. Conversely, a bandwidth that is close to 1 reproduces better the general contour of the time trends without imposing a single, close functional form to it. We experimented with variable bandwidths within the range .20-.90 and observed that the results were robust to changes. In all cases we use bandwidths of .90. Once we obtain a local least squares fit we calculate the ratios of the observed to the predicted values of the series. These become the values for the variable y_t and for the elements of the vector X.

An important caveat is necessary here (see also Hill and Palloni, 1992; Palloni and Hill, 1992). During the period of time under study (1920-1990) there are only three major economic downswings followed by their corresponding rebounds. Thus, we expect that our estimated effects will be highly dependent on the short-term responses to **relatively** minor crises and are thus likely to be lower bounds for the true elasticities. The relatively short period of observation means that noise could be influential in inflating the variances of the estimates.

a.2) *Main variables and controls.*

To evaluate levels of nuptiality we use the yearly reported number of legally sanctioned marriages. In some countries of Latin America where consensual unions are fairly prevalent, the reported number of legally married couples at any one time amounts to between 40 to 60 percent of the total number of couples in a union, while the residual corresponds to consensual unions (Palloni and DeVos, 1992). To the extent that decision-making rules about union formation are different in countries with high and low prevalence of consensual unions, our estimated responses will contain biases. As we show below, however, there is no obvious relation between the estimated responses of nuptiality and the type of nuptiality regime.

Since the number of marriages can be affected by recent surges in adult mortality--principally through remarriages--we experiment with a control for lagged detrended adult mortality. However, as the results are virtually identical to models without a control, we conclude that the impact of mortality on the frequency of marriages is trivial and, to simplify presentation of results, we discuss only estimates from a model containing no controls for lagged adult mortality.

To model natality we use the reported yearly number of births. To obtain estimates of the response of **marital fertility** we introduce a control for lagged number of detrended marriages: since economic downswings have important potential effects on both marriages and deaths, the estimated response of births while controlling for marriages is an approximation to the response of fertility **within** marriage. As in the case of marriages, we also estimated models controlling for adult mortality and concluded that its effects are wholly inconsequential.

In the analysis of mortality we use the infant mortality rate and the number of non-infant deaths. We also examine results obtained with a more fine-tuned breakdown of deaths by age and causes but we are able to do this only for the period following World War II. Infant mortality rates are used instead of the number of infant deaths to circumvent the problem generated by the fact that the absolute number of infant deaths in one year changes in response to variations in the number of births during the preceding year.

To the extent that completeness of reporting of vital events varies only gradually, the observed detrended series will represent a good approximation to reality. However, insofar as recessions themselves have non-negligible consequences on the smooth functioning of vital registration systems, it is likely that we will obtain lower than average completeness precisely during periods of economic hardship. Although the observed number of marriages, births and non-infant deaths are more likely to be distorted than the observed infant mortality rate (since this indicator is affected by errors in both numerator and denominator), all our estimated elasticities could contain downward biases. The magnitude of these biases is expected to be of lesser importance in those countries with well established vital registration systems (Chile, Argentina, Uruguay, and Costa Rica) and in all countries during the most recent period (after 1955).

As an indicator of wellbeing we chose GDP per capita expressed in constant U.S. dollars of 1970. In pre-industrial societies annual fluctuations in grain prices were taken as the most important determinant of real wages and used as indicators of standards of living. The choice has not gone uncriticized as even drastic fluctuations in food availability may not have been entirely reflected in their market price (Fogel, 1989). In contemporary Third World countries with fairly diversified economies, real wages and the prices of one or a combination of commodities are unlikely to be a good gauge of standards of living. Diversified production and consumption renders futile the attempt to single out a combination of staples whose price could be taken as a reliable indicator of budgetary pressure experienced by households. Real wages represent the experience of variable (and frequently reduced) segments of the labor force and, more often than not, fluctuations in real wages are heavily influenced by the strength and fortunes of working class political organizations but track poorly even sharp oscillations of economic performance. Although the choice of GDP per capita is by no means ideal, we believe it has some important advantages over other, equally plausible choices at least during the period following World War II (Palloni and Hill, 1992). In this paper, however, we simply had no choice: GDP is the only indicator available to us from national accounts that reaches as far back as 1910.

In addition to controlling for the lagged number of adult deaths (in the equations for births and marriages) and for the lagged number of marriages (in the equation for births), we also model the effects of **historical period**. Period is measured as a dummy variable attaining a value of 1 if the year under observation is before 1955 and 0 otherwise. With this simple indicator we attempt to separate the years before and after the onset of what turned out to be a rather sustained period of economic growth following the end of World War II that rested on far-reaching import substitution programs.

b. **Data.**

For the analysis of nuptiality, natality and infant and non-infant deaths we use the following country-years: Argentina (1910 to 1989); Chile (1908-1989), Colombia (1925-1988); Costa Rica (1925-1989); Guatemala (1930-1989), Mexico (1921-1989), Panama (1945-

1989), El Salvador (1925-1989), Uruguay (1935-1989) and Venezuela (1936-1989). In addition, information for Cuba (1950-1989) is included in some analyses of the post-World War II period. For the more detailed analysis of mortality by cause we are unable to use Argentina, Cuba, Colombia and El Salvador but add instead Trinidad and Tobago and Ecuador. The set of countries was chosen to represent the entire spectrum of demographic regimes in Latin America. Argentina and Uruguay began their mortality and fertility transition during the last two decades of the XIXth century and Chile, Costa Rica and Cuba began later during the second or third decade of the XXth century. These are countries with demographic regimes that are closer to those prevailing in Europe and North America. The remaining five countries, but particularly Guatemala and El Salvador, initiated their mortality transition rather late and show only weak indications of the onset of fertility decline. Colombia, Mexico and Venezuela are in an intermediate situation, closer to the more modern Latin American countries but not fully sharing a modern demographic regime.

In addition to variability in demographic regimes we were interested in maximizing the variability in response to economic crises. On the one hand Argentina, Chile, Costa Rica and Cuba were the four countries most affected by the crisis of 1929, whereas Colombia, for example, experienced milder effects (Maddison, 1985). Similarly, there is substantial variability in the response to the crisis of the 1980s. Frieden (1991) has argued that in Argentina and Chile, the two countries where class conflict was rife in the wake of the crisis, the state intervened in a more decisive way with redistributive policies favoring asset-holders and domestic economic sectors at the expense of well-established social programs. By contrast, conditions in Mexico did not dictate such draconian interventions and milder forms of structural adjustments were put in place.

Under these conditions we expect responses to be stronger in the first two countries.

c. **Analysis of results.**

Figure 1 shows plots of detrended GDP per capita, detrended number of births, marriages and infant mortality rates for selected countries included in our sample. Without exceptions the imprints of the crisis of 1929, of the recessions that followed the outbreak of World War II, and of the last (and longest) recession that began after 1980 (the 'debt crisis') are quite visible. In addition to these three major recessions, there are other relatively minor ones. In the case of Chile, for example, there is a crisis of some significance around the years 1973-1978, right after the military coup that terminated Allende's government.

Initial results are displayed in Table 1 that shows the estimated coefficients and standard errors (in parentheses), the adjusted R-square, and the net effects (the sum of the coefficients for the five lags) of alternative distributed lag models. To detect changes in responses before and after 1955 for all four demographic outcomes we estimated a simple model. It is based on the assumption that the increase (decrease) in the response of one period relative to the other is **constant**, that is, that it remains the same regardless of whether the effect is an initial effect or simply an echo. To implement this model we assumed that the responses before 1955 equal the responses after 1955 plus a constant. Equation (1) then becomes:

$$Y_t = \alpha + \beta X + \delta\ A^*W \quad (2)$$

where α, β and X are as before, δ is the difference between the level of response before and after 1955, W is a dummy variable equal to 1 if t is less than 1955, and A is the **sum** of the five lagged terms of GDP. The results of this model are also presented in Table

1. With the exception of births, there are two models for each outcome, one without interaction term (Model (1)) and the other including an interaction term (Model (2)). In the case of births we estimated models with and without control for lagged marriages so that Model (1) is the simplest one (no controls for lagged marriages and no interaction term), Model (2) adds controls for lagged marriages and, finally, Model (3) adds the interaction term. The results of the simplest models (not including the interaction term but including the control for marriage) are represented in the form of box-plots for the estimated responses in Figure 2.

i) Marriages.

The number of marriages respond as expected in Argentina, Chile, Costa Rica, Uruguay and Venezuela but are statistically significant only in Argentina, Chile and Uruguay. Among the remaining countries, only Guatemala shows a truly anomalous pattern with negative (though statistically insignificant) coefficients. Colombia, Cuba, Mexico and El Salvador show the expected pattern. The net effects (sum of all coefficients) are positive in all cases except in Guatemala.

Does the marriage response depend on the nature of the nuptiality or household formation processes? Two arguments could be advanced. The first is that consensual unions are less vulnerable to the whims of the economy as they involve considerably lower longer term commitments. If so, in countries with higher prevalence of consensual unions we should find a substantially reduced response. But this is not directly verifiable since vital statistics only report the number of **legal** unions, not the number of total unions. However, we would still expect a relation between prevalence of consensual unions and magnitude of the marriage response if consensual unions are more likely to occur among the most vulnerable subgroups of the population. If so, the sensitivity of **legal** marriages to economic cycles should be correspondingly lower.

The second argument rests on the nature of the relation between the process of nuptiality and the process of household formation. In societies where entry into marriage initiates a new household, decisions about marriage anticipation or postponement should be correspondingly more sensitive to appraisal of economic horizons than in societies where couple formation is subordinate to preexisting households. A simple albeit crude test of this relation is to compare the magnitude of responses in countries with varying prevalence of extended households. The test is far from being ideal since, among other things, it relies on aggregate indices when the argument is about individual or couple's decision making.

Table 2 displays indices of prevalence of extended households, prevalence of consensual unions, and a set of rank-order correlation coefficients between these indices and the magnitude of the net marriage response (sum of all lagged coefficients) and the sum of the response at lags 0 and lag 1 only. The rank order correlation coefficients are in the right direction, but their magnitude is fairly low.

ii) Births.

Fluctuations in GDP per capita depress births at lags 0 or 1 in all cases except Mexico and Colombia where the signs of the corresponding coefficients are opposite to expected. The coefficients attain statistical significance in the case of Argentina, Chile and Guatemala. The pattern of response in these countries is as anticipated and rebounds in the number of births that occur at lags of order 2 or higher. But in Mexico, Colombia and Uruguay a somewhat perverse pattern prevails whereby the echo outplays the initial effect so that the **net** effect is negative.

A control for lagged marriages reduces the absolute magnitude of the estimated response and in the case of Chile the estimates cease to be statistically significant. In other countries a control for marriages produces no significant changes. It is likely that the relative invariance of the original elasticities for births to control for marriages is due to the rather muted marriage response.

As in the case of marriage, the existence of widespread extended family arrangements is likely to spread the costs of childbearing among several members of a family. If so, we expect the birth response to decrease as the prevalence of extended or complex households increases. Again, Table 2 and the rank-order correlation coefficients pertaining to births do indeed support at least the direction of the association but offer scarce clues about the relative importance of this mechanism.

iii) Infant and non-infant mortality.

For the most part the effects on non-infant mortality are properly signed and follow the expected sinusoidal pattern. The estimated response is statistically significant in the cases of Costa Rica, Cuba, Panama, Uruguay and Venezuela. The effects on infant mortality are stronger and statistically significant in Colombia, Chile, Costa Rica, Panama, and Uruguay. We will defer discussion of these findings to the last section of the paper.

iv) Variability of responses over time.

Do the effects of fluctuations in standards of living vary over time? The sensitivity of demographic outcomes to economic fluctuations could change as a result of two very different processes. First, the nature of the mechanisms linking demographic responses to economic changes may be altered over time. If not central, this is at least an important issue in theories of mortality and fertility transition. As a more modern demographic regime is established, mortality levels and patterns should become more dissociated from short-run fluctuations in standards of living. At the very least this is one of the discernible characteristics of the passage from high to low mortality regimes in more developed countries (Flinn, 1974; Mercer, 1990). The evolution of the linkage between measures of economic output and births and marriages is less straightforward since, even in modern demographic regimes, births, though not always marriages, do fluctuate as prosperity gives way to recession. However, in societies with fairly high levels of marital fertility such as those in Latin America before 1940, we are likely to find only modest responses in marital fertility. During more recent periods and propelled by the advent and diffusion of voluntary fertility control, marital fertility may tend to respond more closely to cycles of economic contraction and expansion than it did during the past. There is little theoretical and empirical basis on which to make predictions about the evolution of the linkage between marriages and aggregate economic performance. One could expect, however, that in societies where there has been a transition from high to low prevalence of extended household arrangements, the marriage response should become sharper (see discussion above). Regrettably we have little empirical evidence to discern changes of this type with any accuracy.

