

ESSAYS ON INTERNATIONAL CAPITAL

by

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in Partial Fulfillment of the Requirements
for the Degree of

DOCTOR OF PHILOSOPHY

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

September 1990

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ABSTRACT

Three aspects of international capital markets are investigated in this dissertation. Chapter I models and evaluates the empirical relevance of the "debt relief Laffer curve" hypothesis. Chapter II tries to establish whether a forward-looking partial equilibrium model of the black market for hard currency is applicable in East European countries. Chapter III reexamines the "Feldstein-Horioka puzzle" and offers a new explanation.

Recent developments have conferred the debt overhang hypothesis and the related "debt relief Laffer curve" (DRLC) political credibility. Up to now however, the scarce empirical work on this subject tended to show that only a handful of countries might lie beyond the top of the DRLC. Chapter I first lays out a simple stochastic model of debt overhang, encompassing its standard version as an extreme case of full appropriability by the creditors of each additional unit of output produced by the debtor. It also emphasizes the liquidity constraint facing the latter, and stresses its interaction with the incentive constraint. A number of specifications of the secondary market price for developing country loans equation are then tested, in order to determine whether the elasticity of the price with respect to the debt burden is likely to exceed one. When the elasticity is made functionally dependent on the price, close to half of the 42 countries in the sample were likely to lie on the downward sloping side of the DRLC as of February 1989. This chapter can be interpreted either as documenting the real world relevance of the DRLC, in contrast to previous explorations, or as providing a firm basis for agnosticism as to the empirical foundations of the DRLC.

Black markets for hard currencies are a traditional and important feature of East European economies. Chapter II develops a partial equilibrium model of a single currency black market that accounts for the behavior of prices and quantities in various circumstances. The predictions of the model concerning the premium on the US dollar are tested econometrically using quarterly and monthly series from the second half of the seventies onwards. Despite severe informational limitations, it seems reasonable to conclude that the model roughly fits the data for Poland, Hungary and Yugoslavia. For the USSR, Romania, Czechoslovakia, East Germany and Bulgaria instead, the postulated relation does not hold empirically. This evidence is consistent with the idea that arbitrage can only be effective when a market in the full sense of the word is operating.

The high positive long run correlation between domestic saving and investment across industrialized countries is a priori difficult to reconcile with the conventional open-economy-cum-perfect-capital-mobility class of models. The empirical regularity is robust, even if it tends to weaken somewhat in recent years. Chapter III attempts to reinterpret this enigma. It first shows that it is hazardous to try and base a rationalization of this puzzle on short run behavior, using a simple non-optimizing but forward-looking model. Several explanations for the long run apparent financial insularity of national economies have been brought forward. A new one is added in the context of an overlapping generations model. After showing how permanent demographic and productivity shocks can produce the puzzling empirical regularity, the standard setting is amended to incorporate housing as a non-tradeable, durable good into the utility function. Then permanent taste shocks of two kinds do generate the observed co-movements as well. But even though this channel is a plausible one, it can account for only a fraction of the total saving-investment correlation.

Thesis supervisor : Dr. Paul R. Krugman

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ACKNOWLEDGEMENTS

Paul Krugman and Rudiger Dornbusch constituted a team of advisors of quasi-mythical dimensions. They taught me when and how to challenge conventional wisdom and forcefully demonstrated that economics is by no means a dismal science. At every stage of my work, they provided encouragement and most helpful guidance.

This thesis benefited from remarks and insights of many other illustrious economists, including Martin Weitzman, Lance Taylor, Franco Modigliani, Ben Bernanke, Donald Lessard, Maurice Obstfeld, Kenneth Froot, Jeffrey Wooldridge, John Heaton, Bryan Roberts, Andrew Berg, Dimitri Vayanos, Yacine Ait-Sahalia, Makoto Saito, Jamil Baz and Bozidar Djelic. All of them are protected though by the usual set of disclaimers.

Generous financial support from the Bank of France is also gratefully acknowledged.

Finally, if this work had to be dedicated to someone, it would no doubt be to Catherine, Coralie and Séverine, but I already burdened them enough with economics.

