Social Costs of Consumer Impatience in a Catching-up Economy[1]

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Abstract

In several catching-up EEC countries we experience an expenditure boom explained by arguments referring to intertemporal consumption optimization. We have calibrated a model assuming externalities from foreign direct investment and country risk premium dependent on the debt/GDP ratio. In the model the internal real rate of return of marginal saving turned out to be about 13-15 percent, higher than the level that any estimate of the time preference might justify. Its existence comes from the two externalities, saving and foreign direct investment, which are not internalized by private agents. This calls for fiscal policy to make the necessary adjustments.

Keywords: Small open economy, Economic growth, Externalities, External debt, Fiscal policy, Foreign direct investment, Risk premium

JEL Classification: E6, F4, O11.

1 Introduction

In several CEE countries consumers and governments have been accumulating high levels of debt recently. Some economists have referred to the high growth rates having experienced in the catching-up process and the argument of intertemporal consumption smoothing as a justification for this behavior. In this paper we try to quantify the trade-off between future and present consumption to see whether such an argument is justifiable and if not what lesson can we draw for economic policy. This calculation relies on the assumption that in the catching-up process the inflow of foreign owned capital has a positive external effect on productivity. This feature makes social rates of return differ from individual rates of return.

We know that the social rate of time preference is not the average of individual rates. Part of the population has a very high time preference,[2] resulting in a behavior that considers savings at best as a buffer stock against short run losses in income. On the other hand, there are many who would be

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[2]The idea of a high rate of time preference has come up at Friedman (1957) already, and Carroll (1992) was one of those who contributed most to the rigorous analysis of the consequences. Empirical econometric models use mostly the related concept of Mankiw who considers the majority of consumers as liquidity constrained, consuming as much as they earn. The fiscal implications of this behavior are discussed in Mankiw (2000).

reluctant to borrow even at modest real interest rates. In addition to the aggregation problem, there is an externality problem as well. As Harberger (1986) has shown, individual debt taking adds to a county's risk, creating external costs for the rest of the country. Therefore, economic policy must involve savings policy and this policy cannot be implemented without information on time preferences and social rates of return. In this paper we do not dare to quantify the social time preference rate, but try to estimate the present actual social opportunity cost of consumption. When calibrating the model we kept the Hungarian growth process in mind, we hope however, that the qualitative conclusions are valid for emerging economies in general.

In Chapter 2 we give a verbal description and justification of the main assumptions, in Chapter 3 and 4 we present the equations and the calibration assumptions, in Chapter 5 the simulation results and in Chapter 6 the conclusions.

2 Main assumptions and features

The model is a classical, market clearing model. The economy is a small open economy where capital flows are unconstrained but their speed is dampened by adjustment costs. There is one aggregate good, although we have set up a version of the model where tradables and non-tradables are distinguished in an implicit way (Version C).

The general way of modeling intertemporal consumption in theoretic growth models is to assume a representative infinite horizon consumer with point-expectations. Although in a small open economy the base version of the model is unstable, the assumption of a debt-dependent interest rate premium provides stability and makes the model operational.[3] We used this approach in a version of our model in order to follow the "academic" practice in the literature (Version A). As an alternative to the Euler-equation approach we applied a more pragmatic reduced form consumption function, generally used in econometric models (Versions B and C).

Part of the convergence of the economy is attributed to pure capital accumulation: capital intensity is rising towards its steady state in a Cobb-Douglas production function. We assumed that labor supply was constant – more or less in accordance with actual demography.

Another component of convergence comes from excess total factor productivity (TFP) growth. TFP growth is composed of an underlying growth rate that is equal to the world rate and an additional component during the catching-up period that is generated by externalities of the inflow of foreign direct capital (FDI). In general there are two channels of external effects of FDI: the agglomeration effect (Krugman (1990), Venables (1996)) and the spillover of know-how. We consider only the latter type, that depends on the *gross* value of foreign owned capital stock, phasing out as the technology level converges to the world level.

The speed of convergence depends on the speed of capital accumulation. This latter depends on the country risk premium, which is influenced by the rate of indebtedness (and the path of the real exchange rate). The lower the country risk (and the weaker the initial exchange rate) the faster will be the accumulation of capital.

