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Are Demographic Variables Unresponsive to Economic Downturns in Developing Countries? The case of 20th century Argentina

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Abstract

Previous research has concluded that mortality and natality did not react in a systematic way to income fluctuations in Latin America during the 19th and 20th centuries. We show in this paper that, at least for the case of 20th century Argentina, this negative result can be attributed to the use of country-wide measures of vital rates. When we consider the responses of vital rates at the provincial level a rich pattern emerges showing that demographic variables are quite sensible to income fluctuations in Argentina during the period of analysis. We find that less developed provinces did experience significant increases in mortality, but only a small decrease in natality, after negative shocks to income per capita; while more developed provinces experienced significant decreases in natality and no change in mortality after these income shocks. This result is robust to transformations of the variables and to different econometric specifications.

Resumen

Estudios previos sobre el tema llegaron a la conclusión de que en América Latina la mortalidad y la natalidad no han reaccionado de forma sistemática frente a las fluctuaciones en el PIB durante los siglos XIX y XX. Nosotros mostramos en este trabajo que, al menos para el caso de Argentina durante el siglo XX, esta conclusión puede atribuirse al uso de estadísticas vitales medidas a nivel de país. Cuando analizamos las respuestas de las tasas vitales frente a las fluctuaciones del PIB a nivel provincial, encontramos una rica gama de respuestas y mostramos que las variables demográficas son sensibles a los cambios en el ingreso en Argentina durante ese período. Luego de un shock negativo al ingreso, en las provincias menos desarrolladas la mortalidad aumenta de manera significativa, pero la natalidad apenas disminuye, mientras que en las provincias más desarrolladas la natalidad disminuye de manera significativa pero la mortalidad permanece inalterada. Este resultado es robusto a trasformaciones en las variables y bajo diferentes especificaciones econométricas.

Introduction

Argentina's real GDP sunk 11.5% during 2002, totaling a decrease of about 20.3% between 1998 and that year. All Argentine provinces were affected; the standard deviation of the 1998-2002 fall in income was 6.9% across the provinces, which indicates that all of them were severely affected by the crisis (Mirabella and Nanni, 2004). The crisis produced, however, a differential reaction of infant mortality across provinces. In the province of Tucumán, especially, infant mortality rate reached an average of 23.4 between 1999 and 2002 from a pre-crisis 1997-1998 average of 19.6; this is an increase of 3.8 mortality points during the crisis. Infant mortality for Argentina as a whole actually *decreased* 2.1 mortality points during the period (INDEC, 2006). It might seem puzzling that an economic crisis that affected the whole country with equal force only affected infant mortality in some regions. This paper shows, however, that Tucumán has historically been prone to react to recessions with significant increases in mortality.

That mortality peaks during economic downturns is reminiscent of the Malthusian "positive checks" that characterized the dynamics of European populations until the 18th century. Malthus thought that these checks to population growth were the only ones which could keep the level of population proportional to its means of subsistence (these means of subsistence were identified with the extension of cultivable land and other natural resources). Less pessimistic thinkers of the time such as Godwin and Condorcet added to these "natural" checks the kind of preventive ones that result from the conscious behavior of couples, like the postponement of marriage or the use of contraceptives. Malthus reluctantly included these "preventive checks" in the second edition of his essay (Stigler, 1952).

Nowadays there is sound evidence of the presence of both of these checks in pre-industrial European populations; and the consensus seems to be that positive checks tend to disappear with economic development, while preventive checks are less sensitive to changes in the economic conditions (Lee, 1981; Galloway, 1988; Nicolini, 2006). The evidence is scarce outside Europe, however. ¿Should we not find the same patterns of population responses in other countries as well? ¿How universal are these population dynamics? Palloni *et al.* (1996) have tested for the existence of these patterns for several Latin American countries using national averages of vital rates, and they have found that the estimated effects were significant only in a handful of cases (and they were not significant for the case of Argentina). Ortega and Reher (1997) have explored the demographic responses to economic fluctuations in Argentina and Chile during the 20th century and did not find any significant statistical pattern;[1] they argue that one of the possible reasons for the lack of significance of their estimations is that these countries are changing the demographic regime during the period of analysis and that the underlying demographic responses are probably not stable across the whole period.

The events of 2002 in Argentina suggest that the adoption of a regional perspective can provide additional insights to clarify the topic. Instead of studying the evolution of country —averages of vital rates— as Palloni *et al.* (1996) and Ortega and Reher (1997) do, we concentrate in their differential behavior across regions. Developing countries in general, and Latin American ones in particular, are typically characterized by large regional differences in standard of living and economic development and thus it is natural to expect large differences in demographic behavior across regions.

The main hypothesis of this paper is that one should focus on regional dynamics in order to fully understand the interactions between economic and demographic behavior in developing countries, especially in Latin America where the national averages usually hide huge disparities across regions. In this paper we thus undertake a complete study of the short-run responses of natality and mortality to aggregate income fluctuations for selected provinces of Argentina for the period 1914-1970.

From a policy-making point of view, the relationship between income fluctuations and demographic variables is important because keeping natality and especially mortality at low levels is a goal of any sensible development policy. The existence of systematic demographic responses to economic crises would thus leave room for the design of preventive actions on the eve of a recession.

The paper is organized as follows. Section 1 shows that Argentine provinces differed greatly in their levels of development and also in their demographic regimes during the period of analysis; provinces with a lower level of economic development (measured by income per capita, infant mortality, literacy, and immigrants as a percentage of total population) were in a less advanced stage of the demographic transition (with higher levels of mortality and fertility rates). The data we use to estimate the demographic responses to income shocks is discussed in detail in Section 2. In Section 3 we explain the methodology used to estimate these responses. Section 4 discusses the main result: during the period of analysis poorer provinces react to economic downturns with a significant increase in mortality, while the richer ones react by changing natality. Section 5 presents the conclusions, and Section 6 lists the relevant bibliography. In this version all Tables and Figures are confined to Section 7 at the end.

[1] The relationship between mortality and income has been extensively studied using cross section regressions. For evidence from 18th and 19th century, see Bengtsson, Campbell, Lee *et al.* (2004). For contemporaneous evidence see Wolpin (1997).

1. Regional Development and Population Dynamics. Argentina, 1914-1970

The customary approach followed in the literature to analyze the interaction between income fluctuations and changes in vital rates is to estimate this relation using the national averages of demographic and economic variables. National averages, however, usually hide the large disparities found across regions in less developed countries. This phenomenon is even more acute in Latin American, the continent with the highest levels of inequality in income and standard of living (De Ferranti *et al.*, 2003).