TESTING THE DEBT OVERHANG HYPOTHESIS

August 1989

"Les hauts taux tuent les totaux"

TURGOT ¹

1. INTRODUCTION (*cuique suum*)

Heavily indebted countries seem to be trapped in a gloomy low-growth high-debt service spiral: squeezing investment, a politically easier short run target than cutting consumption, in order to service their debt undermines their very ability to continue doing so in the future. Severe credit rationing since 1982, along with a number of sometimes more circumstantial reasons, has been put forward as a key obstacle to growing out of the debt crisis. Indeed, voluntary private lending is scarce in the presence of large stocks of external debts that will probably never be fully serviced, as reflected in the almost monotonous fall of secondary market prices for developing country loans, presently averaging 35% (May 1989, Salomon Brothers market index). On the other hand, the need to make large net outward debt-service transfers may erode the incentives of

¹ In order to avoid any suspicion of French biasedness, let us mention that in the late fourteenth century, Ibn Khaldun expressed the same idea in a more detailed and elegant way in his *Muqaddimah* (see the excerpt cited in LIPSEY et alii[1987,p.436]).

debtor countries to adjust, as the expected benefits are likely to be perceived as accruing mainly to their creditors. These aspects of the developing country debt problem have been increasingly emphasized over the past few years, and have been analyzed by SACHS[1986a,b], KRUGMAN[1988a,b] and others as a debt overhang deadlock².

More specifically, debt overhang is said to occur when the contractual value of a country's "inherited" liabilities exceeds its expected capacity and/or willingness to meet its debt-service obligations. In such a situation, involuntary lending is the rule and actual payments to the creditors will depend on the outcome of direct negotiations between both sides, in the context of which net outward transfers tend to become positively linked to the debtor's economic performance. The proceeds of increased output and exports will then in part be used for payments to foreign creditors. In addition to the inefficiencies associated with costly and sometimes almost continuous renegotiation of the debt, a moral hazard problem therefore arises: adjustment efforts bearing a high marginal tax, the debt burden acts as a disincentive. This effect is reinforced by the elusiveness of the perspective of renewed access to international financial markets.

A substantial fraction of the developing country debt is public or quasi-public³. Thus the dollar transfer involves a twin fiscal ("peso") transfer as well. But stimulating savings and investment,

² Note that countries like Ireland (which at the end of 1988 displayed a public external debt over GNP ratio of 70%) might perhaps be subject to a debt overhang as well.

³ On the transfer of risk from the private to the public sector, see e.g. DIAZ-ALEJANDRO[1985].

already costly in and of itself, will appear all the less attractive politically as debt payments will absorb most of the related gains. Domestic potential private investors will be discouraged by the actual or expected high taxes, which will tilt their decision schedules in favor of consumption and capital flight. Foreign potential investors generally won't even give investment a thought, as, in the absence of credible seniority, a project would require an extremely high rate of return to compensate for the probability of country default (see DOOLEY[1987]).

KRUGMAN[1988a], introducing uncertainty into the debt overhang framework, showed that if disincentives are strong enough, a "debt relief Laffer curve" (henceforth DRLC, which sounds more neutral) might arise, depicted in figure 1. At low levels of debt, such as D, its face value equals its market value. Beyond some threshold R however, full repayment is not expected anymore by the average creditor. Up to L, the market value still increases, albeit more slowly, with the contractual amount. But to the right of L, the market value shrinks as the nominal debt grows: a country is then said to lie on the "wrong side" of its DRLC (a misleading qualification however, both graphically and conceptually). In that extreme case, pure forgiveness of a fraction of the debt would improve both the debtor's prospects and the value of the portfolio of its creditors because it would generate a sharp acceleration of investment and exports. It should nonetheless be stressed at this point that disincentives can be at work to the left of L. Hence the wedge in figure 1.

