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A rational, economic model of paygo tax rates

Georges De Menil^{a,*}, Fabrice Murtin^b, Eytan Sheshinski^{c,d}, Tite Yokossi^e^a Paris School of Economics (EHESS), 48 Blvd. Jourdan, 75014 Paris, France^b OECD, France^c Hebrew University of Jerusalem, Israel^d Brown University, United States^e MIT, United States

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ABSTRACT

We argue that paygo rates are determined by a representative agent and a benevolent government jointly maximizing the expected life-time utility of the agent. The distributions of labor and capital income are calculated from national data on real GDP, real wages and the real return to capital since 1950. With uniform risk aversion, predicted rates explain 83% of the variance of observed rates. The globalization of capital markets would lead to convergence of paygo rates. Our results are immune to crises like 2008.

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One of the puzzles of macroeconomic policy analysis is the extent to which the importance of pay-as-you-go retirement systems varies across countries in the developed world. [Table 1](#), which presents effective tax rates for these systems in the largest countries of the OECD, shows that, in 2002, they varied from 5% in Australia to 36% in Italy.

Analysts have sought to explain this diversity in different ways. Some have argued that it reflects historical differences, such as differences in the degree of social conflict and the power of unions.¹ Others have suggested that it is the mark of cultural factors, some societies being more risk averse than others, and thus more intent on ensuring the stability of retirement incomes.

We seek to demonstrate that pay-as-you-go (henceforth paygo) effective contribution rates – are the consequence of rational, welfare maximizing decisions by individuals and societies in countries whose underlying economic characteristics are themselves different. Our hypothesis builds on the [Aaron \(1966\)](#) proposition that a society's choice between paygo and

* Corresponding author.

E-mail address: gdemetil@gmail.com (G. De Menil).

¹ In seeking exogenous explanations for different attitudes toward social policy in the United States and Europe, [Alesina and Glaeser \(2004\)](#) point, among other factors, to the presence of racial tensions in the United States. In their discussion of the divergent evolution of social security provisions in different countries, [Bruno and Sachs \(1985\)](#) emphasize the nature of union pressures.

Table 1
Effective paygo tax rates.

Country	Effective tax rates
Australia	4.8
France	18.4
Germany	19.1
Italy	36.3
Japan	18.8
Spain	33.5
United Kingdom	10.9
United States	8.7

Source: OECD (2003), OECD labour force participation projections and authors' calculations.

funded saving should depend on whether the natural rate of growth is greater or less than the rate of return on capital – paygo being optimal in the first case and funded saving in the second. Aaron's criterion was a knife-edge criterion. We suggest that, in the richer world of stochastic dynamics, it is optimal for societies to choose to rely on both forms of provision (paygo and saving), and that it is the balance of the two that is affected by economic conditions. Simply put, in countries in which labor income is expected to grow slowly and to be subject to recurrent shocks, individuals and society will, *ceteris paribus*, emphasize personal saving for the provision of retirement income. In countries in which the real return to capital is expected to be low and volatile, they will, on the contrary, put more weight on paygo transfers.

In order to test this approach, we construct a model of how societies and individuals determine the levels of paygo and saving in the provision of retirement income. This is a simple, two-period overlapping generations model in which a benevolent public authority and a representative individual jointly choose that paygo tax rate and saving rate which maximize the representative individual's expected life-time utility. The next step is to construct empirical estimates of the dynamic distributions of labor and capital income in each country. Armed with these distributions, we use the model to generate a cross section of predicted values of paygo and saving rates for each country in a reference year, which we take to be 2002. The test of the validity of the model is how well it explains actual, effective paygo commitments in that year.² Though the model describes the dynamic behavior of individuals and societies over time, what it explains is differences in effective paygo contribution rates across countries at a given point in time.

The biggest challenge in this exercise is data construction. In order to analyze a society's paygo and saving choices, we must first estimate the distribution of the labor and capital income of a representative individual for sixty or more years – active life plus retirement. Moreover, the variability and higher moments of this distribution are decisively important for the computation of expected utility. In order to estimate these, we would ideally like to have historical data on as many life-cycles as possible. The available macroeconomic data, which only stretch back one hundred years, do not provide direct evidence of more than two or three lifetimes.

To overcome this obstacle, we resort to a Monte-Carlo approach. Using data since the end of World War II, we estimate simple models of the annual dynamics of labor and capital income. We then use the parameters of these models, and bootstrapped estimates of the distributions of their error terms, to simulate as many life-time histories as we need. With these, we compute the expected life-time utility of the representative individual corresponding to any pair of paygo tax and saving rates. Our model says that the rates that maximize this expected utility are the rates that society will choose.

We test the model on a subset of the countries of the OECD, focusing on high-income countries which have developed financial markets, and which, though open to trade, are not so small that trade dwarfs domestic production. Specifically, we chose from the 23 developed countries in the OECD in 2003, the eight for which the average value of the ratio of exports plus imports to GDP during the decade of the 1990s was less than 55 percent.³

This paper builds on a long literature about the implications of risk and uncertainty for the efficiency of paygo schemes. Merton et al. (1983), Gordon and Varian (1988), Gale et al. (1990), Demange and Laroque (1999, 2001), Demange (2002) and others have shown that a paygo system can enhance welfare in dynamically efficient economies because of the unique opportunity it provides for workers to spread the risk of life-time earnings over different generations. Gottardi and Kubler (2011) extend these analyses and note that the result depends on the degree to which the paygo system reduces capital accumulation. In De Menil et al. (2006), we derived analytical results relating steady state optimal saving and paygo tax rates (when they exist and are unique) to underlying fundamentals. The present paper uses the same model to obtain empirical estimates of a cross section of economically rational tax and saving rates.

More recently, several papers have used models similar to ours to analyze the properties of public policies designed to provide intergenerational risk sharing. Bohn (2009) posits a comprehensive, intergenerational welfare maximization

² We chose 2002 as reference year because it is the first year when comparative and comprehensive data on pension systems in the OECD became available (OECD, 2003). We would like also to test the ability of the model to predict saving rates, but data on life-time saving rates, which are necessarily estimated by cohort rather than by calendar year, exist in only a few countries.

³ The countries we selected are Australia, France, Germany, Italy, Japan, Spain, the United Kingdom and the United States. The average ratio of exports plus imports to GDP during the 1990s in these eight countries ranges from 18% in Japan to 53% in the United Kingdom.

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