Income inequality in Latin America is not limited to acute differences in income and wealth between individuals but also between whole regions within countries. The development of Latin American economies until the first half of the 20th century was based on the exports of a rather small set of goods produced in the agricultural and mining sectors. The production of these goods was usually confined to specific regions in each country; these regions experienced rapid economic growth leaving the rest behind (Bulmer-Thomas, 1994). In the second half of the 20th century, many Latin American countries adopted a development policy based on imports substitution; this policy mostly affected the traditional exports sectors negatively, increased the share of government consumption in aggregate demand, and stimulated rural-urban migration. National capital cities generally benefited from these policies and in those cases in which these cities were located in the traditional exporting regions imports substitution policies did not reverse regional differences in economic development but rather they might have further deepen them [See Díaz Alejandro (1970) for the case of Argentina].

In Argentina, the Pampas region was the one that benefited most from both the exports-driven economic growth (1880-1929) and inward-looking industrialization (1940-1974), while the Northwestern and the Western provinces and the Territories remained relatively underdeveloped. The Pampas region comprises the city of Buenos Aires, and the provinces of Buenos Aires, Córdoba and Santa Fé. The traditional Northwestern provinces include Jujuy, Salta, and Tucumán and the Western provinces include San Juan and Mendoza; the Territories (provinces, nowadays) were Chaco and Patagonia. During the last 150 years, therefore, the Pampas region —and particularly the province of Buenos Aires— was the most dynamic region of Argentina, the region where most of the economic activity took place and where the majority of population concentrated; the rest of the regions lurked behind. The Pampas region was also more "European" in the sense that it received most of the European immigrants to Argentina, and with a much higher income per capita than the rest of the country its population, particularly the elites, followed a conspicuous European life-style.

Table 1 shows some statistics which convey a clear idea of the extent of regional differences in development in Argentina in the first half of the 20th century. Table 1 reports statistics on mortality rates, illiteracy, and income per capita for selected provinces of Argentina and the city of Buenos Aires.[2] In 1930 infant mortality rates and illiteracy among voters were more than 100% higher in Tucumán and San Juan than in the city and province of Buenos Aires. By 1960 income per capita in the city of Buenos Aires more than double the income per capita observed in the provinces of Buenos Aires, Santa Fé and Córdoba, and was between 3.6 and 4.6 times higher than income per capita in the provinces of Tucumán and San Juan.

The disparities observed among these provinces in economic development are consistent with the differences observed in their demographics, with the richer ones outpacing the poorer ones in terms of demographic transition.

Figure 1 shows the evolution of crude birth rates (CBR) and crude death rates (CDR) for Argentina as a whole and for the provinces of Córdoba, Santa Fé, Buenos Aires,[3] Tucumán and San Juan between 1914 and 1970 [Elías (1996) y Ministerio de Salud Pública y Medio Ambiente (1983a) y (1983b)].

At the beginning of the period the provinces of Córdoba, Santa Fé and Buenos Aires had already achieved quite low levels of mortality but birth rates were still almost as high as those observed in the rest of the provinces. Between 1914 and 1940 these provinces go through the last stage of their demographic transition and thus experience a strong decline in natality. In the same sub-period birth and death rates remain very large in Tucumán and San Juan, meaning that these provinces are only going through their first stage of demographic transition.

After 1940 the richer provinces experience low and stable levels of both natality and mortality (typical of an after-transition period). The poorer ones —San Juan and Tucumán— enter the last stage of their demographic transition only in the 1950s.

By the end of the period of analysis mortality levels have converged across provinces but birth rates are still much higher in Tucumán and San Juan suggesting that they still had to go through the final steps of their demographic transition.

[2] The reason for selecting these provinces will become clear in Section 2.

[3] For reasons that will also become clear in Section 2, we have taken the city of Buenos Aires and the Province of Buenos Aires as a unique administrative unity and therefore the graph of Buenos Aires corresponds to the union of both.

2. Economic and Demographic Data

In this section we discuss the data we use in our analysis of the short-run responses of vital rates to income fluctuations.

2.1. GDP per capita

For the period of our analysis, 1914-1970, there is no comprehensive and reliable data on income per capita or other economic performance indicators at the provincial level (Garegnani and Di Gresia, 1999). The reason for this lack of data has to do in part with the evolution of Argentina´s political districts. Argentina comprises nowadays 24 provinces and the city of Buenos Aires; some of the provinces are traditional, in the cultural and economic sense, and they were established as administrative units immediately after Independence in 1816; but other provinces' administrative status is more recent as they officially remained Territories administered directly from Buenos Aires until the mid 20th century. Thus, there are some estimations of income per capita or real wages but only for some provinces and periods of time, especially after 1970 (Garegnani and Di Gresia, 1999).

The only source of information on income fluctuations in Argentina for the whole period 1914-1970 is the time series of national GDP per capita (Dornbusch and De Pablo, 1989). Figure 2 shows the evolution of Argentina's (log) GDP from 1914 to 1970. Fluctuations in provincial GDP per capita would mirror income per capita fluctuations at the national level if the correlation between the cyclical components of national and provincial GDPs were sufficiently high. In fact this is generally assumed in previous approaches trying to evaluate the impact of structural change on demographic behaviour (Palloni *et al.* 1996; Bravo, 1997; Ríos Neto and Magno de Carvalho, 1997). Of course, since time series for provincial GDPs are unavailable until 1970, it is impossible to test if this condition holds for the period of our analysis.

It is possible to compute the correlation between the national and the provincial GDPs after 1970, however. Under the assumption that the correlation between national and provincial GDPs in the period 1970-1995 was similar to that of the period 1914-1970, it is possible to asses how good is national GDP as an indicator of the welfare in the different provinces for the whole twentieth century.

Garegnani and Di Gresia (1999) analyze the correlation between the cyclical components of national and provincial GDPs for the period 1970-1995 and they classify the provinces in three groups according to the size of correlation coefficients: *i)* provinces with high correlation coefficients (more than 0.75); *ii)* provinces with intermediate values of the correlation coefficients (between 0.4 and 0.75); and *iii)* those provinces with low correlation (less than 0.4).

