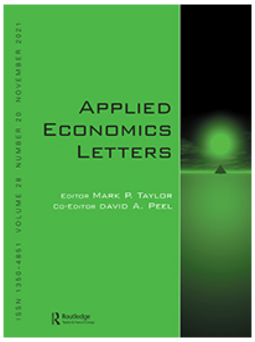

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On the social discount rate for South American Countries

Marcelo J. Villena and Hugo Osorio

Universidad Técnica Federico Santa María, Valparaiso, Chile

ABSTRACT

In this paper, the social discount rate (SDR) is calculated for nine South American countries. We use the social time preference methodology, and as opposed to previous studies for the region, the elasticity of marginal utility of consumption is estimated econometrically using a panel data approach. In particular, a fixed effect panel data model was used to estimate the income elasticity of demand for food. The time-series data used come from the same sources for every country under consideration and correspond to the period 1990–2020.

KEYWORDS

Social discount rate; income elasticity of demand for food; South American countries; cost-benefit analysis

JEL CLASSIFICATION

H43; C33; O12

I. Introduction

Governments around the world often conduct cost–benefit analyses (CBA) for large social and infrastructure investments, as well as for some regulatory issues. South American countries are no exception; in fact, all the countries analysed in this paper have a well-organized National Investment System.

Undoubtedly, one of the most significant parameters for CBA is the social discount rate (SDR). In the case of South American countries, discount rates are rarely updated and some of them seem to be extremely high. In the academic literature, there are only a few studies analysing the SDR for these countries, see Lopez (2008)

In this context, in this work, a social discount rate for Argentina, Bolivia, Brasil, Chile, Colombia, Ecuador, Paraguay, Peru, and Uruguay will be estimated. In particular, we will calculate the social time preference rate (STPR), as many academic studies undertaken for developed economies, see Percoco (2008) Evans and Sezer (2004), and Evans (2004b), besides some countries with a long tradition in CBA as the UK, see Hurst (2018).

II. The social time preference methodology

The STPR reflects the extent to which society is willing to forgo current consumption in exchange for higher future consumption, and as such has long been considered a good proxy for the social discount rate (Marglin 1963a). It is important to point out that this trade-off is not based solely on market forces, but also on other factors. Moreover, the consumption period of society is longer than that of the individual. Therefore, STPR is not equivalent to the individual time preference. The standard Ramsey formula (Ramsey 1928) is usually used to calculate this rate and takes the following form:

$$s = \rho + \mu g \quad (1)$$

where ρ is rate of time preference; μ is the elasticity of marginal utility of income (or consumption); and g is the projected rate of growth of per-capita real consumption. Thus, the STPR considers two components: i) the time preference, and ii) the wealth effect. The origin of this equation comes from models of individual savings behaviour; in which individuals maximize utility over time. The STPR is equated to the interest rate, if one uses it to allocate income between savings and consumption.

As pointed out by Pearce and Ulph (1999), the term ρ in turn comprises two elements: pure time preference (δ) and life chances (L), leaving the above equation as follows:

$$s = (\delta - L) + \mu g \quad (2)$$

Thus, the time preference takes into account two perceptions: the individual's utility (such as impatience or myopia) and the change in the lifetime

CONTACT Marcelo J. Villena marcelo.villena@usm.cl Universidad Técnica Federico Santa María, Guayaquil, Ecuador

probability of a population. The logic of this is that if the life probability rate is lower, the utility discount rate will be higher. There is a long-standing debate in the literature concerning the appropriate value of δ, see OXERA (2002). The wealth effect, as mentioned above, reflects expected growth in per capita consumption over time, where future consumption will be higher relative to current consumption and is expected to have a lower utility. Each component of (2) is explained in detail below.

III. Estimates of SDR components for each country

Pure time preference (δ)

Many authors, such as: Kula (1987, 2004); Cline (1992); and Stern (2006), set the value of the pure time preference of individuals to zero, because of ethical considerations, claiming that all generations should be treated equally. The value of δ is difficult to determine through an empirical study; hence, most studies determine this rate based on the literature. Usually, a value of 0.2% seems reasonable, see Evans (2004b) and Hurst (2018). We will use this value.

Life chances (L)

The life chance rate is determined as the mortality rate over the population rate. In general, based on the findings of previous studies (Pearce and Ulph 1995; Kula 2004; Evans 2006; Stern 2006 and others), the empirical estimates are in the range of 0.1% to 3%. We determined the life chance rate considering the annual death rates and population rate from 1990 to 2020, for each of the countries under analysis.

The elasticity of marginal utility of consumption (μ)

Two approaches are usually used in order to estimate e. First, e is estimated based on the consumer demand for a product independent of preferences, called the indirect behavioural testing approach, see Fellner (1967). Several models can be used as consumer demand models in order to estimate the value of μ, for example, the traditional Cobb-Douglas, the Constant Elasticities Model (CEM), the Quasi-ideal Demand System (SIDA), and the Quasi-ideal Quadratic Demand System (QUAIDS), see Evans, (2004a) y (2005).

