Extended Abstract

The Random Country Model: An examination of likely demographic surprises in Latin America and their fiscal impact.

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1. Version 2 of the Random Country Model

Our current work is based on Version 2 of the Random Country Model. There are 2 key revisions to the RCM since Version 1 (Miller, 2007). First and most importantly, our forecast of fertility has changed and is now substantially lower. Second, we now take into account uncertainty in the "starting position"of the forecast.

2. Overview of RCM

The Random Country Model is based solely on 4 characteristics of the country in question. These 4 country-specific factors are the total fertility rate (TFR), life expectancy at birth for both sexes combined (e0), the net migration rate (NMR), and the population count by age and sex. RCM uses the collective experience of 192 UN member countries over the 55 year period from 1950 to 2005 in order to forecast the future trajectories of fertility, mortality, and migration. RCM generates a future trajectory of TFR by random selecting a country which has a similar level of TFR and following the historical experience of that country for a random length of time. Then, beginning with that end-point, another country is selected at random (with a similar fertility level to that end-point) and followed for a random length of time. In this way, a future trajectory for the country of interest is pieced together from the actual historical experience of several different countries. Similar methods are used to generate the trajectories of life expectancy and net migration rates. Using the age and sex distribution of each country, we generate RCM projections for 20 Latin American countries.

2.1 Future fertility

The historical experience of the UN member countries provides a varied experience of fertilty change from which to sample. This results in a variety of different forecasts – some in which the fertility transition stalls; some in which fertility falls extremely rapidly; but most show the typical moderate rate of transition from high to low fertility as reflected in the historical experience of most countries. The historical demographic experience from which we sample is limited to the post-1950 period as we are using the UN World Population Prospects database. Therefore, events such as the post-war baby boom of the 1940s are not well-represented as possible outcomes in the RCM forecasts because they are not recorded in the UN historical record. This is one reason why the probabilistic forecasts of TFR have much smaller probability intervals than those of Lee-Tuljapurkar (1994), for example, who base their forecast on a long time series of US data which includes the possibility of another US baby-boom. For this reason, the Lee-Tuljapurkar 95% prediction interval for the TFR of the United States in 2050 is about twice as great as our RCM forecast.

Another important difficulty arises from the question of tempo effects. The long-run fertility estimate of the RCM model will be based on the historical experience of current low fertility countries. The presence of tempo effects means that the very low levels of fertility in these countries are temporary and therefore the levels may be expected to rise. In a sense, the difficulty in applying the RCM approach is that the data base is truncated --- we are missing the future fertility experience of these low fertility countries. In Version 1 of the RCM, an attempt was made to correct for the tempo effects. There were two difficulties with this correction. First, the technique resulted in an overcorrection for tempo effects and led to long-run fertility levels which were too high relative to the historical experience (a mean of 1.85). Second, the adjustment of the model to reflect tempo effects runs counter to the basic idea of the simplicity of the RCM approach and letting the historical experience guide the forecasts. For these reasons, Version 2 does not attempt correction of tempo effects --- leading to a long-run covergence of TFR toward 1.60 with a 95% prediction interval from 1.2 to 2.0. The widespread emergence of below-replacement fertility in Latin America is one of the likely surprises based on the RCM forecast.

2.2 Future mortality

The future trajectory of life expectancy is also chosen by piecing together trajectories of randomly chosen countries (in which the join-points are the same life expectancy). Owing to the upward trend in the data, all countries will eventually reach into the higher ranges of life expectancy. How then should we make predictions for e(0) projections in these higher ranges and beyond? Our solution is to use the experience of UN member countries whose e(0) lies above 75 – representing 161 observation points. These countries, on average, experienced gains in life expectancy of about 1 year in every 5 year period or about 0.22 years annually. Therefore, the RCM forecasts show life expectancy increasing rapidly and at a linear pace. Interestingly, the rate of increase is quite close to that calculated by Oeppen and Vaupel (2002) for increases in record female life expectancy over the past 160 years (+0.24 year annually) and for men (0.22 annually). Interestingly, most scenario forecasts for the region show a slowdown in the rate of increase in life expectancy, holding life expectancy constant. That is, according to these scenarios countries with life expectancy of around 70 are expected to make fewer gains in the next few decades than indicated by the historical records of countries with life expectancy of around 70 in previous decades. This appears in nearly all countries and is not a product of the future impact of AIDS on life expectancy in these scenario forecasts. Therefore, one of the

likely surprises for the region revealed by the RCM forecast is the likely continued rapid increase in life expectancy.

2.3 Future migration

There is considerable controversy over how to best incorporate assumptions about net migration into long run forecasts. Most countries set legal limits on the number of in-migrants. And many demographers favor forecasts in which net migration continue at its current level throughout the length of the forecast. They argue that this forecast represents a status-quo evaluation of current policy. Other demographers point out that legal limits to immigration are often "soft limits." For example, the United States sets strict numerical limits on immigration, but certain groups of immigrants (spouses of US citizens) are admitted without limit. Special exceptions are often granted for refugee populations. Mass amnesties have been granted for legalization of immigrants who entered illegally. In addition, demographers argue that social forces shape immigration in the long-run and current legislated limits should be expected to change over the course of a long-run forecast.

The RCM approach samples from the historical data for net migration to UN member countries whose population exceed 2.5 million in 1950. We exclude small countries from the sample on the grounds that they are un-representative of most populations – they tend to have dramatic swings in net migration which are extremely uncommon in most populations. Net migration rates have been extremely variable over the past 55 years. Herein lies one of the strengths of the probabilistic forecast of migration. In the deterministic scenario forecasts, demographers are faced with a difficult problem. Despite the past variability of net migration, they must forecast only a few, likely paths for future net migration. In the probabilistic forecast, this variability observed in the past translates into great uncertainty about the future course of migration. This uncertainty about future net migration is not hidden from policy makers, but is plainly evident for all to see in the probabilistic forecast. One of the big surprises based on the RCM approach is the possibility of changing from a labor-sending to labor-receiving country and vice-versa. Changes which are present in the historical record but absent from most scenario forecasts.

3.0 The fiscal impact of demographic uncertainty

Currently, there are 5 Latin American countries participating in the National Transfer Accounts Project. This project is an international, collaborative effort aimed at monitoring and forecasting the impact of the population aging on economic well-being, based on National Accounts (Mason and others, 2008). As part of the data collection effort, we have information on age-specific government taxes and age-specific benefits. We can use this information to project the impacts of demographic uncertainty on government budgets. In this section, we analyze probabilistic forecasts of government budgets in Brazil, Mexico, Chile, Uruguay, and Costa Rica to identify the role of demographic change and demographic uncertainty on the future path of government benefits and taxes.

Sources:

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