Garegnani and Di Gresia (1999) identify five provinces and the city of Buenos Aires as the districts where income per capita fluctuations are highly correlated with fluctuations in national GDP per capita. The correlation coefficients are 0.91 for the city of Buenos Aires; 0.96 for the province of Buenos Aires; 0.92 for the province of Córdoba; 0.91 for the province of Santa Fé; 0.82 for the province of Tucumán, and 0.75 for the province of San Juan.

We adopt Garegnani and Di Gresia (1999) classification and consider this group of high-correlation districts as the one for which local income fluctuations mirror the fluctuations in national income. Therefore, we have 6 regions or districts for which we can test the hypothesis that vital rates react to income fluctuations.[4]

2.2. Vital rates

As it was discussed in the previous section and shown in Table 1 and Figure 1, these provinces are characterized by different levels of economic development and demographic regimes during the period of our analysis; this is an essential feature of the data if we want to test the hypothesis that demographic responses to income fluctuations differ across demographic regimes.

The vital rates shown in Figure 1 were computed using data on live births and total deaths from Ministerio de Salud Pública y Medio Ambiente (1983a and 1983b) and population data from Elías (1996).

As advanced in footnote 3, we consider the city and the province of Buenos Aires as a unique district when computing the vital rates. As most of the population of the province of Buenos Aires lives in the Buenos Aires metropolitan area —less than 80 km away from Buenos Aires downtown— the data on birth and death rates for these two districts taken separately do not capture the true evolution of natality behavior there. Many people choose to have their children born in the city hospitals rather than in the provincial hospitals and since birth events are counted as occurring in the district where the hospital is located then we conclude that the city and province of Buenos Aires have to be considered as a single demographic unit of analysis.

3. The Empirical Model

3.1. Preliminary time series analysis

To estimate the short-run interaction between our economic and demographic time series we must first determine their long-run stochastic properties. In particular, we need to establish whether the series are stationary or not; and

[4] This is the reason for which we have selected these provinces to be included in Table 1.

if they are not so then we need to determine the order of integration that they have.

After applying the Augmented Dickey Fuller test (ADF) we cannot reject that twelve of the thirteen series involved have a unit root.[5] Therefore, we analyze the short-run interaction among the variables using the first differences of the time series.[6]

An alternative approach would be to assume that the time series have a deterministic trend and compute and work with the deviations from that trend. As many authors have chosen this latter approach (*e.g.* Palloni *et al.* 1996) we estimate our regressions using both the first-differences and the detrending procedures, and check for the robustness of our results.

3.2. Exogenous variables and direction of causality

3.2.1. Distributed lags (DL) model

In order to capture the dynamic response of vital rates to income shocks distributed lags models have traditionally been estimated (Lee, 1981; Galloway, 1988; Palloni *et al.*, 1996). In these models it is assumed that income (y_t) is exogenous and the vital rates are endogenous. Hence, the empirical models in the distributed lags specification take the form $b_t = \sum_{i=1}^{p} y_{t-i} + \varepsilon_t$ for the regression of crude birth rates (CBR) on income; and $d_t = \sum_{i=1}^{p} y_{t-i} + v_t$ for the regression of crude death rates (CDR) on income; and where ε_t and v_t are the series of uncorrelated errors in each regression equation. In these models b_t, d_t and y_t are either the deviations from the trend or the first-differences of the original time series.

The assumption usually made in distributed lag models that lag values of one variable are exogenous when estimating the responses of the others, does not seem realistic in this context because the interactions between economic and demographic variables are complex and the direction of causality is not obvious (Lee and Anderson, 2002; Nicolini, 2006). That is, although most of

[5] The 13 series are national GDP, national Crude Birth Rate (CBR), Crude Death Rate (CDR), and the series of CBR and CDR for the five selected provinces. The only series in which the null hypothesis of a unit root is rejected is Buenos Aires' CBR. However, the KPSS test (in which the null hypothesis is stationarity) does reject the null hypothesis. Given these results we have preferred to treat the series of Buenos Aires' CBR as having a unit root. The results of the test are available under request.

[6] The characterization of the variables as I (1) introduces the possibility of a model of cointegration to estimate long run relationships together with short run responses (for a introduction in cointegration see Dolado, Gonzalo and Mármol (2000), for an application of this methodology to study demographic and economic interactions, see Bailey and Chambers (1993)). This approach will make the comparison with previous estimations less straightforward and is beyond the scope of this paper.

the empirical models trying to asses short-run interactions do assume that income per capita is not a function of demographic variables (*e.g.* Lee, 1981; Galloway, 1988; Palloni *et al.*, 1996; Ortega and Reher, 1997), there are a number of reasons to believe that certain demographic shocks might affect income per capita; *e.g.* an increase in population —due to a decline in mortality or an increase in natality— can produce a decline in production per capita if the production technology is characterized by strong diminishing marginal returns to labor like in a traditional agricultural society.[7]

3.2.2. Vector Autoregression (VAR) model

To take into account all the possible interactions between the variables involved in the empirical analysis a Vector Autoregression approach can be followed. In VAR models there is no need to decide a priori which variables are endogenous or exogenous, as the procedure has been devised precisely to determine causality.

Let $Z_t = [b_t, d_t, y_t]'$ be the vector of variables in the model at time t. These stationary (either detrended or differenced) variables are the crude birth rate (CBR), b_t, crude death rate (CDR), d_t, and income per capita, y_t. Vector Z_t is then assumed to follow a dynamic process that can be described with a vector autoregression model

$$(2) \qquad A_0 Z_t = \sum_{j=1}^{p} A_j Z_{t-j} + u_t$$

Where $A_j, j = 0,1,\ldots,p$ are $3x3$ matrices.

The vector u_t is the vector of error terms, which captures the annual unexplained or surprise movement in each variable. We interpret these error terms as unobserved uncorrelated random shocks, so that the variance - covariance matrix of the u's is the identity matrix; i.e. $E(u_t u_t') = I$.

Direct estimation of the matrices $A_j, j = 0,1,\ldots,p$ from (2) is not possible because the system is not identified. It is possible, however, to rewrite the VAR as:

$$Z_t = \sum_{j=1}^{p} \Phi_j Z_{t-j} + e_t$$

With $E(e_t e_t') = \Omega$ is a $3x3$ matrix. In this case a consistent estimation of Φ and Ω can be obtained through an equation-by-equation OLS regression.

The usual way to present the results from a VAR estimation is to display the Impulse Response Functions (IRF) that trace the effect of a change in u_t on Z_t over time; *i.e.* the IRF depicts the response of each variable in the vector Z

7 For a debate of the interactions between demographic and economic variables see Eckstein et al. (1986), Nicolini (2006) and Lee (1997).

to an exogenous shock in the other variables of the model. To calculate the IRF it is necessary to combine information from Φ and Ω.