The second process that may yield time-varying effects is the changing intensity and duration of crises. Economic downturns (or upturns) before 1955 may have been more (less) intense and longer (shorter) than those that have occurred more recently and may have stressed more (less) the coping mechanisms that could be deployed. If so, one would expect that the responses of births, marriages and mortality would be much stronger(weaker) before 1955 than after.

We test for the existence of response changes using model (2). Estimation of the models leads to results displayed in Table 1 (on the third column for births and on the second column for all the other outcomes). When the coefficient for the interaction term (the estimate of δ) is positively signed, the main responses of outcomes with positive signs in the first few lags (births and marriages) will be larger before 1955 but the corresponding echoes will be have lower magnitudes. The opposite applies to the other two outcomes.

Conjectures will be different depending on which of the two processes described above is the dominant one. If the linkage between responses and standards of living has changed as indicated before, we would expect the coefficient of the interaction term to be **negatively** signed for births--suggesting a stronger response during the more recent period--and also negatively signed for mortality measures–implying that past responses were of higher magnitude than current ones. The expectation for marriages is less clearcut since there is little reason to believe that nuptiality regimes would respond any differently today than they did forty years ago except in those cases identified above where there is an association with the regime of household formation.

If, on the other hand, time-variance of responses are the result of differences in the intensity (and/or duration) of crises, a different set of expectations applies and they should depend on the relative magnitudes of the crises. During periods of more intense and longer-lasting crises, marriages, births and deaths should respond more sharply. This means that the interaction effects should be positive for births and marriages but negative for mortality if crises prior to 1955 were indeed more intense and/or protracted.

The results in Table 1 give partial support to some of these conjectures. In the case of births all countries show negative (or zero) coefficients (although they attain statistical significance only in Uruguay and Venezuela). For marriages, all interaction effects are either positive or zero (though none is statistically significant.) This **joint** pattern of interaction effects for marriages and births is more consistent with the idea that the nature of the linkages between stimulus and response has changed and less so with the second process in which responses are intensity (duration)-dependent: if the latter process had been dominant, then **both** the birth and the marriage response should have been sharper before (or after 1955) depending on when the crises were more intense.

With one exception, all coefficients for the interaction terms in the models for infant mortality are either zero or negative and in none are they statistically significant. The one exception is Uruguay with a positive coefficient. The results for non-infant deaths are exactly analogous. Leaving aside the case of Uruguay and overlooking for the moment the scarce statistical power of these results, it is difficult to argue that these results support one conjecture in particular. This is because a weaker mortality response is the result of **either** more intense crises in the past or of the dissociation between mortality and aggregate economic performance that results from the mortality transition.[1]

In summary, the time-pattern of responses of infant mortality is considerable more ambiguous than for marriages and births and does not admit an easy interpretation, but it weakly suggests that responses follow a process dominated by intensity (see endnote 3).

Arguably Model (2) contains an important weakness since it assumes that the amount of change in the main effect is the same as the change in the echo. Indeed, Model (2) is constrained so that a constant shift, δ, applies across all lags. But this is unnecessarily restrictive since it is empirically possible that the time-effects on the main response may be more significant than the time-effects on the echoes. Model (3) is a generalized version of Model (2) where the effects of time are free to vary across lags:

$$y_t = \alpha + \beta X + \delta(X*A) + \varepsilon_t \quad (3)$$

where y_t, X, A, α, β and ε_t are as before and δ is a vector of coefficients δ_{t-j}, (j=0, 1,...4), representing the shift in each of the lag-specific responses. Unlike Model (2), in Model (3) all lag-specific responses are allowed to change freely. The results are presented in Table 3. To avoid unnecessary cluttering Table 3 is in compressed form and it only highlights the main effects and corresponding interaction terms for the first two lags for each of the outcomes. A cursory examination of this table reveals very little that is new relative to the simpler Model (2) estimated before. In fact, simple tests indicate that the loss of explanatory power incurred when we constrain the time effects to be constant across lags is statistically insignificant.

v) Many countries, only one process: the pooled sample.

The model we have estimated is not parsimonious enough since it assumes maximum intercountry heterogeneity of responses. One could argue that there is only trivial inter-country variability in responses and that, as a consequence, the proper model is one that constrains all effects to be the same across countries. Since we can test statistically for the appropriateness of the constraints, we do not need to rely on arbitrary decisions to choose between one model or the other. The first column of Table 4a displays the estimates that obtain after pooling together all countries except Cuba.[2] A series of F-tests indicates that, regardless of outcome, the unconstrained models (all countries with different responses) do not add significantly to the explanatory power of a constrained models, where all countries are assumed to have the same pattern of response [3].

The patterns observed in the Table 4a are more regular and in much better agreement with expectations. The initial response of marriages (first lag) is very strong, properly signed and statistically significant. The corresponding echo (a negative reaction) is protracted and dominates all other lags. The natality response at lag 0 is very strong and so is the echo at lag 1. This pattern is consistent with the existence of anticipatory behavior. The effect at higher lags is negative but statistically insignificant. As in the case of the country-by country findings, a control for lagged marriages changes only slightly the estimated effects. The effects on infant mortality rate and non-infant mortality corresponding to lag 0 and 1 are also statistically significant but their magnitude is smaller than the effects on marriages and births.

The estimates for the pooled model with the simplest interaction effect (see Model (2)) appearing in columns 3, 5, 7, and 9 of Table 4a suggest that before 1955 the responses of births and marriages are **lower** but that those of mortality are **higher**. This is indeed the pattern found in the country-by-country analysis. And here, as was the case before, the absolute differences (see the estimated coefficient for the interaction term) are somewhat low, and only in the case of births is it statistically significant. Estimation of the more complicated model in the pooled sample (see Model (3)) appearing in Table 4b does not introduce important novelties but reinforces the impression that the time-variance of responses is minor and that it affects all outcomes.

vi) Are the net responses sizeable?

Previous studies have emphasized an important operational aspect of the distributed lag models used throughout the paper. This is that the sum of the lag-specific effects is an estimate of the net effects of an initial economic change. For example, if the sum of the coefficients for birth is .39, as in Argentina, one would expect that five years after an initial shock of, say, a 10 percent drop in GDP per capita, we will observe an overall deficit of births (relative to normal periods) of about 3.9 percent. Is this 'net' impact relevant? This is a rather complicated problem that involves two separate aspects. The first which has been heretofore neglected in the literature has to do with whether or not such net effect is **statistically significant**. The second is whether or not it is of any **demographic significance**. We address these two themes in turn.

The issue of statistical significance is not straightforward and needs to be stated precisely: we want to know whether the **sum** of a set of random variables--the estimated lag-specific effects--is close to zero.[4] To test for this we estimate a model where the **sum** of the coefficients is constrained to be 0 and then perform an F-test to assess the statistical significance of the increase in explained variance accounted for by the elimination of the constraint. If the constraint entails a significant reduction of the explained variance, then the net effect of the lag-specific responses must be statistically different from zero. Table 5 displays the main results of the test in the form of critical probability values. In the pooled sample, only the net effects of marriages and births are statistically significant from 0.[5] The net effects on non-infant deaths are significant only with fairly liberal criteria and those for infant mortality not at all. The country-by-country results add very little to these patterns except to suggest that the net effects of infant mortality are negative and significantly different from zero in two countries, Costa Rica and Uruguay.[6]

The question of demographic importance is more difficult to evaluate. To simplify the problem we start from the assumption that only marriages and marital fertility have a net response different from 0. One can show that the proportionate deficit (excess) of births and marriages caused by economic oscillations during the interval (t_1, t_2) is given by:

$$\pi = \theta^*\delta_1 + \phi^*\lambda^*\delta_2 \tag{4}$$

where θ and ϕ are the net effect on births and marriages respectively, λ is the fraction of all births due to a marriage that are lost (gained) due to marriage postponement (anticipation) during the effective arch of a minimum duration crisis (in this study assumed to be 5 years from the onset until the last echo is felt) and, finally, where δ_1 and δ_2 are the weighted averages of the deviations of GDP per capita from a secular trend and the weights are the proportional distribution of counterfactual births during the period under study.[7] The derivation of the expression neglects variances of random quantities, and overlooks age and time dependencies.

To illustrate the implications of the expression derived before we first chose the net effects on births and marriages, θ and ϕ respectively, from the pooled sample. We then calculated numerically the values of δ_1 and δ_2 for each country in our sample and for two periods of time, before and after 1955. A period of crisis leads to lower values for these two parameters. But the relative magnitude of these parameters also depends on the timing of the crisis: when births (or marriages) are on an increasing (decreasing) trend, a crisis will have a larger effect if it occurs later (earlier) during the period. Of course, the opposite occurs if instead of a crisis there is an economic upturn. Finally, we need to assign alternative values to λ, the fraction of all legitimate births that are postponed when marriage is delayed. We assumed that in societies with a Total Fertility

Rate within the range 5.00-6.00, λ could vary between .02 and .20 representing, respectively, a loss (gain) of .1 child and 1.0 child within the span of a minimum duration crisis.

Consider a period of time of about 100 years during which each downturn (upturn) evolves from beginning to end over a maximum span of five years and, on average, represents GDP per capita drops of about 15 percent. This regime will produce a deficit of births close to 5 percent in the worst case scenario and of about 2.0 percent in the most optimistic scenario. By contrast, if the crises during the period are less severe (or the upturns less significant) so that average GDP drops are about 5 percent, the deficit in births will fluctuate between .7 and 1.6 percent. Though not trivial, these are not dramatic figures since over, say, a century, they only imply correspondingly minor reductions in the rate of natural increase. But they are even less significant considering the fact that average losses of up to 15 percent of GDP (relative to a century-long trend) is a fairly extreme assumption.

d) **Comparisons of results**

How do our results stack up against those obtained in the pre-industrial period and elsewhere in the developing world? Table 6 displays the elasticities from our pooled sample (from Table 4) and the corresponding net elasticities. It contrasts these with the results from the analysis of a pooled sample including a similar set of countries during the period 1950-1990 (Hill and Palloni, 1992), and with the **median** estimates of the responses for 14 European countries prior to the demographic transition (Galloway, 1988). The net response of births and marriages is remarkably similar across samples. Paradoxically, the effect on marriages is slightly higher in our sample than in the European one. Since Latin America is not known to be an area where restrictions on the nuptiality regime were (or are) overly asphyxiating, it is surprising that the marriage response is larger than in the area where the so-called Western marriage pattern prevailed for several centuries.

The net elasticity of non-infant mortality is less than in Europe but higher than in the sample of countries for 1955-1990. Finally, the response of infant mortality in our sample is only ten percent of the response estimated in the sample for the more recent period. The discrepancy is almost fully accounted for by the different historical period covered in both samples.[8]

The Effect of Economic Well-being on the Pattern of Mortality by Age and Causes.

A more finely tuned analysis of the mortality response by age and cause requires that we neglect years before 1955. The advantage of estimating age-cause specific responses is that it may reveal relations between changes in standards of living and health conditions that are thoroughly concealed by aggregated data. In this section we summarize the framework and results obtained elsewhere (Palloni and Hill, 1992), but also provide new estimates from a pooled sample of countries.

a. The effects of swings in economic well-being on mortality by age and cause of death: a summary of previous results.

The most startling result revealed by the examination of data by age and cause of death is that there is indeed a great degree of heterogeneity in the mortality response which remains concealed if one only uses total number of deaths or deaths by coarse age groups. Even though the ultimate impact of economic recessions on the levels of mortality is somewhat weak,[9] the **patterns** of response are enlightening of the mechanisms that transmit the shock of oscillations in aggregate indicators of economic well-being to individuals' health. The models that we estimate in our previous work are the least parsimonious since they assume that countries had different responses. Yet, despite the inefficiency of the estimates, we were able to identify some important features. By and large, the mortality responses follow a profile by age and cause that is surprisingly consistent with theoretical expectations. Thus, infectious diseases and, in particular, respiratory tuberculosis and diarrhea are the most responsive to economic downturns. Infants and young children as well as youngsters up to age 15 and the elderly are the most affected. We also found some interesting patterns that need further investigation. First, the evidence suggests that the response of mortality at age 0 is inversely related to the median level of breastfeeding. Thus, in countries with less than universal and short lactation the responses to bad economic times are sharper. This is in agreement with the idea that vulnerability of the very young is maximized in societies where the traditional lactation patterns crumble under the onslaught of modernization.