Secondly, the derivation of μ is based on the progressiveness of personal income tax (see Stern 1977; Cowell and Gardiner 1999). The derivation of μ based on the personal income tax model is based on the following formula:

$$\mu = Log(1-t)/Log(1-T/Y)$$

where Y is taxable personal income, t is the effective marginal rate of income tax, and T is total income tax liabilities.

In general, the range value of this elasticity is between 1% and 2%. The results of this component have differences due to model specifications, level of data aggregation, choice of estimators, sample size and length of sampling periods (Zhuang et al. 2007).

In our analysis, we will follow the modelling strategy employed by Kula (2004). In this model, food and non-food items are regarded as complementary goods with a restriction of homogeneity. Hence, μ is calculated by the following relationship:

$$\mu = b \times \frac{y}{p} \tag{3}$$

where b is the average propensity to spend money on non-food goods, $p$is the relative price elasticity of food, relative to other goods, and corresponds to the income elasticity of food. To determine p and y, the following relationship is proposed by Kula, and we modified it for panel data:

$$D_{ij} = AY_{ij}^{y}\left[\frac{P_{1ij}}{P_{2ij}}\right]^{p}$$

where D_{ij} is the per capita expenditure on food of the country i in year j, A constant, Y_{ij} in this case is the income per capita of country i in year j, P_{1ij} corresponds to the price index of food and non-alcoholic beverages the country i in year j, and P_{2ij} price index of non-food goods, snuff and alcoholic beverages of country i in year j. Applying natural logarithm to the above expression, the following equation log type that determines the relative price elasticity of food on non-food and food income elasticity is obtained:

$$lnD_{ij} = ln(A) + ylnln(Y_{ij}) + pln\left[\frac{P_{1ij}}{P_{2ij}}\right] \quad (4)$$

We implement this equation using the data set described in Appendix A.

The growth of per capita real consumption (g)

Pearce and Ulph (1999) that long-run data must be used to calculate g. The reasons are that the value of g will be underestimated if there is a shift from consumption to leisure, and will be overestimated if there are social costs of consumption. In our case, g is calculated over the data period 1990–2020.

IV. Econometric estimations and main results

Our econometric results are presented in Tables 1, 2 ,3 and 4 of Appendix B. In Table 1, we can see the fixed effect panel data model used to estimate the income elasticity of demand for food, model presented in equation (4). The model is robust in terms of R^2, with both elasticities statistically significant at 1%, and with the right signs. Table 2 shows the panel cointegrate, while Table 3 presents the countries results, again all statistically significant, and with the right signs. Our overall results are presented in the following table:

V. Concluding remarks

Our results point to three conclusions. First, there are still great differences in the SDR value among the selected countries, implying that despite its geographical closeness there is still great heterogeneity in their level of time discounting.

Secondly, we have found that the SDR turns out to be significantly lower than the current official discount rate in most countries,[1] Chile being an exception, where the rate is very similar to that calculated by the Investment Department at the Ministry of Social Development (6%). Therefore, in these countries, the application of this discount rate in project appraisal should improve the prospects for financing long-term social projects, those that produce net benefits for future generations.

Thirdly, as we can see from Figure 1, there is a high correlation between the SDR and g (the growth of per capita real consumption in the last 30 years in each country of the region). Since g represents one of the key components of the discount rate calculation, see equation (1), this variable partly explains the current relatively low social discount rate in Latin American countries.

Table 1. Fixed effects demand for food regression

Fixed-effects (within) regression					Num of obs =	259
Group variable: **country**					Num of groups =	9
R-sq:					Obs per group:	
within = **0.8987**					min =	27
between = **0.6723**					avg =	28.8
overall = **0.7222**					max =	29
					F(2,248) =	1100.56
corr(u_i, Xb) = **−0.4591**					Prob > F =	0.0000
F2010	Coef.	Std. Err.	t	P > t	[95% Conf.	Interval]
C2010	.8351845	.0190641	43.81	0.000	.7976364	.8727326
PF_PNF	−.1777308	.0416445	− 4.27	0.000	− .2597528	− .0957089
_cons	−.1678593	.1551899	− 1.08	0.280	− .4735175	.1377989
sigma_u	.24382791					
sigma_e	.06976688					
rho	.92432435	(fraction of variance due to u_i)				
F test that all u_i = 0: F(8, 248) = 268.58						Prob > F = 0.0000

[1]The rate in Argentina, Bolivia, Colombia and Ecuador is 12%, Paraguay 11.4%, Perú 9%, Uruguay 7.5%, and Brazil 8.5% in real terms.