The usual approach to calculate the IRF is to define a priori the timing of shocks affecting the variables in Z_t by assuming that some variables cannot react contemporaneously (that is, at $t = 0$) to shocks in a subset of the others (Sims, 1980). For instance, it is possible to assume that no variable is responsive to shocks in the other ones within the same period (Eckstein *et al.,* 1986); or that birth rates are unresponsive to shocks in both mortality and income per capita within the same period (Nicolini, 2006). This approach —which in practice implies that a given ordering of the variables within the vector Z_t — must be assumed, is never completely beyond dispute.

Pesaran and Shin (1997) suggested improving this traditional approach by estimating Generalized Impulse Responses Functions (GIRF). The advantage of GIRF is that IRF are invariant to the reordering of the variables and fully take into account the historical patterns of correlations observed amongst the different shocks; i.e. with this approach it is possible to estimate the response of each variable to shocks in the others without assuming that a subset of the variables remains unaffected by the shock.

4. Results

4.1. Results from VAR specifications

Figure 3 shows the birth rate (CBR) and death rate (CDR) responses to a shock in national GDP per capita for Argentina as a whole, and for the provinces of Buenos Aires, Santa Fé, Córdoba, San Juan, and Tucumán. These impulse-response functions were estimated using a VAR specification with variables in first-differences.

For the case of Argentina as a whole neither preventive nor positive check are statistically significant. The shape of the CBR impulse-response function is the expected one but the magnitude of the response is not significant; the positive response of CDR after a shock in income is unexpected but insignificant. These findings coincide with previous literature and are thus not surprising.

CBR and CDR do response significantly to income shocks at the provincial level and the magnitude and sign of the responses depend on the level of development of the province.

For the more developed provinces —Buenos Aires, Córdoba and Santa Fé— we find a positive reaction of CBR to income per capita shocks. The response is statistically significant at particular years: in the second and the fourth year after the income shock for the case of Córdoba, and in the third year after the shock for the case of Buenos Aires; the positive response of CBR observed in Santa Fé in the fourth year after the shock is not significant, however. We do not find any significant response of CDR to the income shock in these provinces.

For the less developed provinces of San Juan and Tucumán we do not find significant evidence of a response, either positive or negative, of CBR to national income per capita shocks. CDR's responses to income shocks are also insignificant in San Juan, but we find a significant decline of CDR in Tucumán three years after the income shock.

Figure 4 shows the impulse-response functions when the VAR specification is estimated for the variables defined as deviations from a polynomial deterministic time trend. Under this definition of the variables the responses tend to be significant for more periods in most regressions; the pattern found above of preventive checks characterizing the demographic behavior of more developed provinces and of positive checks that of the less developed ones is further confirmed in this model.

A surprising result is that for this specification both positive and preventive checks are significant for Argentina taken as a whole. The positive effect of an income shock on CBR persists for six years; reaching a peak in the fifth year; while CDR significantly declines in the third year after the shock.

For none of the more developed provinces do we find an impact of income shocks on CDR. Regarding preventive shocks, CBR's responses to income shocks in the more developed provinces are stronger and more persistent under this specification.

For the case of Buenos Aires the positive effect on CBR persists for six years, with a peak in the third year after the shock. A similar pattern is found in Córdoba but with two peaks: in the second and fourth years after the shock. For the case of Santa Fé we now clearly find a significant and positive effect in the fourth and fifth year after the shock.

A positive and significant response of CBR is also found in the less developed provinces of Tucumán and San Juan; with the latter displaying a pattern similar to that found for the case of Argentina as a whole, and the former just evidencing a small but significant response six years after the shock. More importantly, in both cases we find a significant negative response of CDR to the income shock three years later, with the greatest impact found in Tucumán.

4.2. Results from DL specifications

The second set of models that we estimate are Distributed-Lags (DL) models. As was the case with VAR models, we estimate two versions: DL models with variables in first-differences and DL models with detrended variables.

Table 2 shows the signs and significance of the coefficients of the CBR and CDR regressions at different lags; cells left in blank indicate an insignificant effect of income shocks at those lags. As can be observed, statistically significant positive responses of CBR to GDP per capita shocks are only found in the more developed provinces of Buenos Aires, Córdoba, and Santa Fé; and that statistically significant negative responses of death rates are only found in Tucumán, thus confirming the pattern found in the estimations with VAR models.

A richer pattern of statistically significant effects is found when we switch from models with variables in first-differences to models with detrended variables, as was the case in the previous section with VAR models.

The results from the estimation are shown in Table 3. Argentina as a whole is found to be characterized by both preventive and positive checks are statistically significant only at 10%. The positive and strong response of CBR in the more developed provinces remains unaltered, with the unexpected exception of Santa Fé; and no response of CDR to income shocks is found in these more developed provinces.

San Juan demographic regime is found to be characterized by preventive checks but no trace of positive ones is found there; while for the case of Tucumán only evidence of positive checks is found.

The demographic responses of Argentina as a whole are an average with a strong influence of Buenos Aires. When the response of a given demographic variable to an income shock is weak in Buenos Aires and insignificant in the other developed provinces, the national average is not significant. The decline in deaths rates in Tucumán following a positive shock in income per capita seems to be reflected in the national average, although Tucumán a small province. Indeed, if there is no response of death rates to income shocks elsewhere, what it is happening in Tucumán —and in other provinces with a similar pattern of death rates responses— should be reflected at the aggregate level.

Conclusions

Previous research on the topic has concluded that demographic variables did not react systematically to income fluctuations in Latin America. We show in this paper that, at least for the case of 20th century Argentina (1914-1970), this negative result can be attributed to the use of country-wide measures of vital rates. When one considers the responses of vital rates at the provincial level a rich pattern emerges showing that demographic variables are quite sensible to income fluctuations in Argentina during the period of analysis.

Evidence from pre-industrial Europe suggests that we should expect different patterns of interaction between demographic and economic variables at different stages of both economic development and the demographic transition. Argentina, as most developing countries, is characterized by large regional disparities in income and population dynamics. This has been the motivation for our taking the analysis of demographic responses to income shocks to the provincial level.