Second, we found only weak evidence suggesting that the mortality response was different during the most recent ('debt') crisis than it had been between 1955 and 1975. Third, there is circumstantial evidence to support the idea that the level of response of mortality to economic recessions depends on the levels of socioeconomic development already achieved by a country.

b. **New estimates of elasticities by age groups and causes of deaths.**

To increase the efficiency of our estimates we have pooled the countries in the sample with available causes of deaths between 1955 and 1990 and re-estimate the most significant models.[10] Table 6 displays the estimated effects by lags and the net effects of GDP in the pooled sample. The results confirm the conclusions obtained from the country-by-country analysis (Palloni and Hill, 1992), but provide additional information. First, the subpopulations that are most affected by downturns are infants and young children and the elderly. There is also a surprisingly strong reaction of mortality of older children (aged between 5 and 14).

Second, the causes of deaths that are most sensitive to economic recessions are, as speculated in the first section of this paper, diarrhea, respiratory tuberculosis and acute respiratory infections. The overall response of infectious diseases attains its highest levels among infants and children, whereas the overall response of respiratory tuberculosis attains its maximum among those aged 5-14 and 15-64. The strong response of respiratory tuberculosis is in accord with the many historical examples suggesting that TB is highly sensitive to changes in nutritional status and to sudden shifts in the re-distribution of population (Palloni and Hill, 1992). It should be remembered, however, that throughout Latin America the actual levels of mortality by respiratory tuberculosis are fairly low and that deaths attributed to that cause are less than 5 percent of all deaths (Palloni and Hill, 1992).

Third, the pattern of responses by lags is remarkably consistent with expectations: with the exception of respiratory tuberculosis, deaths increase at lags 0 and 1 and thereafter experienced a decrease, perhaps the echo due to changes in composition by susceptibility to illnesses. Respiratory tuberculosis tends to respond at higher order lags as it should if the mediating mechanism involves deterioration of nutritional status.

Summary and Conclusions

The analysis undertaken here of the relationship between economic fluctuations and demographic outcomes for Latin American countries has extended the period of observation back to 1920 or so and includes several demographic outcomes, nuptiality, natality, infant and noninfant mortality. The results are mixed. While in a handful of countries the estimated effects of economic swings in an aggregate indicator of economic well-being (GPD per capita) are statistically significant and follow the expected patterns, in most of them the responses are more muted and are not statistically significant. However, the patterns are consistent since only in one or two cases do we find estimates that are improperly signed. Furthermore, the analysis on the pooled sample is quite robust and reveals the expected relations. In addition, these results show that the linkages between short-run economic shocks and demographic outcomes are fairly similar to those estimated in pre-industrial Europe. Surprisingly, while the effects on births are almost identical across samples, the ones associated with marriage are larger in Latin America than in pre-industrial Europe. On the other hand, while the effects on adult and infant mortality follow expected patterns, they are weaker than in other samples. We find, finally, that the observed time-variance of the estimated response of births (and marriages) accords better with the idea that the association between demographic outcomes and aggregate economic well-being has changed nature over time. The variation of the infant mortality response is less straightforward since the evidence that we are able to gather does not enable us to distinguish between two alternative interpretations, one involving a recent increase in the severity of economic downturns and another that rests on the plausible idea that past recessions had important effects not only on demographic outcomes but also on the accuracy with which those outcomes were registered in official statistics.

The patterns of mortality responses by age and cause are intriguing but, simultaneously, are consistent with argumentation that separates carefully the effects of crises through exposure, resistance and recovery. Thus, we confirm the sensitivity of illnesses such as diarrhea, acute respiratory infections and respiratory tuberculosis and the vulnerability of infants, young children and the elderly to changes in economic conditions.

But even though the patterns of responses are consistent with theoretical expectations, we find that the absolute impact of the mortality response on the ultimate levels of mortality and the absolute magnitude of the births and marriages on the ultimate levels of fertility response is quite small. It remains to be clarified to what extent the interaction between effective registration and the recessions themselves conspire against identification of effects that, though strong, remain concealed when viewed through the lenses of our measurement instruments.

1. One way to adjudicate between these alternative interpretations is actually to assess the intensity (duration) of the crises before and after 1955. If it turns out in our assessment that pre-1955 crises were in fact no different from those after 1955, the pattern of results discussed before can only support the conjecture of dissociation between aggregate economic performance and mortality responses. If, on the other hand, the assessment does indicate that pre-1955 crises were more intense (or lasted longer), the pattern of results obtained before cannot be interpreted without ambiguity.

To assess the intensity of crises before and after 1955 we use the lowest ratio of observed to predicted GDP in each of the periods. To measure the duration we calculate the number of years elapsed between the year the minimum ratio is reached and the year when the ratios return to a normal trend (ratio of 1.0). This is a very rough instrument to perform a rather delicate task, one that in all likelihood requires the careful weighting of historical records on a case-by-case basis. The results we obtain are suggestive, however, for in all cases they confirm the notion that pre-1955 crises, though perhaps of shorter durations, were equally or more intense than the post-1955 crises. With only three exceptions (for which our series only starts after 1976) the identifying crisis corresponds to the Great Depression. The results of this exercise are as follows:

Country	Indices of Intensity (duration in years)	
	Pre-1955	Post-1955
Argentina	.87(12)	.89(>1)
Chile	.87(5)	.85(4)
Colombia	.97(2)	.93(5)
Costa Rica	.84(13)	.92(>3)
Cuba	na	na
El Salvador	.73(10)	.89(>7)
Guatemala	.77(8)	.93(>6)
Mexico	.77(8)	.96(>3)
Panama	.90(10)	.84(>3)
Uruguay	.84(3)	.91(>3)
Venezuela	.80(5)	.87(>3)

With all the qualifications that apply, it is interesting to note that these figures coincide with the appraisal made by Maddison (1985), who suggests that a) Colombia experienced mild after-shocks from the Great Depression and to the "debt crisis"; b) Argentina, Chile and Mexico experienced worst case-scenarios during the Great Depression; c) Mexico experienced only a 'mild' debt-crisis. In contrast, the figures for Venezuela are inconsistent with Frieden's (1991) evaluation of Venezuela's debt crisis being less acute than that for Argentina and Chile.

To interpret these figures, note that the series for Panama, Uruguay and Venezuela start after 1935 and hence do not include the effects of the Great Depression. Also, whenever the duration could not be calculated (the index does not return to a value of 1.00 before the series end) we show the total number of years preceded by the ">" symbol to indicate that the duration will be at least as long as the number of years estimated from the data.

2. We exclude Cuba since its time series, unlike all other countries, only reaches back to 1950.

3. The basic inputs for the tests on each of the outcomes are presented below. The figures are the sums of squares accounted for by the unconstrained country-specific parameters and the overall sum of squared residuals in the unconstrained model. The unconstrained country-specific parameters are 50 (5 interaction terms to retrieve the lagged effects for each of 10 countries; the 11th country operates as a baseline). There is a total of 680 observations and hence the degrees of freedom associated with the residual sums of squares equals 624 (the number of observations minus 56 free parameters). Thus, in each case the F-test requires 50 degrees of freedom in the numerator and 624 degrees of freedom in the denominator.

OUTCOMES

Deaths	Births	Marriages	IMR	Non-Infant
Added Sums of Squares	1.65	2.01	1.36	1.16
Residual Sums of Squares	3.22	12.93	4.70	4.40
F-value	.36	.16	.29	.26

Note that the critical F-value with p=.05 and the stated degree of freedom is 1.36 and with p=.01 is 1.55.

4. It is important to understand that this is **not** equivalent to test for the statistical significance of the variance added by the five lagged term: we are not interested in knowing whether constraining the coefficients to be zero is improved upon by an unconstrained model, but on whether or not the sum of the unconstrained effects is zero.

5. We know from results for the pooled sample in Table 1 that the net effects on marriage and births are positive, whereas those on mortality are negative.

6. It should be understood that the fact that net effects are zero or close to zero does not mean that there is no demographic response to aggregate economic changes but that the possibly important initial response is swamped by 'echoes' that move the demographic outcomes in the opposite direction so that the estimated net effect of the crisis (upturn) is small relative to its standard deviation.

7. The derivation is fairly simple. The deficit (excess) of births (within marriage) and marriages due to a downturn (upturn) in GDP per capita are given by:

t_2

$$B = \theta * \int_{t_1} (\delta(t)B(t)\,dt)$$

for births and

$$M = \phi * \int_{t_1}^{t_2} (\delta(t)M(T)\,dt)$$

for marriages. Note that $\delta(t)$ is the proportionate increase (decrease) in GDP over the normal trend at time t. Although this is a genuine discrete quantity, we have assumed continuity to avoid cluttering. B(t) and M(t) are the counterfactual marital births and marriage trajectories, e.g., those that would have occurred in the absence of any oscillations, and θ and ϕ are the net effects on births and marriages respectively, e.g., the sum of the effects across all five lags. The estimator of excess births, however, only captures the immediate impact on births within marriages. To assess the overall impact we need to translate the decrease (increase) in marriages into deficit (excess) births. This, in turn, requires us to estimate the ultimate number of births per marriage, σ, and the fraction of such number that is lost (gained) when marriages are postponed (anticipated), λ. Then the absolute deficit(excess) of births is given by:

$$B' = B + \lambda * \sigma * M$$

We now multiply and divide B by the total number of counterfactual births during the period, b, and the second part of the expression by the total number of conterfactual marriages, m. This yields

$$B' = b * \theta * \delta_1 + m * \sigma * \lambda * \phi * \delta_2$$

Since $m * \sigma$ must equal b, we see that the proportionate deficit (excess) of births due to economic fluctuations is given by

$$(B'/b) = \theta * \delta_1 + \phi * \lambda * \delta_2$$

8. To make estimates more comparable we re-estimated the models in the pooled sample but suppressed all the information before 1955. The corresponding net effect is estimated to be -.32, slightly lower than in panel II and with an almost identical lag-specific pattern. This suggests that it is the process before 1955 that attenuates the response of infant mortality. Indeed, as is shown in the next section, the estimated net response of infant mortality during 1955-1990 with a different sample of Latin American countries and with a different measure of aggregate economic output is about -.48, even higher than the one appearing in panel II. This supports an intriguing conjecture, namely, that the infant mortality response is larger in the most recent period. This is unexpected, as one would surmise that the linkage between infant mortality and economic conditions has weakened over time. There are two possibilities to explain this finding. The first is that indeed the deterioration of economic conditions after 1955 was more severe or lasted longer than that before 1955. The second explanation is that the failure of the registration system that was associated with economic downturns was much stronger in the past.

9. A similar conclusion was reached by Fogel regarding the impact of crises in pre-industrial Europe (Fogel, 1989).

10. As was done before, here too we applied a battery of F-tests to determine that pooling of countries was indeed the most efficient strategy. The results are more ambiguous here than they were before since, although in the majority of cases we are able to accept the null hypothesis (of no difference between a fully unconstrained and a constrained model), there is a handful of age-groups and causes of deaths which we must reject though adopting somewhat liberal significance levels.