3. Model equations

As our model describes an infinitely growing economy, in order to to have steady state we normalize variables by output. Normalized variables are given in lowercase letters, while steady state values are denoted by a bar above the variable. Further details of the derivation of some equations and coefficients are given in Benczúr – Simon – Várpalotai (2003).

3.1 Output

Output is determined by a Cobb-Douglas production function:

$$Y_t = A_t k_{f,t-1}^{a f} k_{d,t-1}^{a-a f} Y_{t-1}^{a} L^{1-a}, \tag{1}$$

where the labor supply is fixed ($L = 1$), $k_{f,t}$ and $k_{d,t}$ are foreign and domestically owned capitals stocks normalized by output, and TFP includes the external effect of the foreign capital ratio:

$$A_t = A_0 (1+m^{tfp})^t e^{g\, k_{f,t-1}}.$$

Here A_0 is a scaling factor of output, m_{tfp} is the exogenous constant component of TFP growth, and $e^{g\, k_{f,t-1}}$ is the output externality implied by the ratio of foreign owned capital. Since foreign capital intensity has a steady state, this function is compatible with the long run linear homogeneity of production. Finally, g_t denotes the growth rate of output.

3.2 Consumption

In the "academic" version (Version A) we used a CRRA utility function, yielding the following Euler equation:

$$c_t = (1+r_t^d)^{-\frac{1}{s}} b^{-\frac{1}{s}} (1+g_{t+1}) c_{t+1}, \tag{2a}$$

where *ß* is the rate of time preference, s is the elasticity of substitution, and r_t^d is the domestic interest rate.

In the pragmatic versions (Versions B and C) consumption is a linear function of y_t^{lab} (labor income) and w_t (net wealth). Although the interest rate does effect consumption in any sophisticated model, we disregarded it for the sake of simplicity:

$$c_t = b_w \frac{w_{t-1}}{1+g_t} + b_y y_t^{lab}. \tag{2b}$$

3.3 Incomes, asset balances and returns

The return on foreign and domestic capital respectively is determined by profit maximizing behavior,

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[3] Among others Chatterjee–Sakoulis–Turnovsky (2003) uses this approach when simulating the effect of capital flows on growth in open economies. Schmitt-Grohé – Uribe (2003) reviews several other ways of "closing" the Euler-equation based small open economy model, although Carroll (2001) questions whether this model deserves this extension of applicability.

which implies that production factors get a fixed share from income:

$$p_{f,t} = (1+g_t)\frac{a_f}{k_{f,t-1}}, \qquad p_{d,t} = (1+g_t)\frac{a-a_f}{k_{f,t-1}}. \tag{3}$$

$\Pi_{f,t}$ and $\Pi_{d,t}$ are present values of future capital income flows (foreign and domestic):

$$\Pi_{f,t} = \sum_{k=t+1}^{\infty}\frac{(p_{f,k}-d)-r_k^d}{(1+r^w)^k} \qquad \Pi_{d,t} = \sum_{k=t+1}^{\infty}\frac{(p_{d,k}-d)-r_k^d}{(1+r^w)^k}, \tag{4}$$

where r^w is the constant "world interest rate".

Labor income is the rest of income after deducing capital income:

$$y_t^{lab} = 1 - \frac{\pi_{f,t}k_{f,t-1} + \pi_{d,t}k_{d,t-1}}{1+g_t}. \tag{5}$$

The domestic real interest rate is determined by interest rate parity corrected for the risk premium:

$$r_t^d = q(q_t - q_{t+1}) + r_t + r^w, \tag{6}$$

where r_t is the country risk premium, q_t is the log of the real exchange rate (price of non-tradables in terms of tradables), while q is a constant weight parameter that converts the change in the relative price of the two sectors into the change in the relative price of non-tradables to the aggregate basket. This makes the right-hand side consistent with the definition of the real interest rate as a basket-based rate. In the absence of non-tradables ? is set to zero (Versions A and B).