Our main finding is that in the more developed provinces the adjustment of the population to economic shocks is achieved mainly through changes in birth rates, while in the less developed provinces it is achieved through changes in death rates. This differential pattern of responses across levels of development is similar to the one found for pre-industrial European populations. Our results are robust to transformations of the variables and to different econometric specifications.

The implications of these results are twofold. First, future research on this topic for developing countries should focus on the population dynamics at the regional level. Second, if preventing mortality crises is in the agenda of policy-makers in developing countries, our results provide compelling reasons for designing specific preventive plans to avoid mortality upsurges during economic recessions; in particular, our results should be taken into account by all those involved in health, population, and development programs operating in poor countries. Admittedly our findings might seem obvious to many practicing development professionals, but they are not so to the scientific community and thus constitute an improvement upon what we had up to now.

A deeper analysis of the underlying causes of these dynamics and a more complete research of their regional pattern in other developing countries and in particular in Latin America constitute the most obvious agenda for further research.

Tables and Figures

TABLE 1: ARGENTINE DEVELOPMENT INDICATORS IN THE FIRST HALF OF THE 20TH CENTURY

	Total Mortality Rate (a) (1925-1930)	Infant Mortality Rate (b) (1925-1929)	Illiteracy Among Voters (c) (1930)	Income per Capita (d) (1959)
City of Buenos Aires	13	78	3	9406
Buenos Aires	11	99	17	3815
Santa Fe	16	114	19	3516
Córdoba	12	135	28	3180
Tucumán	23	170	37	2603
San Juan	22	229	35	2035

Source: Díaz Alejandro (1970) and Elías (1996); a) per thousand population; b) per thousand born alive; c) percentage; d) 1995 Argentine pesos.

FIGURE 1. DEMOGRAPHIC TRANSITION IN SELECTED PROVINCES OF ARGENTINA

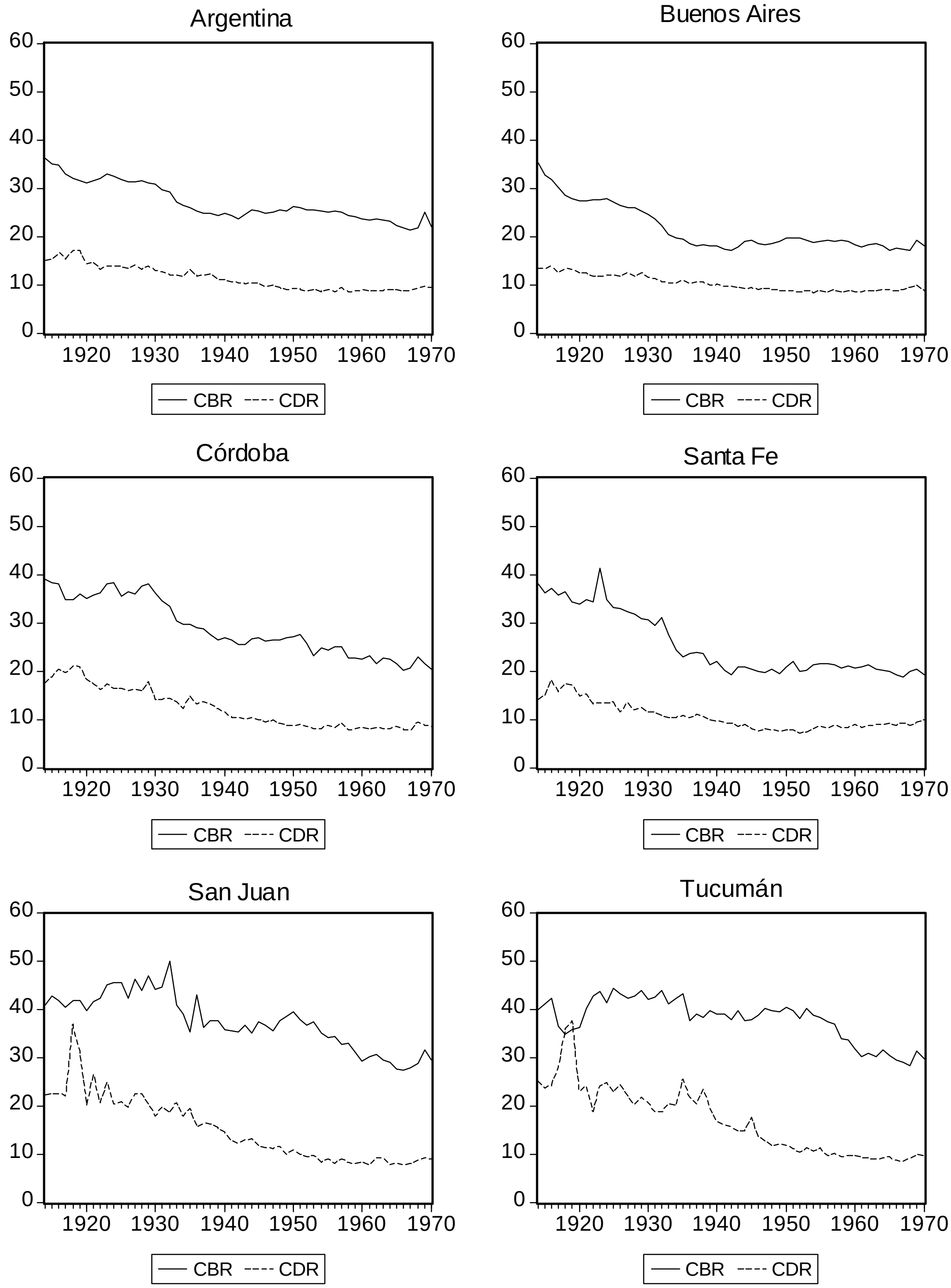


FIGURE 2. GDP PER CAPOTA OF ARGENTINA (LOG SCALE)