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Table 1: Estimated Effects (by Lag) on Births, Marriages, Non-infant Deaths and Infant Mortality Rate (IMR)

	Births[a]			Marriages		Non-infant deaths		IMR	
	(1)	(2)	(3)	(1)	(2)	(1)	(2)	(1)	(2)
Argentina (n=80)									
0	.17 (.08)**	.13 (.08)*	.12 (.08)*	.42 (.31)	.44 (.31)	.15 (.11)	.15 (.14)	.25 (.16)	.23 (.16)
1	.05 (.03)*	.03 (.05)	.03 (.05)	-.01 (.11)	-.01 (.12)	-.04 (.08)	.04 (.09)	.06 (.89)	.00 (.09)
2	.08 (.03)**	.10 (.04)**	.10 (.05)*	.10 (.11)	.10 (.12)	.09 (.07)	- .09 (.07)	.04 (.08)	- .03 (.08)
3	.04 (.03)	.00 (.04)	.06 (.04)	.10 (.11)	.10 (.12)	-.07 (.08)	- .06 (.06)	- .03 (.07)	- .03 (.07)
4	.04 (.03)	.03 (.04)	.03 (.04)	-.08 (.12)	-.08 (.12)	.12 (.06)	.01 (.06)	- .03 (.07)	- .03 (.07)
Inter[(b)]	--	--	-.00 (.01)	--	.01 (.03)	--	.00 (.01)	--	- .01 (.01)
R^2 adj	.17	.18	.17	.13	.23	-.02	.00	.22	.18
Net	.38	.29	.34	.53	.56	.07	-.03	.09	.14
Chile (n=82)									
0	.32 (.08)***	.12 (.08)	.14 (.08)*	.60 (.10)***	.59 (.10)***	-.16 (.12)	- .16 (.12)	- .10 (.06)**	- .11 (.07)
1	-.05 (.05)	-.09 (.08)	-.07 (.08)	.03 (.09)	.03 (.09)	-.04 (.10)	- .05 (.10)	.07 (.06)	.09 (.07)
2	-.03 (.05)	-.04 (.08)	-.03 (.08)	-.02 (.07)	-.17 (.07)	-.04 (.08)	- .04 (.08)	- .16 (.06)***	- .16 (.05)***
3	.08 (.05)	.18 (.08)**	.20 (.08)***	-.06 (.07)	.06 (.07)	-.14 (.08)	- .04 (.07)	.17 (.06)***	.18 (.05)***
4	-.04 (.05)	-.13 (.08)	-.12 (.08)	.02 (.06)	.02 (.06)	-.01 (.08)	.01 (.07)	- .10 (.04)***	- .10 (.04)***
Inter[(b)]	--	--	-.01 (.01)	--	.00 (.01)	--	.01 (.01)	--	.00 (.00)
R^2 adj	.11	.08	.20	.44	.42	.03	.05	.10	.10
Net	.28	.04	.12	.69	.53	-.37	- .28	- .12	- .10
Colombia (n = 66)									
0	-.47 (.44)	-.67 (.37)	-.68 (.37)	-.02 (.42)	.01 (.42)	-.63 (.31)	-.64 (.31)	.51 (.40)	.50 (.40)
1	.33 (.22)	.18 (.31)	.24 (.32)	.13 (.11)	.12 (.11)	-.02 (.18)	-.05 (.19)	-.80 (.47)	-.83 (.48)
2	.16 (.15)	.43 (.18)	.44 (.18)	-.07 (.10)	-.07 (.10)	-.04 (.11)	-.05 (.11)	.17 (.17)	.18 (.17)
3	.13 (.12)	.16 (.17)	.18 (.17)	.04 (.10)	.04 (.10)	.00 (.08)	-.00 (.08)	-.09 (.12)	-.09 (.13)
4	.02 (.10)	-.33 (.15)	-.33 (.15)	.10 (.10	.01 (.10)	-.11 (.08)	-.12 (.07)	.00 (.08)	.00 (.08)
Inter[b]	--	--	-.01 (.05)	--	-.003 (.02)	--	.003 (.006)	--	.002 (.003)
R^2 adj	.02	.58	.59	-.08	.01	.07	.07	-.02	-.04
Net	.17	-.23	-.15	.08	.09	-.80	-.86	-.19	-.24

Table 1 (continued)

Cuba (n = 40)

0	.21 (.20)	.27 (.21)	--	.51 (.71)	--	.10 (.23)	--	.10 (.31)	--
1	.43 (.18)	.45 (.20)	--	-.55 (.61)	--	-.04 (.02)	--	.35 (.28)	--
2	.06 (.07)	.01 (.09)	--	-.02 (.33)	--	-.10 (.08)	--	-.03 (.11)	--
3	.14 (.07)	.10 (.09)	--	-.09 (.23)	--	-.01 (.08)	--	.04 (.11)	--
4	.02 (.05)	.05 (.07)	--	.26 (.23)	--	.02 (.06)	--	-.01 (.08)	--
Inter[b]	--	--	--	--	--	--	--	--	--
R^2 adj	.19	.17	--	-.11	--	-.05	--	-.05	--
Net	.86	.88	--	.09	--	-.03	--	.45	--

Costa Rica (n=65)

0	.03 (.10)	-.04 (.10)	-.06 (.10)	.24 (.20)	.24 (.21)	.06 (.16)	- .05 (.17)	.21 (.16)	.20 (.16)
1	.15 (.03)***	.05 (.07)	.05 (.06)	.14 (.15)	.14 (.15)	.34 (.12)	- .35 (.13)	- .61 (.18)	- .61 (.19)
2	-.01 (.03)	-.07 (.06)	-.08 (.06)	.09 (.09)	.09 (.09)	-.09 (.07)	- .09 (.07)	.12 (.09)	- .12 (.09)
3	.01 (.04)	-.06 (.06)	-.06 (.06)	-.03 (.09)	-.03 (.09)	-.05 (.07)	- .05 (.07)	- .03 (.08)	- .03 (.08)
4	-.02 (.04)	.04 (.06)	.06 (.06)	-.04 (.07)	-.04 (.08)	.00 (.06)	- .01 (.06)	.05 (.06)	.04 (.06)
Inter[(b)]	--	--	-.01 (.01)	--	.00 (.01)	--	.00 (.01)	--	- .00 (.01)
R^2 adj	-.03	.02	.28	.24	.22	.14	.13	.21	.20
Net	.16	-.08	-.09	.40	.40	-.47	- .45	- .26	- .28

El Salvador (n=65)

0	.15 (.12)	.16 (.12)	.06 (.11)	.07 (.30)	-.05 (.30)	.03 (.02)	.10 (.25)	.02 (.14)	.02 (.17)
1	-.00 (.01)	-.07 (.09)	-.05 (.10)	.22 (.27)	.22 (.27)	-.15 (.18)	- .15 (.17)	.00 (.15)	.00 (.16)
2	.09 (.06)	.11 (.07)	.11 (.10)	.05 (.16)	.05 (.15)	-.15 (.12)	- .17 (.12)	- .08 (.09)	- .08 (.09)
3	.03 (.07)	.05 (.07)	.05 (.10)	-.01 (.17)	-.00 (.17)	-.05 (.14)	- .07 (.13)	.12 (.09)	.12 (.10)
4	.02 (.05)	.04 (.06)	.11 (.08)	-.01 (.13)	.01 (.13)	-.04 (.11)	- .08 (.11)	.02 (.08)	.01 (.01)
Inter[(b)]	--	--	.00 (.01)	--	.00 (.01)	--	.00 (.01)	--	.00 (.10)
R^2 adj	.17	.19	.02	-.06	.04	.08	.07	- .02	- .04
Net	.29	.29	.28	.18	.23	-.36	- .37	.08	.07

Table 1 (continued)

<u>Guatemala</u> (n=60)

0	.12 (.07)	.19 (.08)***	.14 (.07)*	.01 (.13)	-.14 (.18)	.10 (.18)	.10 (.17)	.21 (.17)	.23 (.17)
1	.03 (.03)	.01 (.04)	.01 (.08)	-.13 (.11)	-.10 (.08)	-.10 (.09)	- .10 (.10)	- .14 (.12)	- .18 (.12)
2	-.00 (.03)	-.01 (.04)	-.02 (.08)	-.12 (.11)	-.09 (.07)	-.06 (.08)	- .06 (.07)	.05 (.06)	- .05 (.06)
3	.00 (.02)	-.03 (.04)	-.05 (.08)	-.04 (.10)	-.00 (.011)	.02 (.06)	.02 (.07)	.10 (.06)	.10 (.06)
4	.01 (.02)	.05 (.04)	.09 (.06)	-.08 (.08)	-.00 (.07)	.01 (.06)	- .07 (.06)	- .05 (.05)	- .06 (.05)
Inter[b]	--	--	.00 (.01)	--	.00 (.02)	--	- .00 (.01)	--	.00 (.01)
R^2 adj	-.01	.33	.35	.11	.10	.05	.06	.03	.03
Net	.66	.21	.17	-.36	-.33	-.02	- .03	.07	.04

<u>Mexico</u> (n=69)

0	-.10 (.16)	-.04 (.16)	-.11 (.16)	-.08 (.34)	-.08 (.35)	-.12 (.20)	- .09 (.20)	.28 (.26)	.26 (.27)
1	-.07 (.07)	-.10 (.10)	-.03 (.11)	.05 (.22)	.05 (.23)	-.04 (.11)	- .05 (.12)	- .03 (.11)	.02 (.11)
2	-.04 (.06)	-.03 (.08)	-.01 (.01)	-.06 (.14)	-.06 (.15)	-.02 (.08)	- .03 (.08)	.13 (.10)	.02 (.10)
3	-.01 (.06)	-.04 (.07)	-.04 (.07)	.03 (.11)	.03 (.11)	.06 (.07)	- .06 (.07)	.04 (.09)	.04 (.09)
4	.06 (.05)	.16 (.07)	.13 (.08)	.05 (.10)	.05 (.10)	.04 (.06)	.04 (.06)	- .11 (.08)	- .10 (.09)
Inter[b]	--	--	-.01 (.00)**	--	.00 (.01)	--	.01 (.01)	--	- .01 (.01)
R^2 adj	.00	.20	.35	-.06	-.08	.01	.10	- .01	- .01
Net	-.13	.05	-.06	-.01	-.07	-.08	- .19	.31	.19

<u>Panama</u> (n = 45)

0	.09 (.10)	.10 (.10)	.08 (.10)	-.11 (.39)	-.14 (.41)	.02 (.21)	- .06 (.28)	- .56 (.34)*	.62 (.35)*
1	-.08 (.03)***	-.09 (.05)*	-.08 (.05)*	.46 (.32)	.47 (.32)	-.03 (.08)	.06 (.47)	- .13 (.25)	- .01 (.27)
2	-.05 (.03)*	-.03 (.05)	-.03 (.05)	.04 (.15)	.04 (.16)	.04 (.07)	.10 (.09)	.12 (.14)	.13 (.14)
3	-.15 (.03)***	-.13 (.05)***	.13 (.05)***	.01 (.11)	-.01 (.12)	-.17 (.07)**	- .14 (.07)**	- .12 (.10)	- .12 (.10)
4	-.11 (.03)***	-.12 (.05)**	- .12 (.05)**	.12 (.11)	.11 (.11)	-.07 (.07)	- .03 (.07)	.08 (.10)	.07 (.10)
Inter[b]	--	--	.00 (.01)	--	-.00 (.01)	--	- .02 (.01)**	--	- .01 (.02)
R^2 adj	.28	.20	.61	.12	.10	.08	.24	.11	.13
Net	-.30	-.27	-.28	.52	.47	-.21	- .07	- .61	- .55

Table 1 (continued)

Uruguay (n=55)

0	.02 (.15)	.01 (.17)	.01 (.16)	.50 (.14)***	.50 (.14)	.02 (.12)	.04 (.11)	- .11 (.30)**	- .18 (.30)*
1	-.04 (.05)	-.17 (.12)	-.18 (.11)*	-.21 (.09)***	-.21 (.09)	-.15 (.12)	-.20 (.13)*	- .09 (.06)	- .09 (.18)
2	.00 (.04)	-.02 (.11)	.08 (.11)	-.07 (06)	-.07 (.06)	.06 (.05)	.10 (.05)**	.05 (.13)	.05 (.13)
3	-.02 (.05)	-.18 (.11)	-.19 (.10)	-.02 (.05)	-.02 (.05)	.01 (.05)	.01 (.05)	.01 (.10)	.02 (.10)
4	.00 (.05)	.01 (.12)	.02 (.11)	-.05 (.04)	-.05 (.04)	-.08 (.03)***	-.09 (.03)***	- .19 (.10)	- .19 (.10)**
Inter[b]	--	--	-.02 (.001)***	--	-.00 (.01)	--	.07 (.01)***	--	.01 (.01)
R^2 adj	-.06	-.13	.14	-.05	.03	.10	.28	.10	.20
Net	-.04	-.35	-.26	.15	.15	-.14	-.14	- .83	- .79

Venezuela (n=54)

0	.02 (.10)	-.07 (.10)	-.05 (.14)	.31 (.17)*	.34 (.17)***	-.13 (.18)	-.15 (.18)	.28 (.26)	.27 (.26)
1	.06 (.03)**	-.02 (.07)	-.09 (.12)	.31 (.06)***	.29 (.06)***	-.01 (.06)	-.01 (.06)	.01 (.08)	.01 (.08)
2	.02 (.03)	.09 (.06)	.10 (.11)	.09 (.05)*	.08 (.05)	-.03 (.05)	-.03 (.06)	.05 (.07)	.06 (.08)
3	.08 (.03)***	.09 (.06)	.04 (.12)	.14 (.05)**	.13 (.05)***	.03 (.05)	.03 (.05)	- .02 (.07)	- .02 (.07)
4	-.02 (.03)	.03 (.05)	.09 (.10)	.05 (.05)	.05 (.05)	-.14 (.05)***	-.14 (.05)***	- .05 (.07)	- .05 (.07)
Inter[b]	--	--	-.01 (.001)***	--	.01 (.01)	--	-.00 (.01)	--	- .00 (.01)
R^2 adj	.16	.21	.30	.33	.33	.01	.01	- .04	- .08
Net	.16	.12	.09	.90	.90	-.28	-.30	.27	.27

[a] Model 2 includes controls for lagged marriages at t, t-1...,t-4

[b] Inter is the product of A*W. See text for definition of A and W.