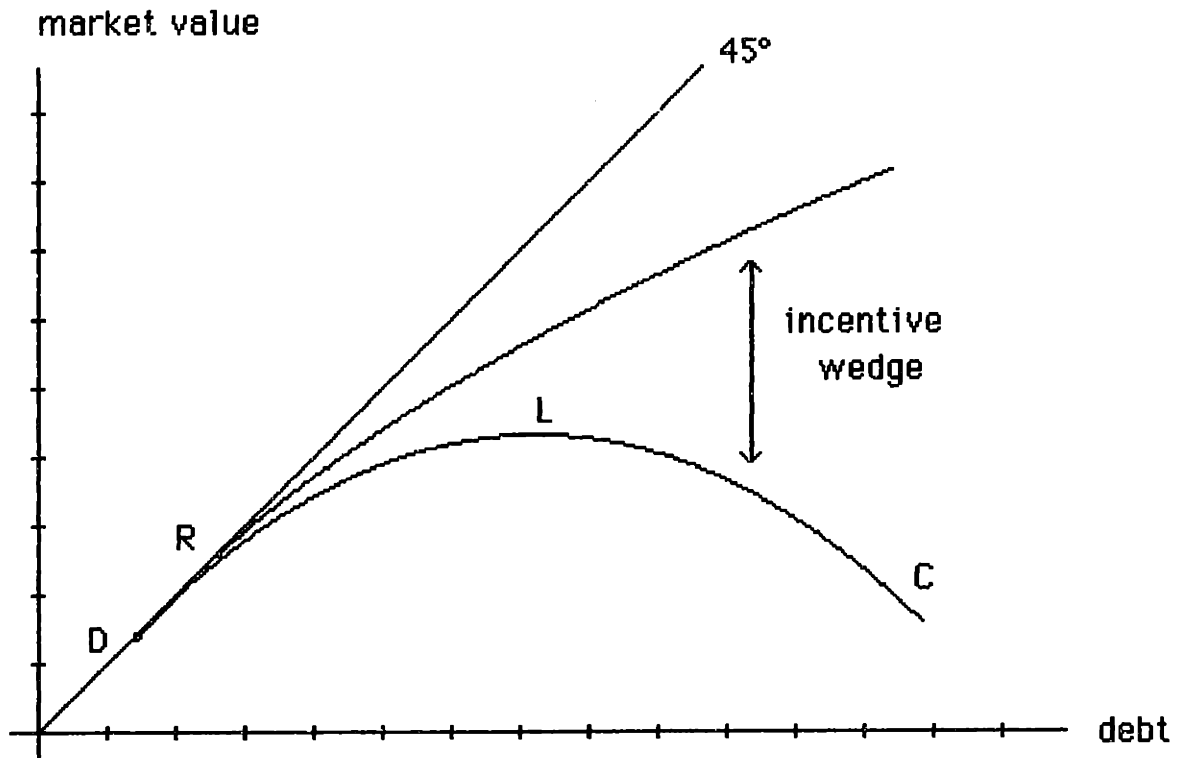


FIGURE 1: THE DEBT RELIEF LAFFER CURVE

The implications for policy deserve analysis. Basically, the key question is whether the economy of a debt-ridden country would benefit more from debt reduction or from additional international lending. If the drop in investment, documented for instance in I.M.F.[1989], is essentially due to insufficient capital inflows rather than to incentive effects, forgiving part of the debt outstanding would not spur investment significantly, as the supply of savings would remain too low (although some improvement might be expected thanks to the reduction in debt service associated with the downscaling of the principal). By contrast, if incentive effects are strong, an increase in lending could turn out to be counterproductive, as it might exacerbate these in so far as it would not generate commensurate fiscal revenues.

The Brady "plan" outlined last March and the subsequent guidelines on debt reduction support measures adopted by the I.M.F. and the World Bank, as well as a series of recent I.M.F. packages (Mexico, Philippines, Costa-Rica, Venezuela) show that the debt overhang hypothesis has gained official support⁴. Commercial banks instead have argued, through the Institute of International Finance, that emphasis on debt reduction should not conceal the need for additional (public) capital inflows (SCHULMANN[1989]). The latest positions and actions taken by the U.S. regulatory institutions with respect to the commercial banks' claims on Mexico and Argentina illustrate however the resoluteness of the U.S. authorities.

⁴ See also the speech by the Fund's Managing Director, CAMDESSUS[1989], and the WITTEVEEN[1989] report.

Besides, the Paris Club creditors in September 1988 already agreed on and started implementing a menu of debt relief options for low income countries (7 Sub-Saharan Africa countries had benefited from these by April 1989)⁵.

The chapter proceeds as follows: section 2 presents a tentative simplified model of debt overhang; section 3 tries to determine empirically which countries, if any, lie on the "wrong side" of the DRLC; section 4 concludes.

2. A THEORETICAL SKETCH OF THE ARGUMENT (*grammatici certant*)

Whatever the specific model of debt overhang, explicit modelling of uncertainty is essential (a minimal version being good state versus bad state, whereas a more elaborate version reasons on a continuum of states of nature). The rationale is obvious. On the one hand, countries are subject to big exogenous shocks, be they economic (dollar, L.I.B.O.R. and terms of trade fluctuations) or not (natural

⁵ The French President's May 1989 proposal to cancel French public claims on 35 Sub-Saharan countries also deserves mentioning (noting that Canada and Great Britain had opened the way). In early July, the United States announced they would follow.