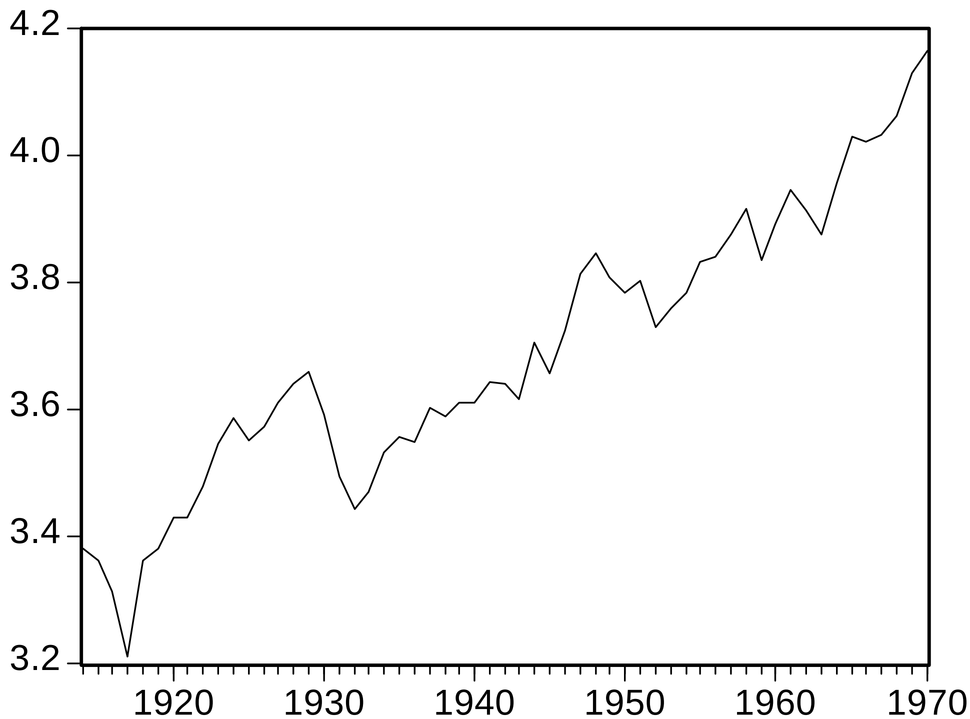
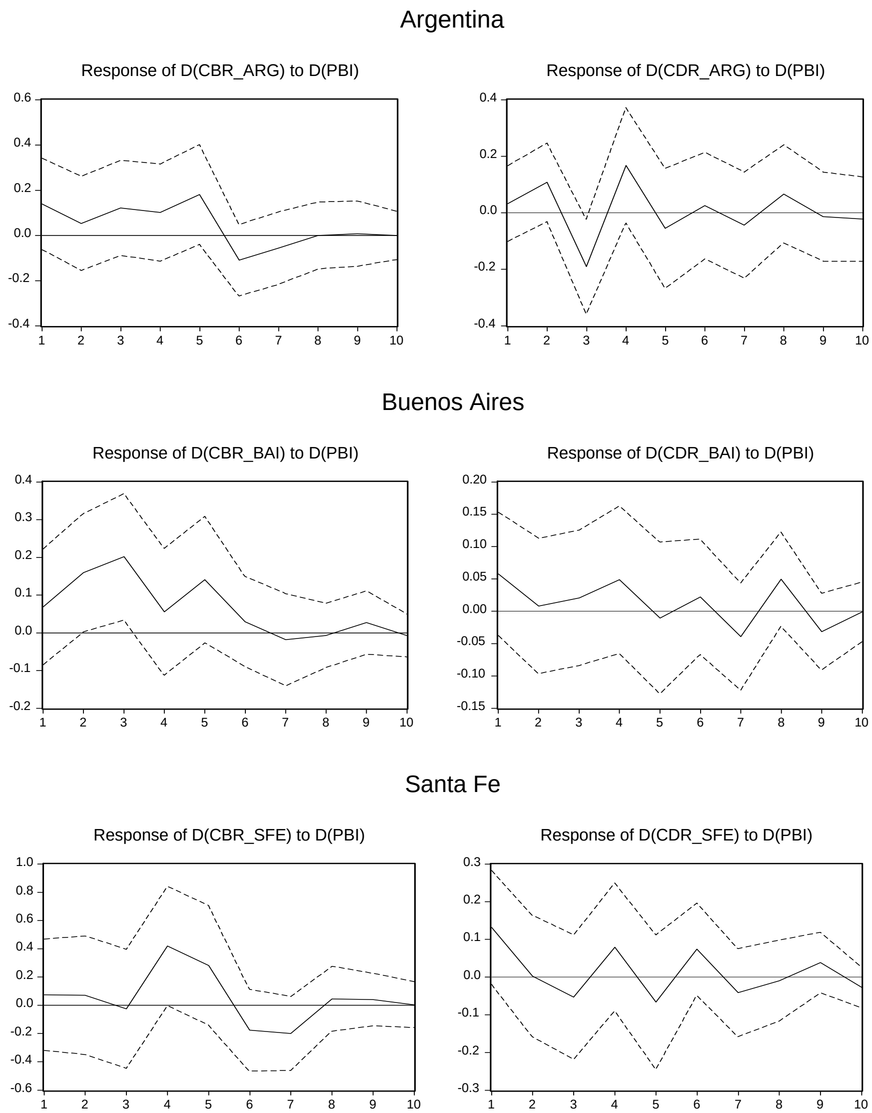
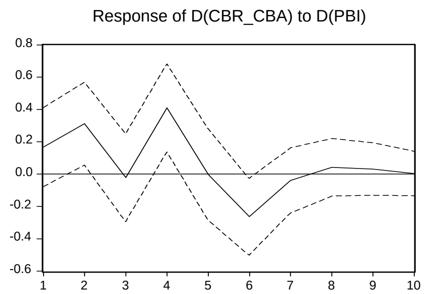
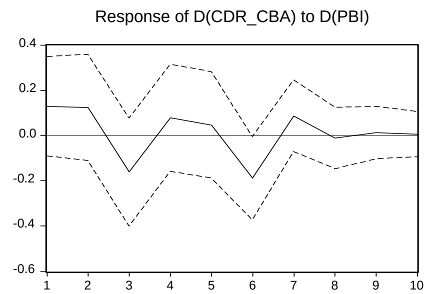


FIGURE 3: IMPULSE-RESPONSE FUNCTIONS FROM VAR MODELS WITH VARIABLES IN FIRST-DIFFERENCES



Cordoba





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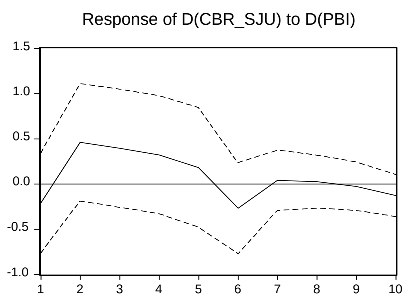