* Significant at .05 < p < 10 (1.7 < | t| < 2.0)

** Significant at .01 < p < .05 (2.0 <| t| < 2.5)

*** Significant at p < .01 (| t| > 2.5)

Table 2: The relation between nuptiality regime and household complexity and the marriage and birth response

Country	Proportion of complex households (circa 1980) CH	Proportion of consensual unions (circa 1980) CU	Responses			
			Marriage		Births	
			Net	Sum lags end 1	Net	Sum lags end 1
			Nm	Sm	Nb	Sb
Argentina	.24	.12	.56	.43	.29	.16
Chile	.23	.05	.53	.62	.04	.03
Colombia	.30	.29	.18	.11	-.23	-.49
Costa Rica	.22	.18	.40	.38	-.08	.01
Cuba	--	.35	-.22	-.04	.88	.72
El Salvador	--	.58	.18	.29	.29	.09
Guatemala	--	.45	-.36	-.12	.21	.20
Mexico	.24	.14	-.01	-.03	.05	-.14
Panama	.31	.47	.52	.35	-.27	.01
Uruguay	.18	.08	.15	.39	-.35	-.16
Venezuela	--	.33	.90	.62	.12	-.09

Summary of Rank-Order Correlations

Association between	Rank correlation coefficient (Kendall's tau)
CH and Nm	.20
CH and Sm	-.30
CH and Nb	.10
CH and Sb	.05
CU and Nm	-.05
CU and Sm	-.52*
CU and Nb	-.33
CU and Sb	-.20

*Significant at $p < .05$

Sources: CH and CU from Palloni and DeVos (1992)
Nm, Nb, Sm and Sb from Table 1

Table 3: Estimates by country of fully interactive model to capture changes over time.
Selected lags (main effects and corresponding interaction effects)

		OUTCOME			
Country	Effects	Births	Marriages	Non-infant deaths	Infant mortality rate
Argentina					
	Main, Lag 0	.060(.11)	- .165(.39)	.053(.21)	.323(.23)
	Main, Lag 1	.001(.11)	- .448(.40)	- .086(.23)	- .065(.25)
	Interaction, Lag 0	.074(.14)	1.163(.49)**	.170(.27)	- .065(.29)
	Interaction, Lag 1	.014(.12)	.473(.41)	.032(.24)	.065(.27)
Chile					
	Main, Lag 0	- .065(.16)	.422(.26)	- .029(.30)	- .037(.21)
	Main, Lag 1	.121(.18)	.174(.30)	- .180(.35)	- .240(.23)
	Interaction, Lag 0	.230(.16)	.200(.27)	- .180(.31)	- .180(.22)
	Interaction, Lag 1	- .210(.17)	- .165(.31)	.137(.37)	.307(.23)
Colombia					
	Main, Lag 0	- .740(.61)	- .734(.62)	- .572(.51)	- .330(.59)
	Main, Lag 1	- .691(.79)	1.182(.68)*	- .309(.59)	1.818(.90)**
	Interaction, Lag 0	.182(.73)	1.152(.73)	- .115(.61)	1.275(.73)
	Interaction, Lag 1	1.07 (.39)**	-1.010(.69)	.260(.62)	3.402(1.03)**
Costa Rica					
	Main, Lag 0	- .087(.15)	.323(.38)	- .050(.30)	.37 (.40)
	Main, Lag 1	.159(.16)	- .063(.46)	- .140(.35)	- .71 (.49)
	Interaction, Lag 0	- .008(.17)	.057(.44)	.160(.34)	- .63 (.46)
	Interaction, Lag 1	- .134(.16)	.245(.50)	- .202(.38)	.050(.54)
El Salvador					
	Main, Lag 0	.108(.38)	- .201(.79)	-1.420(.62)	.134(.47)
	Main, Lag 1	.310(.59)	-1.220(.32)	- .039(.93)	.270(.76)
	Interaction, Lag 0	- .072(.39)	.325(.84)	1.770(.65)	- .152(.49)
	Interaction, Lag 1	- .360(.60)	1.331(1.35)	- .311(.95)	- .260(.78)
Guatemala					
	Main, Lag 0	.133(.27)	1.100(.62)	- .232(.67)	- .243(.62)
	Main, Lag 1	.151(.36)	- .190(.80)	- .041(.99)	.155(.02)
	Interaction, Lag 0	.013(.27)	-1.332(.62)**	.310(.68)	.501(.64)
	Interaction, Lag 1	- .116(.35)	.103(.80)	- .069(.99)	- .347(1.03)
Mexico					
	Main, Lag 0	.007(.32)	.639(.678)	.450(.39)	.550(.50)
	Main, Lag 1	.110(.45)	- 1.011(.90)	- .770(.52)	- .260(.62)
	Interaction, Lag 0	- .218(.36)	- .890(.77)	- .690(.44)	- .380(.56)
	Interaction, Lag 1	- .094(.48)	1.118(.93)	.810(.54)	.243(.62)
Panama					
	Main, Lag 0	.010(.01)	- .210(.45)	.004(.21)	- .350(.33)
	Main, Lag 1	.050(.10)	.510(.53)	.026(.22)	-1.130(.40)**
	Interaction, Lag 0	1.250(.29)**	.950(1.90)	.611(.52)	-1.170(1.46)
	Interaction, Lag 1	- .570(.17)**	- .60 (1.29)	- .163(.28)	1.950(1.08)*
Uruguay					
	Main, Lag 0	- .230(.21)	.410(.19)**	.070(.14)	- .052(.44)
	Main, Lag 1	- .230(.24)	.172(.26)	.085(.26)	- .143(.62)
	Interaction, Lag 0	.450(.27)	.067(.26)	- .250(.21)	-1.09(.61)
	Interaction, Lag 1	- .053(.24)	- .448(.29)	- .063(.33)	.35(.73)
Venezuela					
	Main, Lag 0	- .220(.12)*	.378(.23)	- .110(.24)	.155(.34)
	Main, Lag 1	.089(.13)	.213(.26)	.220(.27)	- .250(.38)
	Interaction, Lag 0	.290(.14)**	- .217(.28)	- .190(.30)	- .012(.41)
	Interaction, Lag 1	- .041(.13)	- .084(.26)	- .230(.28)	.267(.38)

* Statistically significant at $p < .05$

** Statistically significant at $p < .01$

Table 4a: Results with a pooled sample of ten countries (excluding Cuba)

Lag	Births			Marriages		Infant Mortality Rate		Non-Infant Deaths	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0	.16 (.03)	.13 (.03)	.13 (.03)	.34 (.07)	.34 (.07)	-.10 (.04)	- .10 (.04)	-.02 (.01)	-.03 (.01)
1	.00 (.01)	-.05 (.02)	-.05 (.02)	-.04 (.03)	-.04 (.03)	.00 (.02)	.00 (.02)	-.01 (.02)	-.01 (.02)
2	.00 (.01)	.01 (.02)	.01 (.02)	-.05 (.03)	-.05 (.03)	-.01 (.02)	- .01 (.02)	-.01 (.02)	-.01 (.02)
3	.01 (.01)	.02 (.02)	.02 (.02)	-.02 (.03)	-.02 (.03)	-.01 (.02)	- .01 (.02)	-.06 (.02)	-.06 (.02)
4	.01 (.01)	.01 (.02)	.01 (.02)	-.04 (.03)	-.04 (.04)	-.00 (.03)	- .00 (.02)	-.03 (.02)	-.03 (.02)
Inter	--	--	-.007 (.002)	--	-.005 (.004)	--	.0001(.002)	--	-.003 (.002)
R^2 adj	.02	.10	.18	.06	.06	.03	.04	.00	.00
Net	.15	.12	.12	.19	.19	-.10	- .10	-.01	-.02

[a]See Table 1 and text for definition of models

Table 4b: Results with a pooled sample of ten countries (excluding Cuba)
(Fully Multiplicative Model)

	Births	Marriages	Non-infant deaths	Infant mortality rate
Lag and interactions				
0	.004 (.07)	.240 (.15)	-.10 (.10)	.10 (.11)
1	.070 (.08)	-.100 (.17)	-.08 (.12)	-.28 (.14)
2	.070 (.08)	.120 (.17)	.14 (.12)	.18 (.14)
3	-.050 (.08)	.100 (.17)	-.05 (.12)	.07 (.14)
4	.060 (.07)	-.140 (.15)	-.00 (.10)	-.10 (.12)
Inter 0	.160 (.07)	.130 (.15)	-.00 (.10)	-.14 (.12)
Inter 1	-.140 (.08)	-.070 (.17)	.08 (.12)	.27 (.14)
Inter 2	.070 (.08)	-.170 (.17)	-.15 (.13)	-.20 (.15)
Inter 3	.060 (.08)	-.110 (.17)	.06 (.12)	-.02 (.15)
Inter 4	.050 (.08)	.110 (.15)	.01 (.10)	-.07 (.12)
R^2 adj	.18	.06	.03	.07

Table 5: Critical probability values for the test of the restriction that net responses are equal to zero

Sample	Outcome			
	Births	ADeaths	IMR	Marr
Pooled	.017**	.080	.773	.026**
Argentina	.034	.891	.542	.214
Chile	.813	.078	.152	.0005***
Colombia	.483	.036*	.388	.821
Costa Rica	.316	.014**	.001***	.052
Guatemala	.060	.882	.499	.303
El Salvador	.037*	.167	.505	.378
Mexico	.798	.715	.542	.961
Panama	.107	.439	.123	.207
Uruguay	.219	.083	.028**	.331
Venezuela	.536	.216	.427	.0002

Note: The values on the table correspond to the critical probability value for the observed value of the F-statistic with the appropriate degrees of freedom.

* Significant at $p < .10$
** Significant at $p < .0;$
*** Significant at $p < .001$

Table 6. Comparison of Estimated Elasticities by Lag and Net Elasticities in Different Samples and Contexts

Demographic outcome	Lag 0	Lag 1	Lag 2	Lag 3	Lag 4	Net
Case I. Pooled Sample of 11 Latin American Countries (1925-1990)						
Births	.16	.01	.00	.01	-.01	.15
Marriages	.34	-.04	-.05	-.02	-.04	.19
Non-infant deaths	-.10	.00	-.01	.01	.00	-.10
Infant mortality	-.02	-.01	-.01	.06	-.03	-.01
Case II. Pooled Sample of 7 Latin American Countries (1955-1990)						
Births	-.02	.08	.04	.09	--	.19
Marriages	.08	.05	.11	.02	--	.13
Non-infant deaths	-.05	.06	-.00	-.07	--	-.05
Infant mortality	-.37	.07	-.04	-.03	--	-.38
Case III. Medians of 14 European Populations						
Births	.05	.11	-.03	.01	.00	.14
Marriages	.13	.04	-.02	-.02	-.01	.13
Non-infant deaths	-.10	-.19	-.09	.01	.01	-.36
Infant mortality	--	--	--	--	--	--

Sources:
a) Panel I: Results from Table 1 (last panel)
b) Panel II: Results from Hill and Palloni (1992)
c) Panel III: Results from Galloway (1988)

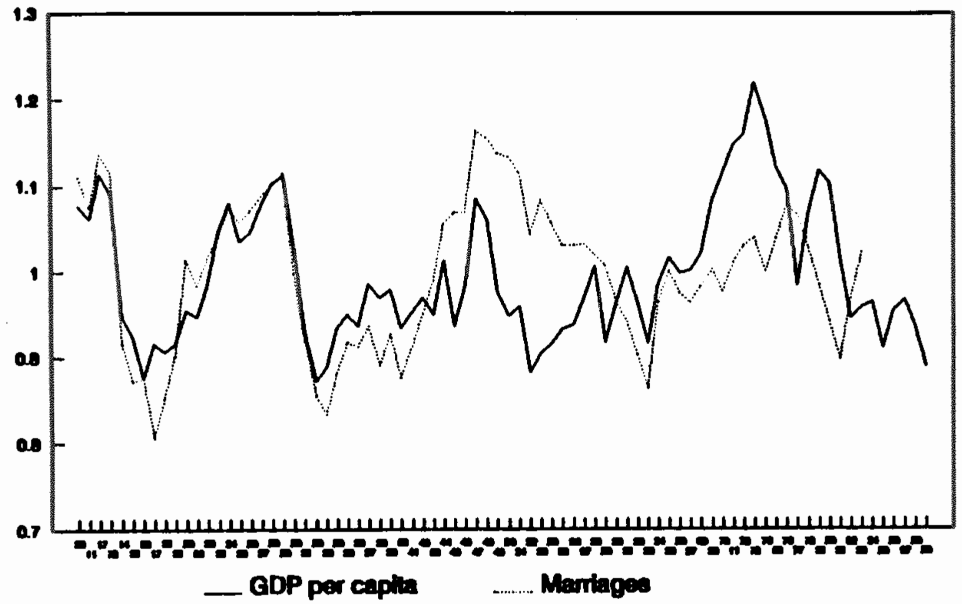
Table 7. Effects by Lag for Selected Causes of Death: Pooled Results for Nine Countries 1955-1990