The country-risk premium depends on net financial assets (nfa_t):[4]

$$r_t = \max\{0; -b_r nfa_t\}. \tag{7}$$

The evolution of net foreign financial assets is described by:

$$nfa_t = \frac{(1+r_t^d)nfa_{t-1} - p_{f,t}k_{f,t-1}}{1+g_t} + tr_t + i_{f,t}, \tag{8}$$

where tr_t is the trade balance, and $i_{f,t} - p_{f,t}k_{f,t-1}/(1+g_t)$ is the net foreign capital related flow (FDI minus profit flow).

For the sake of simplicity we assume that domestic residents do not invest directly abroad. Net wealth of the country (w_t) is then:

$$w_t = nfa_t + k_{d,t}, \tag{9}$$

while the trade balance identity is:

[4]Debt as a risk factor may be defined in several ways. The traditional measurement is the ratio of net foreign financial assets (interest-bearing debt) to income. The alternative concept adds net real assets to the numerator. The choice depends on whether we consider real assets as a good hedge against labor income risk. In the model we followed the usual approach that considers only interest bearing debt as a risk factor.

$$tr_t = 1 - c_t - i_{f,t} - i_{d,t}. \qquad (10)$$

3.4 Investment

Equations for capital accumulation are standard (d is the depreciation rate):

$$k_{f,t} = \frac{1-d}{1+g_t} k_{f,t-1} + i_{f,t}, \; k_{d,t} = \frac{1-d}{1+g_t} k_{d,t-1} + i_{d,t}. \qquad (11)$$

The dynamics of investment ($i_{f,z}$ and $i_{d,t}$) is described in the spirit of Tobin-q theory, similarly to a model with quadratic adjustment costs $\left(\Psi(i,k) = i + b_k \frac{i^2}{2k}\right)$. Accordingly investment is proportional to profit over alternative returns cumulated into the future ($\Pi_{f,t}$ and $\Pi_{d,t}$), by the inverse of the adjustment cost parameters (b_{kd}, b_{kf}):

$$i_{d,t} = \frac{\Pi_{d,t}}{b_{kd}} + \frac{d+\bar{g}}{1+\bar{g}} k_{d,t-1}, \; i_{f,t} = \frac{\Pi_{f,t}}{b_{kf}} + \frac{d+\bar{g}}{1+\bar{g}} k_{f,t-1}, \qquad (12)$$

where $\frac{d+\bar{g}}{1+\bar{g}} k_{d,t-1}$ and $\frac{d+\bar{g}}{1+\bar{g}} k_{f,t-1}$ are parts of investment that maintain an unchanged capital-output ratio at $\bar{g}$ growth rate. When substituting from equation (6) we see that the investment decision depends on the foreign interest rate, the risk premium (and the path of the real exchange rate if ? is nonzero).

3.5 The real exchange rate

The real exchange rate is determined by the Dornbush (1976) equilibrium exchange rate principle in the short run, adjusting to purchasing power parity with a half-life of 5 years. For the sake of saving space we do not reproduce here the relevant model bloc,[5] even though the real exchange rate is an important factor in determining investment decisions. As mentioned before, by setting $q = 0$ the presented set of equations describes the homogenous goods model.

4 Calibration of the parameters

The world interest rate was taken as 4%, and the depreciation rate 9%. q (the relative weight of tradables) was assumed to be 0.5 in Version C, and zero in Versions A and B. The slope coefficient of the rate of debt on country risk is $b_r = 0.1$, which means that a 10 percent increase in debt raises the interest rate by 1 percentage point.[6] We chose $\overline{nfa} = 0$.

For Version A of the the consumption bloc, we chose s = 1.5; while ß was calibrated to match the zero steady state net foreign asset position. In Versions B and C (equation (2b)), b_w and b_y were

[5] See for details Benczúr – Simon – Várpalotai (2003).

[6] Edwards (1984) arrived at a half-elasticity of 0.6-1.0 in a panel estimation. At a level of about 2% this is about the corresponding figure to our linear coefficient of 0.1. Our figure is definitely more cautious than the assumed 0.4 figure in Fagan - Gaspar - Pereira (2002). The relation between risk and debt is presumably non-linear, but in our simulations we do not go as far from the base scenario to take this into account.