Table 2. Cointegration tests for panel.

Pedroni test for cointegration		
Ho: No cointegration	Number of panels = 9	
Ha: All panels are cointegrated	Avg. number of periods = 27.778	
Cointegrating vector: Panel specific		
Panel means: Included	Kernel: Bartlett	
Time trend: Included	Lags: 2.00 (Newey-West)	
AR parameter: Panel specific	Augmented lags: 4	
	Statistic	p-value
Modified Phillips-Perron t	2.2149	0.0134
Phillips-Perron t	1.5634	0.0590
Augmented Dicky-Fuller t	2.6447	0.0041

Table 3. Price and income elasticities by country.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Argentina	Bolivia	Brasil	Chile	Colombia	Ecuador	Paraguay	Peru	Uruguay
VARIABLES	F2010	F2010	F2010	F2010	F2010	F2010	F2010	F2010	F2010
	(0.0219)	(0.0276)	(0.0191)	(0.0210)	(0.0205)	(0.0224)	(0.0193)	(0.0227)	(0.0363)
PF_PNF	−0.340***	−0.368***	−0.167**	−0.436***	−0.261***	−0.374***	−0.503***	−0.275***	−0.216**
	(0.0902)	(0.0903)	(0.0786)	(0.0815)	(0.0948)	(0.0941)	(0.0874)	(0.0908)	(0.101)
Constant	1.367***	1.381***	1.322***	1.067***	1.504***	1.382***	0.748***	1.310***	2.343***
	(0.179)	(0.229)	(0.155)	(0.171)	(0.165)	(0.183)	(0.156)	(0.185)	(0.286)
Observations	259	259	259	259	259	259	259	259	259
R-squared	0.743	0.728	0.799	0.750	0.783	0.728	0.802	0.738	0.760

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4.

Countries	p*	y	b	μ	g	SDR (%)
Argentina	−0.34	0.64	0.743	1.41	4.25	7.20%
Bolivia	−0.36	0.64	0.7151	1.25	1.98	3.70%
Brasil	−0.16	0.65	0.8519	3.34	3.2	11.90%
Chile	−0.43	0.68	0.8434	1.33	3.96	6.50%
Colombia	−0.26	0.63	0.8325	2.02	1.83	5.00%
Ecuador	−0.37	0.64	0.7728	1.33	1.85	3.70%
Paraguay	−0.5	0.71	0.6591	0.94	2.13	3.20%
Peru	−0.27	0.65	0.7255	1.72	2.93	6.30%
Uruguay	−0.21	0.52	0.8176	1.98	1.45	4.10%
Region	−0.32	0.64	0.77344	2.9	2.62	5,2%

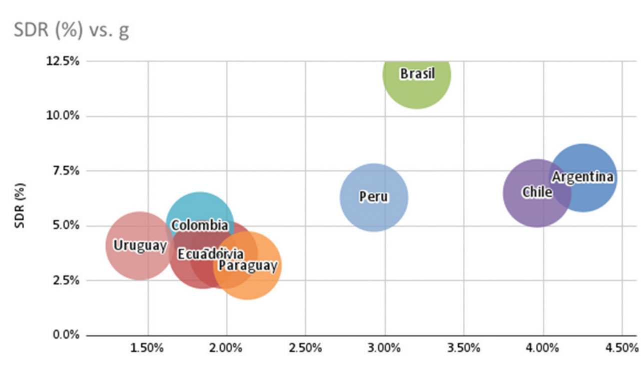

Figure 1. SDR versus growth of per capita real consumption. Source: own calculations

The practical importance of the social discount rate is enormous. The higher the rate, the less importance the government attaches to the future of the community, and, therefore, the fewer resources are spent on long-term projects. Future generations will suffer a higher social discount rate than is technically due, equal to the opportunity cost of postponing the benefits produced by the delay of a public investment. One thousand dollars invested in 50 years time will be approximately just 8 dollars today if the rate of discount is 10%, but about 600 is the rate of return is 1%. Thus, the impact of any miscalculation on this rate is not only crucial for environmental projects but also on poverty alleviation, which deeply affects the countries of the Latin American region. In this context, it is difficult to understand why there is little effort in some of these countries in the correct calculation of this discount rate. One of the objectives of keeping the social discount rate very high could be to keep the level of social spending in check, limiting investment to those projects with very high returns.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix A: Variable Definitions and Data Source

We use the database Euromonitor in order to build the following data set:

- F2010 = Household expenditure on food expressed per capita and measured at constant 2010 prices.
- C2010 = Total household expenditure on goods and services expressed per capita and measured at 2010 prices.
- PF = Consumer price index for food (2010 = 1.0).
- PNF = Consumer price index for non-food products (2010 = 1.0).
- PF_PNF = PF/PNF