Age Group	Lag	All	Infections	Respiratory	Violence	Ill-defined	Respiratory tuberculosis	Diarrhea
All (n=242)	0	-.05	-.45*	.08	.33	-.23	-.38	-.37
	1	-.12	-.65*	-.74**	.15	-.50	-.87*	-.81*
	2	.06	-.00	.08	.40	.49	.39	.02
	3	.02	-.14	-.08	.12	-.06	-.16	-.08
	4	-.04	.06	-.03	-.30	.14	-.19	-.05
	Adj R^2	.00	.08	.03	.05	.04	.04	.05
	Sum	-.13	-1.18	-.69	.70	-.16	-1.21	-1.29
0 (n=249)	0	-.11	-.59**	-.05	-.46	-.56	–	-.55**
	1	-.34*	-.63**	-.83*	.64	.60	–	-.63**
	2	.04	-.09	.05	-.48	.09	–	-.08
	3	-.09	-.56	-.51**	-1.13	-1.95*	–	-.40
	4	.02	-.21	.07	.56	.33	–	-.15
	Adj R^2	.02	.08	.04	.00	.04	–	.05
	Sum	-.48	-2.08	-1.27	-.87	-1.49	–	-1.81
1-4 (n=242)	0	.06	.17	.26	.69	.29	–	-.30
	1	-.37**	-.60	-.89*	-.57	-.46	–	-.77*
	2	.10	-.00	.62**	-.09	.62	–	.32
	3	-.30	-.69	-.44	.15	-.38	–	-.58**
	4	.32	.50	.14	.00	-.39	–	.02
	Adj R^2	.00	.00	.01	-.02	-.01	–	.02
	Sum	-.25	-.62	-.31	.36	-.32	–	-1.31
5-14 (n=242)	0	-.06	-.10	-.21	.60	-.05	1.02	.80
	1	-.26	-.91*	-.66	-.49	-.16	-2.64**	-1.69**
	2	.10	.56	.82	-.06	-.09	1.16	.59
	3	-.17	-.80**	-.47	-.20	-.27	.91	-.87
	4	-.01	.21	.12	.52	-.20	-2.59*	-.22
	Adj R^2	.01	.04	.00	.01	-.02	.02	.01
	Sum	-.40	-1.04	-.40	.37	-.77	-2.14	-.95
15-64 (n=242)	0	.04	-.24	.15	.23	-.13	-.31	-.31
	1	-.08	-.41**	-.50**	.07	-.34	-.77**	-1.06*
	2	.12	.13	-.31	.48	.56	.17	.54
	3	.02	-.14	.26	.14	-.02	-.11	-.41
	4	-.06	.03	-.09	-.31	.17	-.02	.03
	Adj R^2	.05	.03	.02	.04	.00	.02	.02
	Sum	.04	-.63	-.49	.61	.24	-1.04	-1.21
65+ (n=242)	0	-.06	-.45*	.06	.52*	-.17	-.15	-.74*
	1	-.15**	-.03	-.73*	-.46	-.33	-.56**	-.44
	2	.05	.01	.04	.47	.51	.53	.03
	3	-.02	.20	-.11	-.08	.07	-.36	-.07
	4	-.04	-.06	-.07	-.05	.05	.18	-.26
	Adj R^2	.01	.01	.01	-.01	.02	.01	.04
	Sum	-.22	-.33	-.81	.40	.13	-.89	-1.48

* Significant at $p < .05$

** Significant at $p < .01$

Argentina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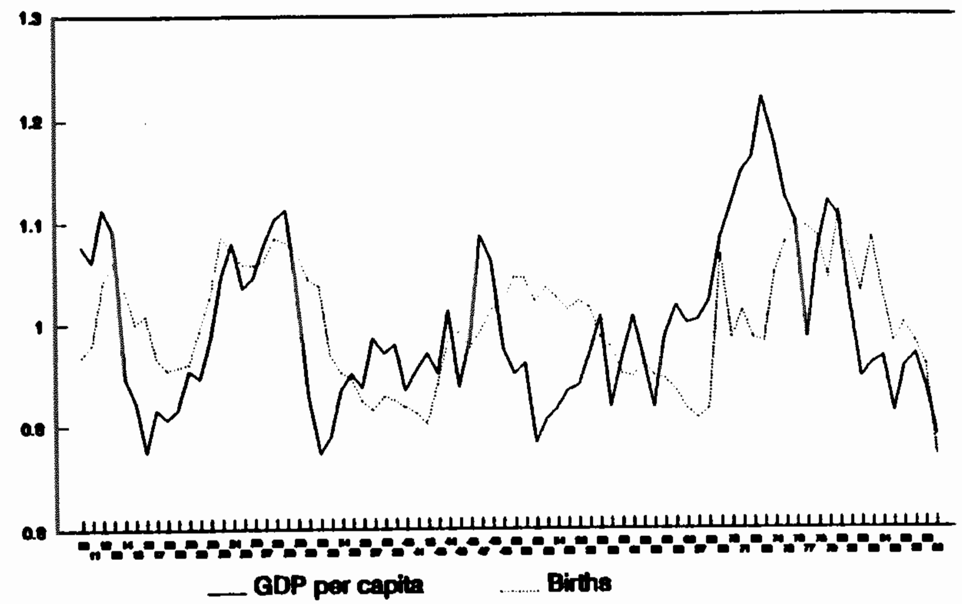
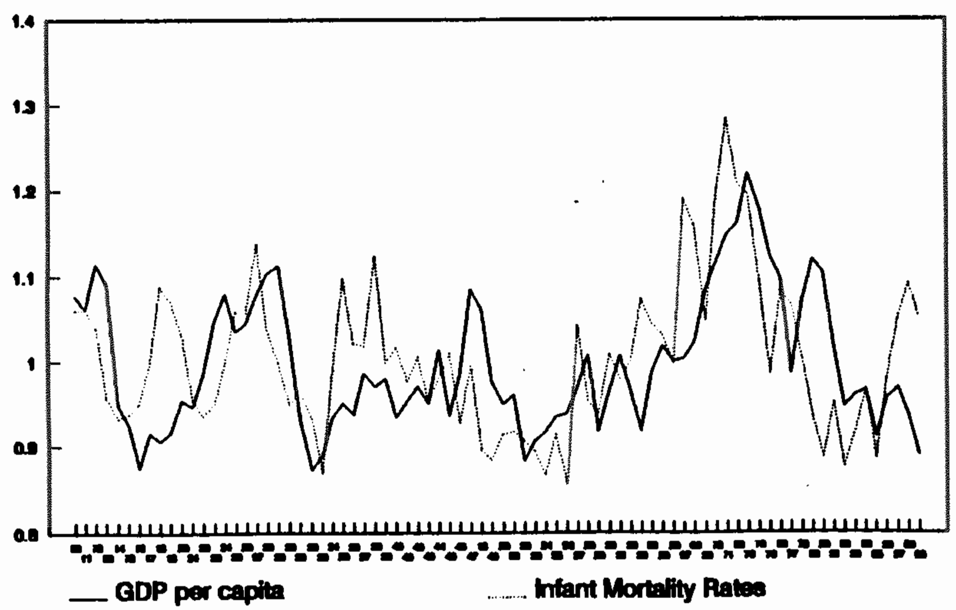
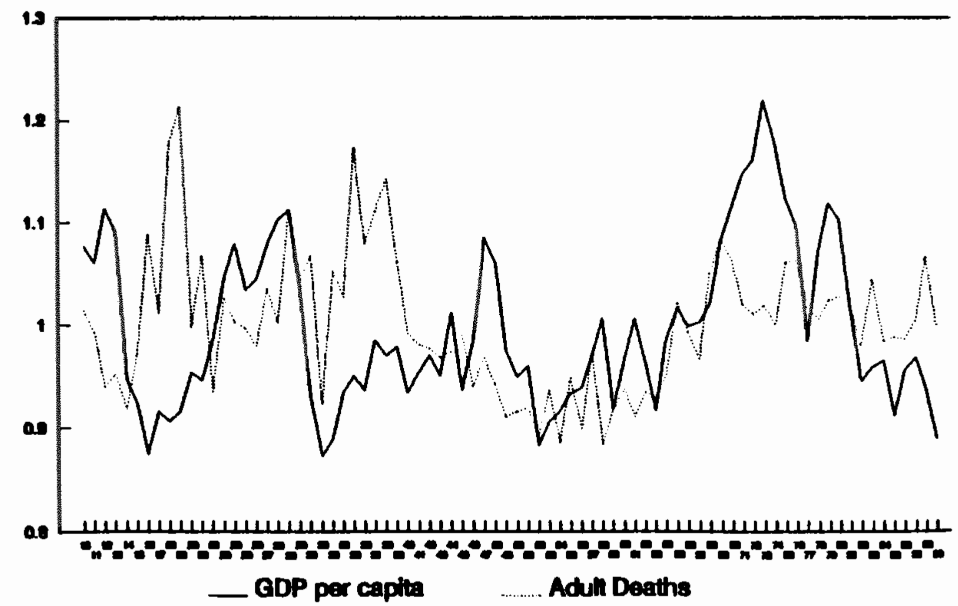
1.2
1.1
1
0.9
0.8
0.7
GDP per capita
Marriages


1.3
1.2
1.1
1
0.9
0.8
GDP per capita
Births


1.4
1.3
1.2
1.1
1
0.9
0.8
GDP per capita
Infant Mortality Rates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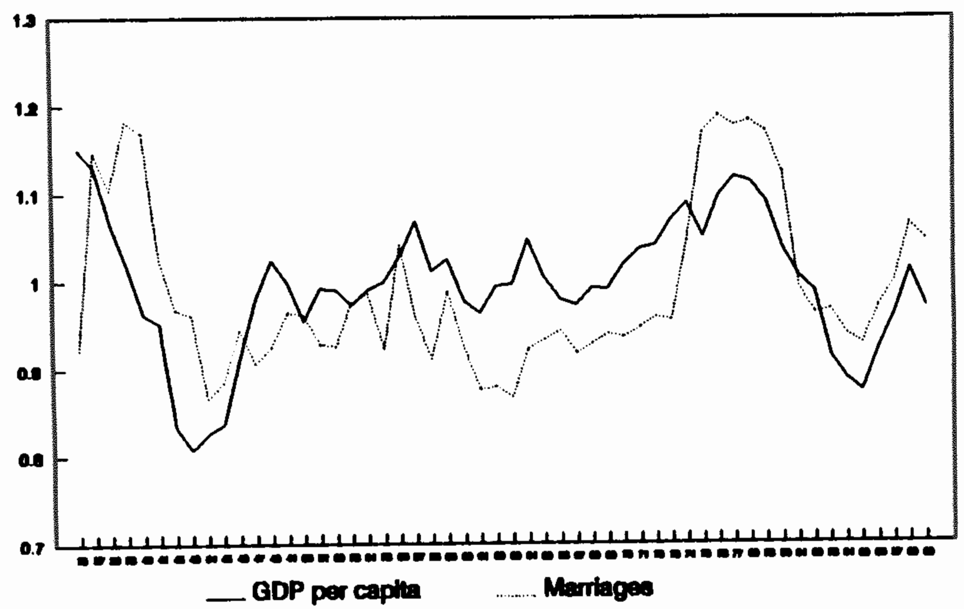
1.2
1.1
1
0.9
0.8
GDP per capita
Adult Deaths