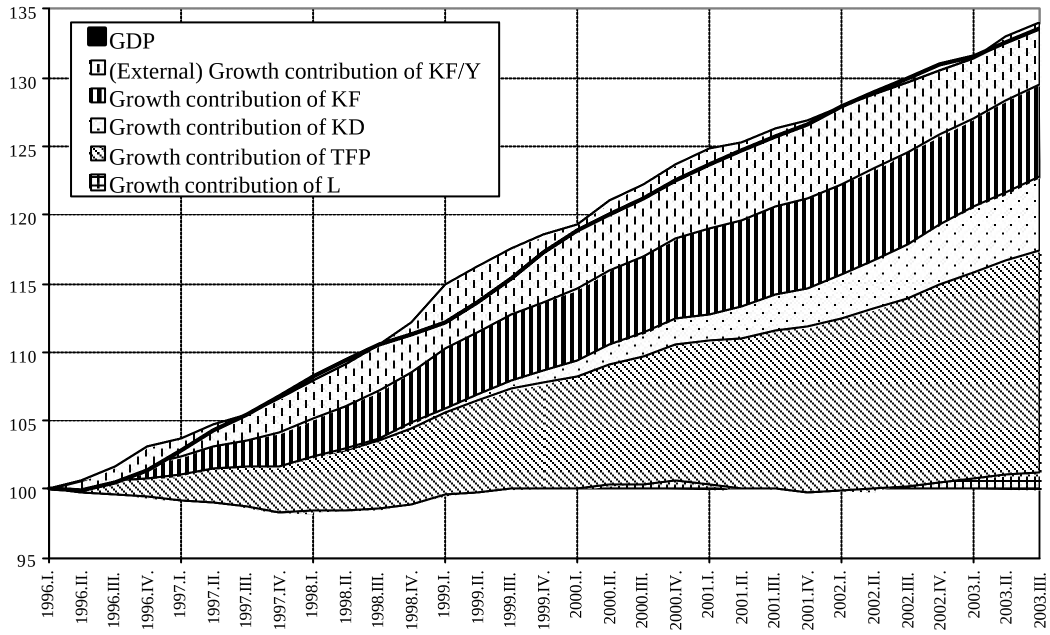
calibrated to ensure a 10 years half-life of a shock to net wealth.

In the production function $A_0 = 0.932438$ was chosen such that in the first year of simulation output be equal 1. Capital share is the standard internationally observed $a = 0.3$. As $g^w = 2\%$, the world total factor productivity growth rate is $m = (1+\overline{g})^{1-a} - 1 = 0.01396$.

The external effect of foreign capital was calibrated in a way that actual GDP growth should fit to the values calculated from the calibrated model in the period of 1996-2003. This criterion gave a coefficient of 0.4. This is higher than the 0.21 estimated by Jakab–Kovács (2002) on Central East European panel data. Figure 1 shows how various components contributed to GDP growth.

Investment behavior is explained in line with Tobin-q theory. There is a large amount of empirical work on the speed of adjustment. The estimated parameters are in a broad range, between 1.4 and 16.1.[7] We chose a value between the two extremes, assuming $b_{k_f} = b_{k_d} = 8$.

Figure 1. Contribution of production factors to GDP growth in Hungary, exogenous TFP and externalities (1996. = 100 %) according to the production function (1) with calibrated parameters



For the initial value of capital ratios we used the estimates of Darvas-Simon (2000) and Pula (2003), while the share of foreign capital has been estimated by accumulating FDI data: $k_d = 1.1$, $k_f = 0.4$. The rest of the stock values for the beginning of 2003 have been taken from the national income accounts: $nfa = -0.25$, and $w = 0.85$ comes from an identity. For the relative level of income we assumed $Y/Y^w = 50\%$, which is the Hungarian level relative to the average of the

[7]Summers (1981) estimated a value of 16.1, Eberly (1997) arrived at a range of 1.4 and 3 using micro data. Cummins–Hasset–Oliner (1997) using US firm data estimated parameters between 5 and 10.

European Union. Our assumptions imply that the Hungarian steady state productivity is approximately 80 percent of the European average. This is in line with the arguments of Darvas-Simon (2000).

Table 1 displays the main parameters, initial values, and the implied steady state values of the models.