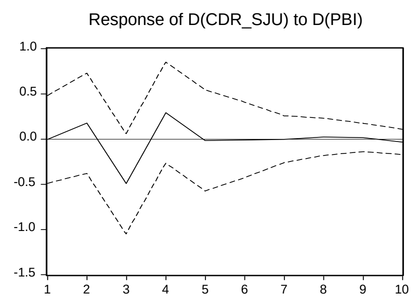

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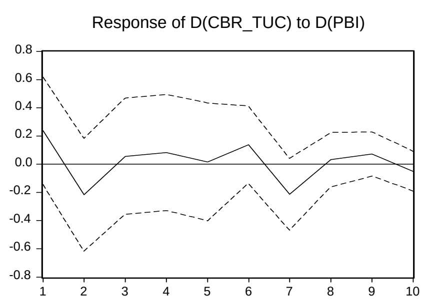


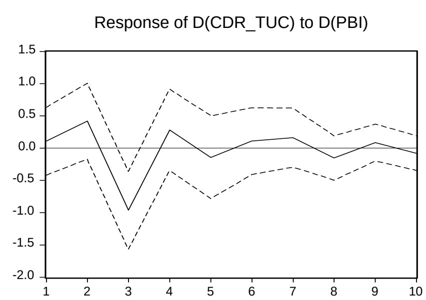
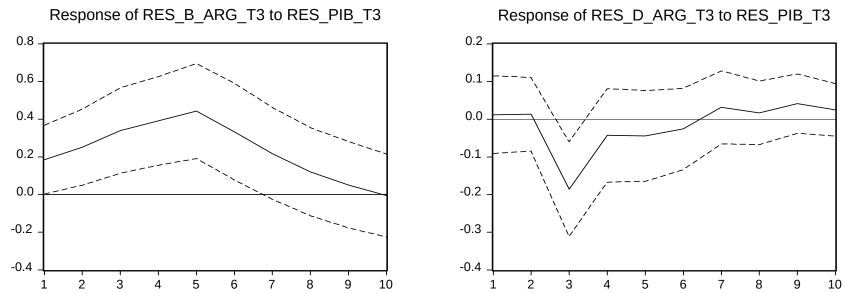
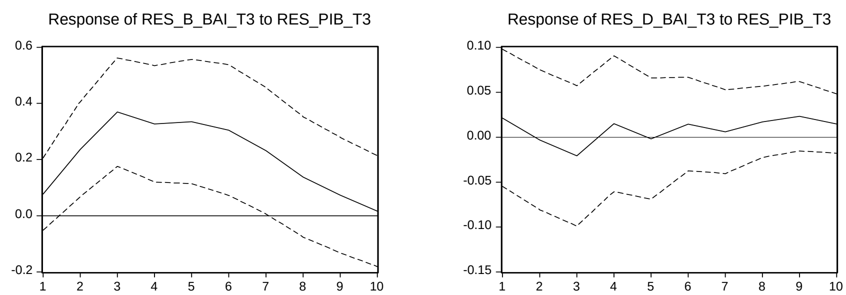


FIGURE 4: IMPULSE-RESPONSE FUNCTIONS FROM VAR MODELS ASSUMING DETERMINISTIC TRENDS

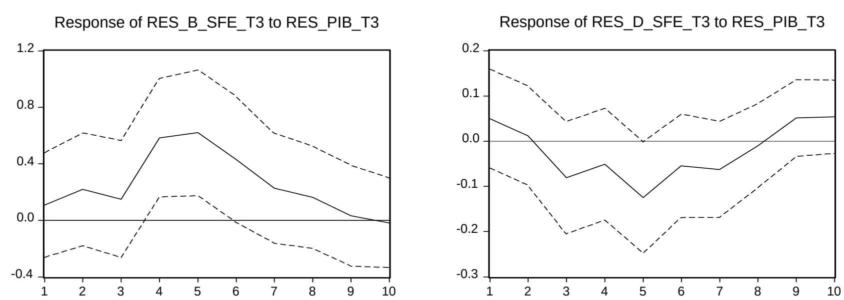
Argentina



Buenos Aires



Santa Fe



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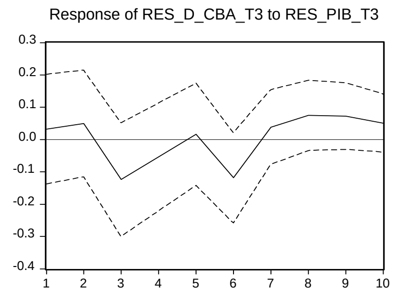
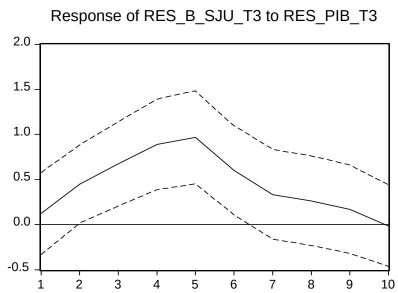
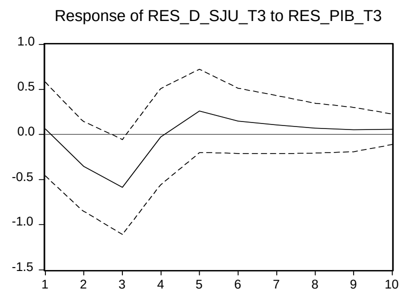


San Juan





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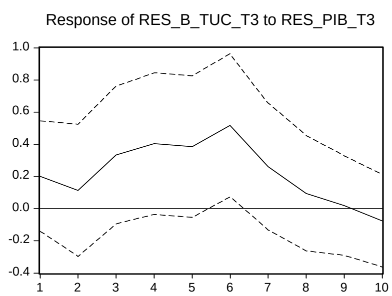

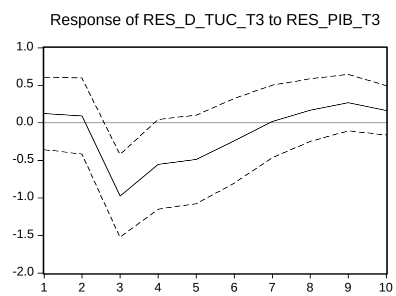

TABLE 2: SIGN AND SIGNIFICANCE OF THE COEFFICIENTS OF THE CBR AND CDR REGRESSIONS ON INCOME AT DIFFERENT LAGS IN A DL MODEL WITH VARIABLES IN FIRST-DIFFERENCES

	Birth Rates (CBR)				Death Rates (CDR)			
	Lag 1	Lag 2	Lag 3	Lag 4	Lag 1	Lag 2	Lag 3	Lag 4
Argentina								
Buenos Aires	+ (**)	+ (**)		+ (**)				
Santa Fe			+ (*)					
Córdoba	+ (*)		+ (***)					
San Juan								
Tucumán							– (**)	

Levels of confidence: * 10 %, ** 5 %, *** to 1 %.