Venezuela



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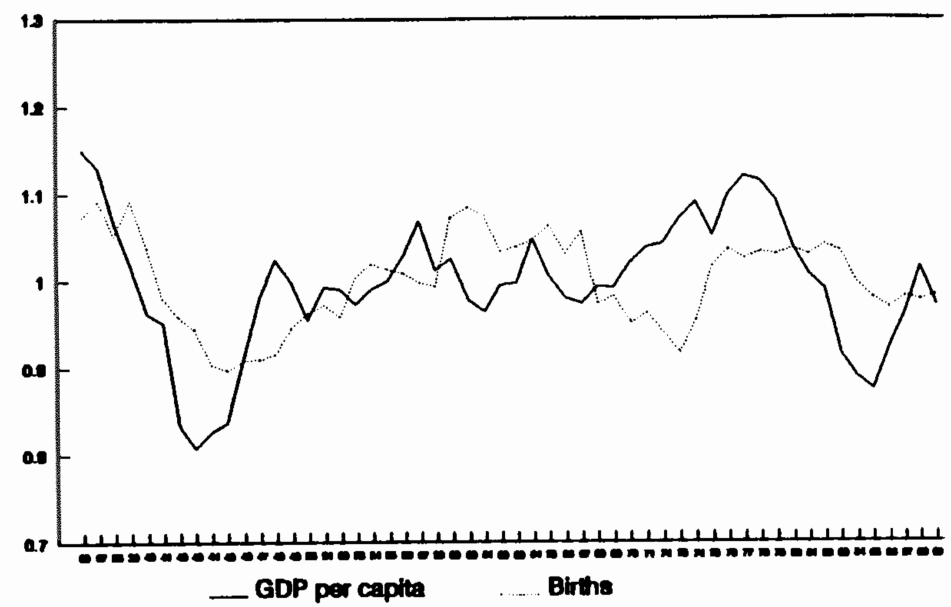
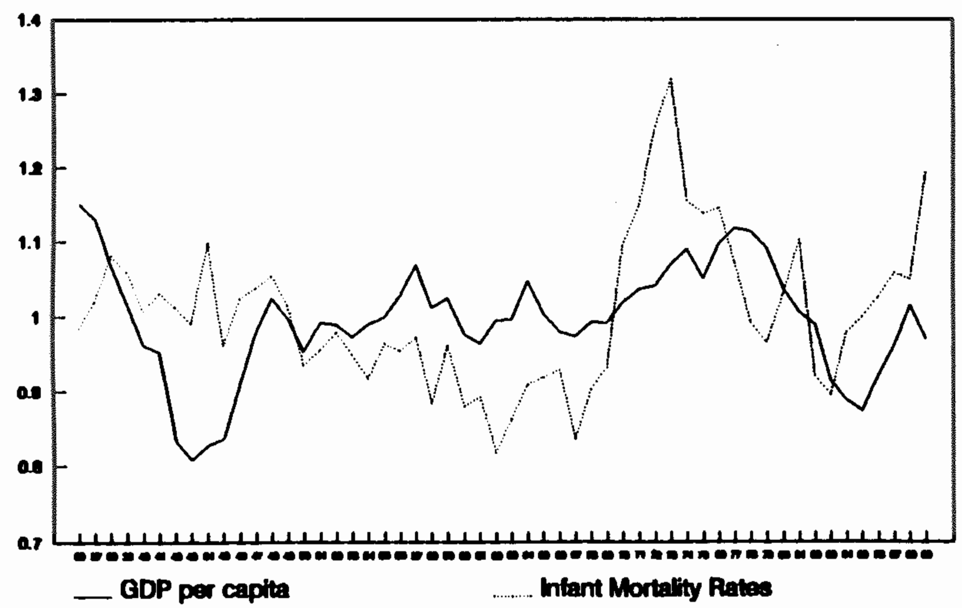
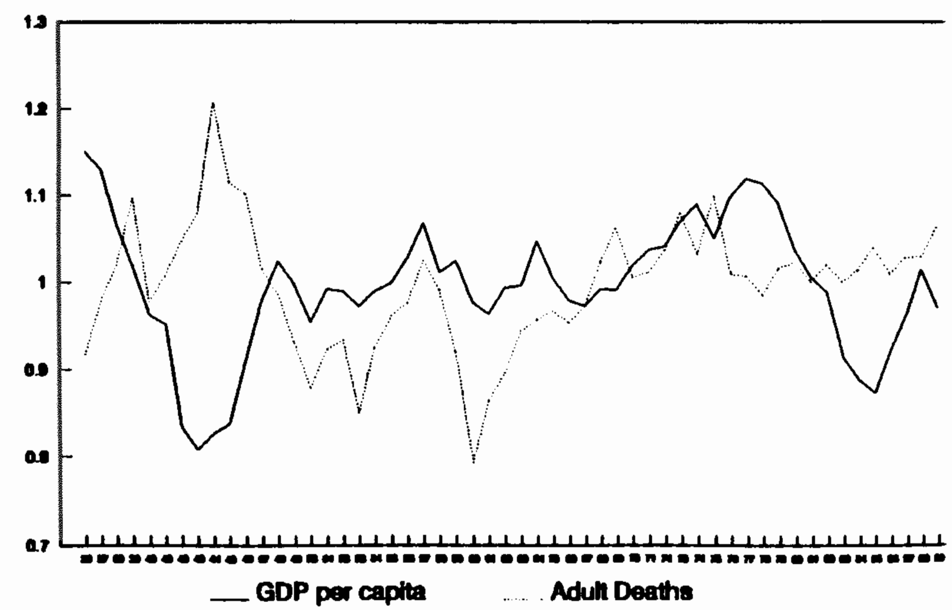
1.2
1.1
1
0.9
0.8
0.7
GDP per capita
Marriages



1.3
1.2
1.1
1
0.9
0.8
0.7
GDP per capita
Births

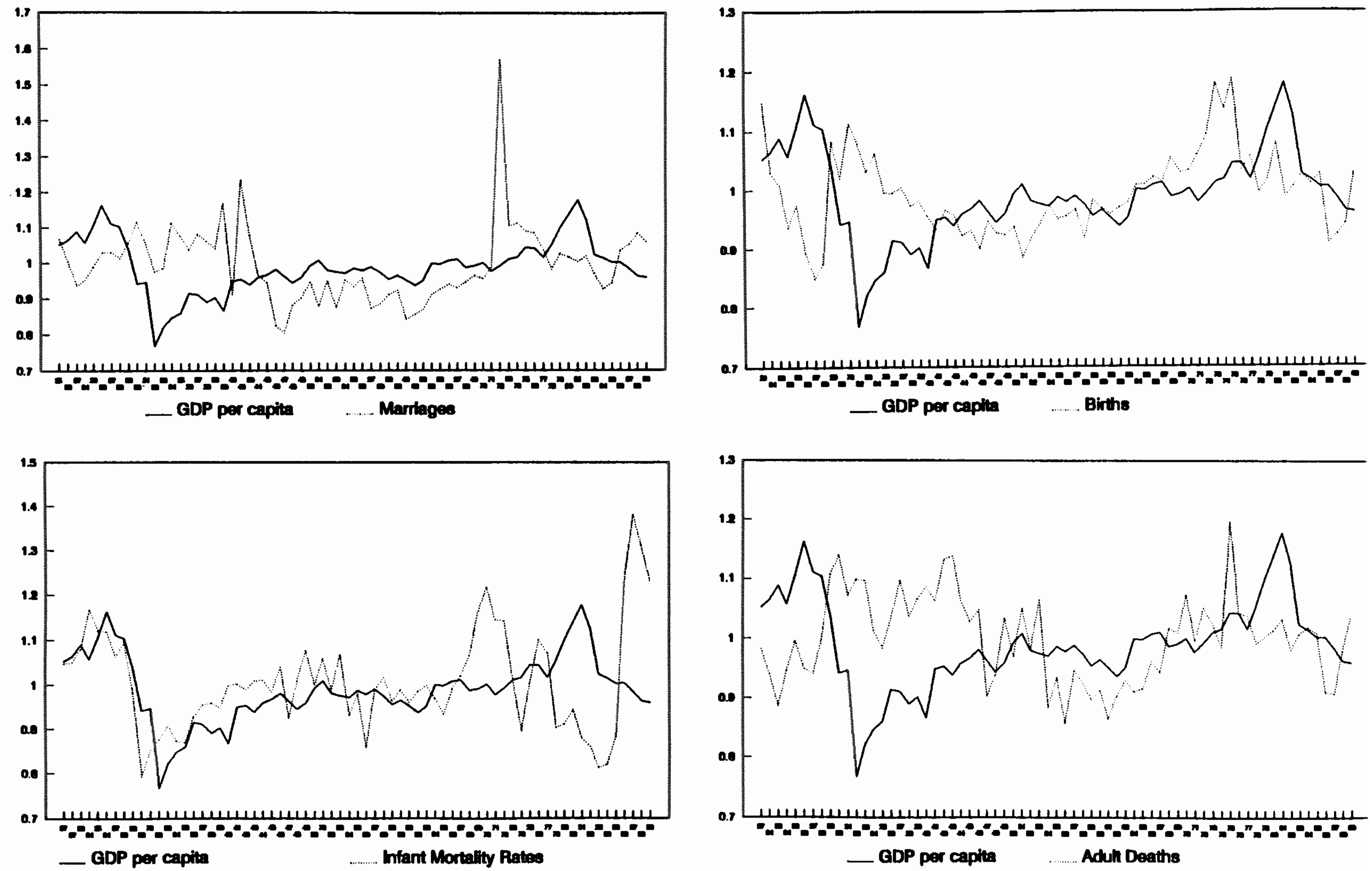


1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
GDP per capita
Infant Mortality Rates



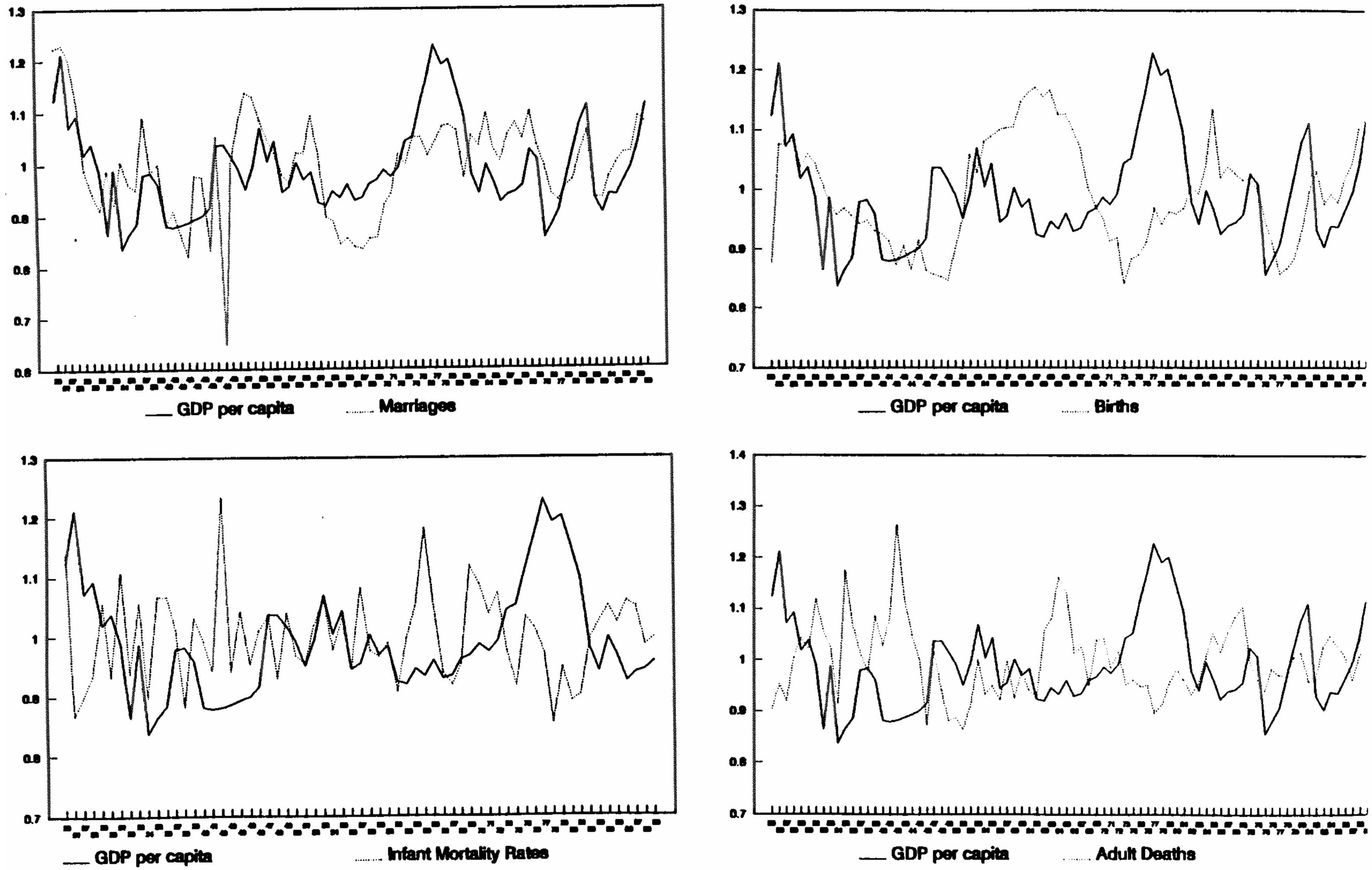
1.3
1.2
1.1
1
0.9
0.8
0.7
GDP per capita
Adult Deaths