Table 1 Parameters, Initial and Steady state values

							Parameters								
Version A, B and C	a	=	0.3	a_f	=	0.1	g	=	0.4	b_{kd}	=	8	b_{kf}	=	8
	d	=	0.09	g^w	=	0.02	m^{tfp}	=	0.01396[a]	r^w	=	0.04	b_r	=	0.1
+ Version A	b	=	0.99053[a]	s	=	1.5	q	=	0						
+ Version B	b_w	=	0.16204[a]	b_y	=	0.70981[a]	q	=	0						
+ Version C[b]	b_w	=	0.16204[a]	b_y	=	0.70981[a]	q	=	0.5						
							Initial values								
Version A, B and C	k_d	=	1.1	k_f	=	0.4	nfa	=	- 0.25	Y/Y^w	=	0.5			
							Steady states values								
Version A, B and C	$\bar{k}_d$	=	1.5692	$\bar{k}_f$	=	0.7846	$\overline{nfa}$	=	0	$\overline{Y/Y^w}$	=	0.7717	$\bar{y}^{lab}$	=	0.7
	$\bar{i}_d$	=	0.1692	$\bar{i}_f$	=	0.0846	$\bar{c}$	=	0.7308	$\overline{tr}$	=	0.0154			
	$\bar{g}$	=	0.02	$\bar{h}$	=	0.13	$\bar{r}$	=	0	$\bar{r}^d$	=	0.04			

[a] These numbers have been derived from primitive parameters.
[b] Full Version C has many other variables and parameters which are discussed in Benczúr – Simon – Várpalotai (2003).

5 Simulations: effects of consumption shocks

To assess the opportunity costs of consumption we calculated the differences between a base scenario of the catching-up process and an alternative scenario when consumption is hit by a shock. We were working with three versions of the model:

Version A: Consumption function specified by the Euler-equation, homogenous goods,

Version B: Consumption function specified in the pragmatic way, homogenous goods,

Version C: Consumption function specified in the pragmatic way, distinction between tradables and non-tradables.

We defined two kinds of consumption shocks. Both can be thought of as originating from fiscal policy:

- In a *transitory* consumption shock the consumption ratio increases by 1 percentage point in the first period (year) but the steady state wealth ratio does not change.
- In a *permanent* consumption shock the consumption ratio increases by 1 percentage point in the first period (year) and the steady state wealth ratio decreases by the same 1 percentage point. In Version A, this is implemented as a fall in the rate of time preference.

We made a present value calculation, determining the intertemporal rate of transformation around the baseline path between consumption today and tomorrow. For Version A, which contains an explicit utility function, we have also calculated the permanent consumption loss that would yield the same utility as the perturbed consumption path. The results were modest but significant. Since the numbers showing the internal rate of return are more indicative, we decided to report only those numbers.

We are aware that choosing coefficients on the production externality and the risk premium is always debatable, besides being influential for our results. Therefore we calculated alternative scenarios with or without assuming the existence of these effects. In the Euler-equation case the no-risk premium version has no meaningful steady state.

The results are reported in Table 2 The main mechanism of the model is the following. A consumption shock worsens the net foreign asset position, which leads to an increase in the risk premium. Higher interest rates depress investment, which creates a social loss: due to the spillover effect of foreign capital, foreigners underinvest in equilibrium. Without the endogenous risk premium term, this effect is roughly inactive. The exchange rate introduces another channel: a shock increases demand, that appreciates the currency and – because of the interest rate parity – it raises the domestic interest rate further. This is why Version C leads to an internal rate of return exceeding the world rate, even without any externalities.

Table 2 Implicit interest cost (return of aggregate saving) at the present level of indebtedness

	Permanent shock				Transitory shock			
	With risk premium		Without risk premium		With risk premium		Without risk premium	
	With capital externalities	Without capital externalities	With capital externalities	Without capital externalities	With capital externalities	Without capital externalities	With capital externalities	Without capital externalities
Version A	15.0%	9.5%	–[a]	–[a]	13.4%	10.5%	–[a]	–[a]
Version B	12.5%	7.0%	3.8%	3.8%	10.2%	7.3%	4.0%	4.0%
Versionl C	13.3%	7.4%	4.2%	4.2%	14.4%	11.4%	7.4%	7.5%

[a] Scenarios without risk premium are not applicable to Version A.