TABLE 3: SIGN AND SIGNIFICANCE OF THE COEFFICIENTS OF CBR AND CDR REGRESSIONS ON INCOME AT DIFFERENT LAGS IN A DL MODEL ASSUMING DETERMINISTIC TRENDS

	Birth Rates				Death Rates			
	Lag 1	Lag 2	Lag 3	Lag 4	Lag 1	Lag 2	Lag 3	Lag 4
Argentina	+ (***)			+ (**)		– (*)		
Buenos Aires	+ (***)	+ (*)		+ (**)				
Santa Fe								
Córdoba	+ (***)		+ (***)					
San Juan	+(**)		+(**)					
Tucumán						– (**)		

Levels of confidence: * 10 %, ** 5 %, *** to 1 %.

References

Bailey, R. E. and M. J. Chambers (1993): "Long-term demographic interactions in Precensus England", *Journal of the Royal Statistical Society* 156, Part 3, 339-362.

Bengtsson, Tommy, Cameron Campbell and James Z. Lee *et al.* (2004): *Life Under Pressure. Mortality and Living Standards in Europe and Asia, 1700-1900*, MIT Press, Cambridge, Massachusetts.

Bravo, Jorge (1997): "Demographic Consequences of Economic Adjustment in Chile" in Tapinos *et al.* (eds.): *Demographic Responses to Economic Adjustment in Latin America*, Clarendon, Oxford.

Bulmer Thomas, Victor (1994): *The economic history of Latin America since Independence*, Cambridge University Press, Cambridge.

De Ferranti, David, Guillermo E. Perry, Francisco H. G. Ferreira and Michael Walton (2003): *Inequality in Latin America and the Caribbean. Breaking with History?,* World Bank, Washington D.C.

De Pablo, Juan Carlos and Rudi Dornbusch (1988): *Deuda externa e inestabilidad macroeconómica,* Editorial Sudamericana, Buenos Aires.

Díaz-Alejandro, Carlos F. (1970); *Essays on the economic history of the Argentine Republic*, Yale University Press, New Haven.

Dolado, Juan J., Jesús Gonzalo y Francesc Mármol (2000): "Cointegration" in Baltagi, Badi H. (ed.): *A companion to theoretical econometrics*, Blackwell, Oxford.

Eckstein *et al.* (1986): "Short Run Fluctuations in Fertility and Mortality in Pre-industrial Sweden", *European Economic Review* 26, 295-317.

Elías, Víctor J. (1996): *Informe sobre la economía de Tucumán,* Fundación del Tucumán, Tucumán, Argentina.

Galloway, Patrick R. (1988): "Basic Patterns in Annual Variations in Fertility, Nuptiality, Mortality and Prices in Pre-industrial Europe", *Population Studies*, 42, 275-303.

Garegnani, María Lorena and Luciano Di Gresia (1999): "Relación entre ciclo económico regional y nacional, 1961-1995", *Anales de la Asociación Argentina de Economía Política*, Buenos Aires.

Instituto Nacional de Estadísticas y Censos, INDEC (2006): Estadísticas en línea, www.mecon,indec.gob.ar, Buenos Aires.

Lee, Ronald Demos (1981): "Short Term Variation: vital rates, prices and weather" in Wrigley and Schofield: *The Population History of England, 1541-1871. A reconstruction*, Arnold, 357-401.

Lee, Ronald Demos (1997): "Population Dynamics: Equilibrium, Disequilibrium, and Consequences of Fluctuations" in Rosenzweig, Mark R. and Oded Stark (eds.): Handbook of Population and Family Economics, Volume 1B, Elsevier, Amsterdam, 1063-1116.

Lee, Ronald Demos and Michael Anderson (2002): "Malthus in State Space: Macro economic-demographic relations in English History, 1540 to 1840", *Journal of Population Economics,* 15, 221-242.

Ministerio de Salud Pública y Medio Ambiente (1983a): *Estadísticas de Salud,* Serie Histórica 5, número 21, años 1914-1943, Buenos Aires.

________________ (1983b): *Estadísticas de Salud,* Serie Histórica 5, número 22, Años 1944- 1970, Buenos Aires.

Mirabella de Sant, María Cristina and Franco Eugenio Nanni (2004): "Hacia una macroeconomía de provincias", Mimeo, Universidad Nacional de Tucumán, Argentina.

Nicolini, Esteban A. (2006): "Was Malthus Right? A VAR Analysis of Economic and Demographic Interactions in Pre-Industrial England", Working Paper 06-06, Economic History and Institutions Series, Universidad Carlos III de Madrid.

Ortega-Osona, José Antonio and David Reher (1997): "Short Term Economic Fluctuations and Demographic Behaviour: Some examples from Twentieth-Century South America" in Tapinos *et al.* (eds.): *Demographic Responses to Economic Adjustment in Latin America*, Clarendon, Oxford.

Palloni, Alberto, Kenneth Hill, and Guido Pinto Aguirre (1996): "Economic Swings and Demographic Changes in the History of Latin America", *Population Studies* 50, 1, 105-132.

Pesaran, H. Hashem and Shin, Yongcheol (1998): "Generalized impulse response in linear multivariate models", *Economic Letters* 58, 17-29.

Ríos Neto, Eduardo and José Alberto Magno de Carvalho (1997): "Demographic Consequences of Structural Adjustment: the Case of Brazil " in Tapinos *et al.* (eds.): *Demographic Responses to Economic Adjustment in Latin America*, Clarendon, Oxford.

Stigler, George J. (1952): "The Ricardian Theory of Value and Distribution", *Journal of Political Economy,* 60: 187-207.

Wolpin, Kenneth (1997): "Determinants and consequences of the mortality and health of infants and children" in M.R. Rosenzweig and O. Stark (eds.): *Handbook of Population and Family Economics*, Elsevier, Amsterdam.

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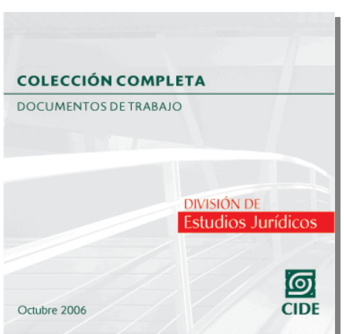

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