Mexico



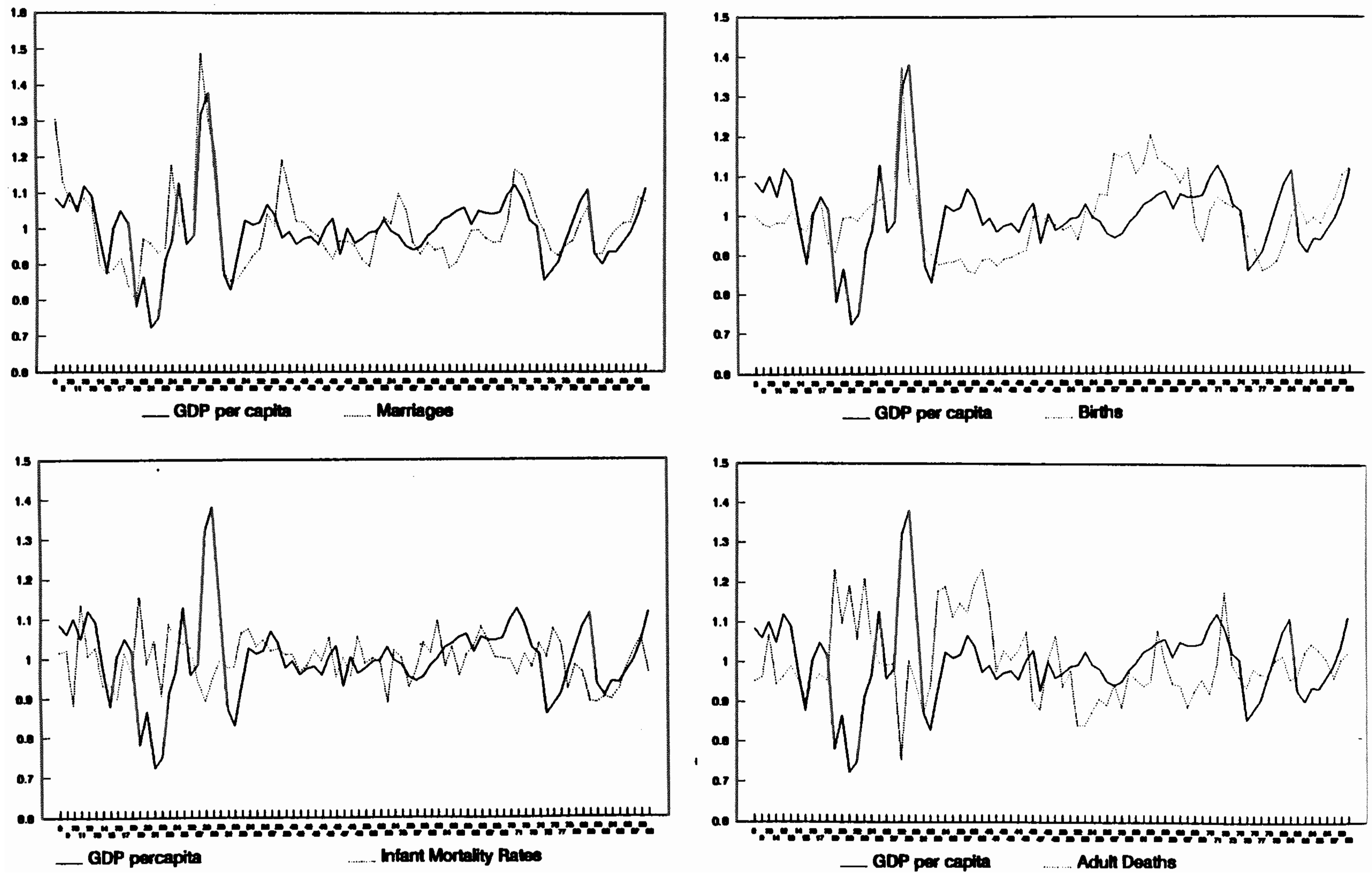
GDP per capita
Marriages
GDP per capita
Births
GDP per capita
Infant Mortality Rates
GDP per capita
Adult Deaths

Costa Rica



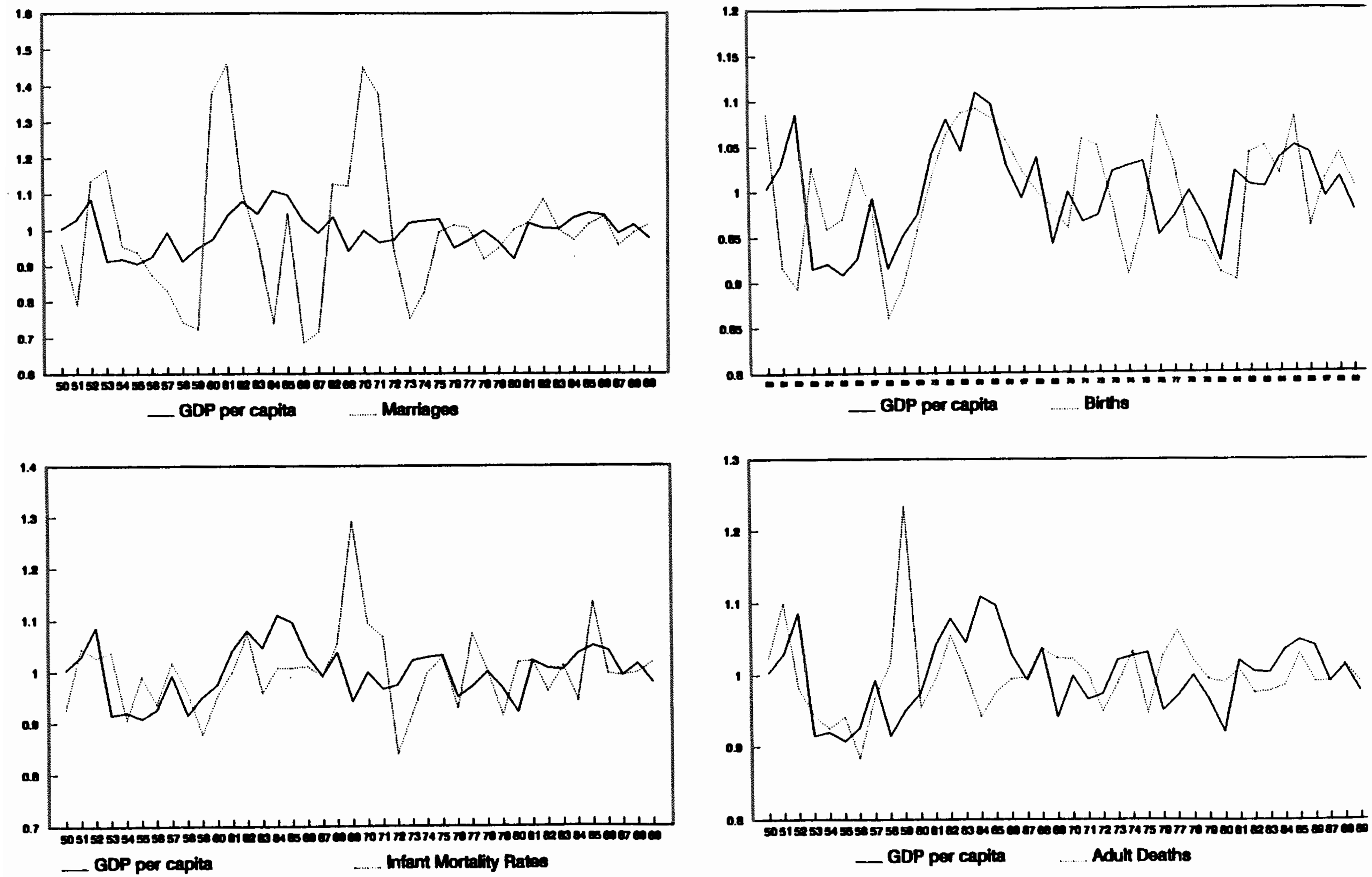
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
GDP per capita
Marriages
1.3
1.2
1.1
1
0.9
0.8
0.7
GDP per capita
Births
1.3
1.2
1.1
1
0.9
0.8
0.7
GDP per capita
Infant Mortality Rates
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
GDP per capita
Adult Deaths

Chile



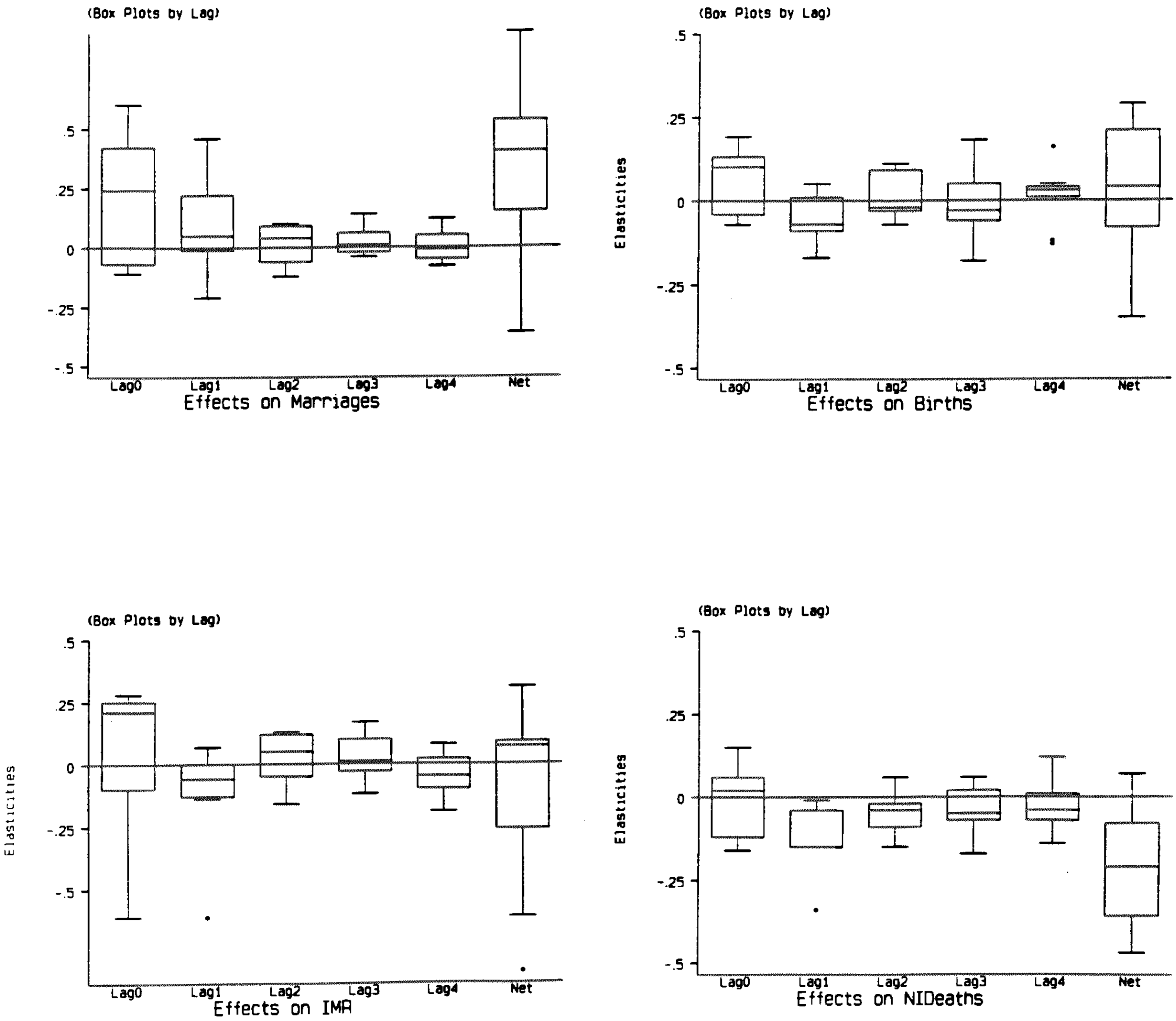
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
GDP per capita
Marriages
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
GDP per capita
Births
GDP percapita
Infant Mortality Rates
GDP per capita
Adult Deaths

Cuba



GDP per capita
Marriages
GDP per capita
Births
GDP per capita
Infant Mortality Rates
GDP per capita
Adult Deaths

Figure 2: Box Plots of Proportionate Effects of GDP on Marriages, Births, Non-infant Deaths (NI Deaths) and Infant Morbidity Rates (IMR)



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