We tested the robustness of the results in a sensitivity analysis. We have found that in most cases, changing a parameter even by 50 percent (keeping everything else the same) does not result in a change higher than 1 percent in the internal interest rate. In the variants without country risk premium the sensitivity is even lower. The parameters that have the highest effect on the interest rate (shown in Table 3) are the parameters influencing capital accumulation and productivity directly, like g, the external effect of foreign capital, b_{kd} and b_{kf}, the adjustment costs of investment, and b_r, the risk premium coefficient. Even these parameters cause changes in the range of 2 percentage points only and the highest value is 2.6 percentages.

Table 3 Analysis of parameter sensitivity

Implicit interest costs of a unit change in consumption, difference from the baseline

	Permanent shock				Transitory shock			
	With risk premium		Without risk premium		With risk premium		Without risk premium	
	With capital externalities	Without capital externalities	With capital externalities	Without capital externalities	With capital externalities	Without capital externalities	With capital externalities	Without capital externalities
Version A								
γ=0.3	-1.6	-0.4	–[a]	–[a]	-1.2	-0.6	–[a]	–[a]
γ=0.5	1.5	0.4	–[a]	–[a]	1.1	0.5	–[a]	–[a]
$\beta_{kf}=\beta_{kd}$=4	0.9	0.1	–[a]	–[a]	1.2	0.5	–[a]	–[a]
$\beta_{kf}=\beta_{kd}$=12	-0.6	-0.1	–[a]	–[a]	-0.7	-0.3	–[a]	–[a]
β_{ρ}=0.05	-2.6	-1.4	–[a]	–[a]	-2.6	-1.8	–[a]	–[a]
β_{ρ}=0.15	1.6	0.9	–[a]	–[a]	1.8	1.3	–[a]	–[a]
Version B								
γ=0.3	-1.3	-0.1	0.0	0.0	-1.0	-0.3	0.0	0.0
γ=0.5	1.3	0.1	0.0	0.0	0.9	0.3	0.0	0.0
$\beta_{kf}=\beta_{kd}$=4	1.2	0.4	0.0	0.0	1.6	0.9	0.0	0.0
$\beta_{kf}=\beta_{kd}$=12	-0.8	-0.3	0.0	0.0	-1.0	-0.6	0.0	0.0
β_{ρ}=0.05	-2.4	-1.0	–[b]	–[b]	-2.2	-1.3	–[b]	–[b]
β_{ρ}=0.15	1.5	0.6	–[b]	–[b]	1.6	1.1	–[b]	–[b]
Version C								
γ=0.3	-1.5	-0.1	0.0	0.1	-0.9	-0.1	-0.2	0.1
γ=0.5	1.4	0.1	0.1	0.0	1.1	0.2	0.6	0.0
$\beta_{kf}=\beta_{kd}$=4	1.4	0.5	0.1	0.0	1.8	0.9	0.4	0.2
$\beta_{kf}=\beta_{kd}$=12	-0.9	-0.4	0.0	0.0	-1.2	-0.7	-0.1	-0.1
β_{ρ}=0.05	-2.4	-0.9	–[b]	–[b]	-2.4	-1.5	–[b]	–[b]
β_{ρ}=0.15	1.4	0.6	–[b]	–[b]	1.8	1.2	–[b]	–[b]

In the individual lines all parameters are the same as in the baseline except the parameter indicated.
[a] Scenarios without risk premium are not applicable to Version A.
[b] Version A and Version B do not depend on β_{ρ} in scenarios without risk premium.

6 Assessment

Our results show that additional saving might bring as much as 13-15 percent real return for consumers. This rate is unlikely to be compatible with any reasonable social time preference. If we accept that actual savings are below the socially desirable level, government policy has the task to make adjustments, by promoting savings and investment. If we do not assume Ricardian equivalence, there is a straightforward way to move in this direction: instead of running deficits and promoting current consumption, governments should constrain the accumulation of debt by increasing net government saving. This would work on both margins: lowering foreign indebtedness would decrease interest rates, which in turn would boost (foreign) investment.

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