disasters, such as hurricane Gilbert that swept through Jamaica last September, the 1985 Mexican and the 1987 Ecuadorian earthquakes, the floods in Peru or the recurrent droughts in Sub-Saharan Africa). On the other hand, some relief schemes might look deceptively attractive in an environment devoid of uncertainty, as SACHS and HUIZINGA[1987] show in the case of exit bonds.

i) Debt overhang as an investment disincentive

The following is a slightly generalized version of the standard two-period overhang model as it is laid out for instance in FROOT[1989]. A shorter and more graphical discussion can be found in CORDEN[1988]. The earlier KRUGMAN[1988b] version reasons on the adjustment efforts undertaken by the debtor as depending on the interest rate set by the creditors on the "inherited debt", but is essentially equivalent.

Collapsing the whole relevant future in period 2, denoting the debtor's consumption by C_t ($t=1,2$) and its discount factor by β (with β strictly smaller than the unit world discount factor because the debtor is typically confronted with credit rationing), we assume its welfare takes the form:

$$(2.1) W = U_1(C_1) + \beta C_2$$

The debtor country starts period 1 with an endowment K and originally faces debt obligation D in period two. No payments to the

creditors fall due in period one, during which the country can consume its endowment or invest I of it, which will yield output $\tilde{y} = f(I) + \epsilon$ in period 2. Like U_1 , f is increasing, strictly concave, and satisfies the Inada conditions, whereas ϵ is a random variable taking its values over $[\epsilon_L, \epsilon^U]$, with probability distribution g and cumulative density G .

Assume now that debt fatigue is so overwhelming and the likelihood of the debtor being able and/or willing to fully repay in period two is so small that the creditors, perhaps with the aid of a third party such as the I.M.F. or the World Bank, forgive an amount X , so that the second period debt burden is reduced to $D-X$. Assume also that should the country still default in period two, it would lose a fraction θ ($0 \leq \theta \leq 1$) of its output, which would be seized one way or another by its creditors. Period 2 de facto payments to its creditors will then be:

$$(2.2) R = \inf(D-X, \theta \tilde{y})$$

Thus the debtor maximizes W so that:

$$(2.3) W^* = \max_I (U_1(K-I) + \beta E[\sup((1-\theta)\tilde{y}, \tilde{y}-D+X)])$$

The cutoff level of output that will trigger default is $\epsilon_c = [(D-X)/\theta] - f(I)$. We will assume $\epsilon_c \in]\epsilon_L, \epsilon^U[$, as $\epsilon_c \leq \epsilon_L$ would preclude and $\epsilon_c \geq \epsilon^U$ would entail default in all states of the world, i.e. we would be back to a purely deterministic setting. Let H be the probability of full repayment:

$$H = H(I, X, \theta) = \int_{\epsilon_c}^{\epsilon_U} g(\epsilon) d\epsilon = 1 - G(\epsilon_c)$$

The first order condition derived from (2.3) is:

$$(2.4) \quad f'(I) = \frac{U'_1(K-I)}{\beta[1-\theta(1-H)]}$$

and the second order condition:

$$(2.5) \quad U''_1(K-I) + \beta f''(I)[1-\theta(1-H)] + \beta\theta[f'(I)]^2 g(\epsilon_c) < 0$$

As the first two terms are negative and the third is positive, satisfaction of the second order condition requires U'_1 and/or f to be sufficiently concave.

The optimal level of investment I^* is implicitly defined by (2.4) and (2.5) and is lower than the first best level, as $1-\theta(1-H) < 1$ implies $f'(I^*) > U'_1/\beta$. Note that the higher the penalty θ , the smaller I^* : a tough penalty in low output states of the world augments the disincentive effect. Two extreme cases may be highlighted in that respect: $\theta = 0$, which brings us back to the first best solution; $\theta = 1$, which implies $f'(I) = U'_1/\beta H$, as in FROOT[1989]. In practice, as pointed out by KALETSKY[1985], θ is probably quite small, suggesting that the standard model of debt overhang tends to overstate investment disincentives.

A straightforward comparative statics exercise shows how I^* varies with debt relief X . By the implicit function theorem:

$$(2.6) \frac{dI^*}{dX} = \frac{-\beta f' g(\epsilon_c)[1-\theta(1-H)]}{f''\beta[1-\theta(1-H)] + U''_1 + \beta\theta(f')^2 g(\epsilon_c)} > 0 ,$$

Unambiguously, the debtor country will invest more as X increases. Indeed, a lower debt burden means a higher expected reward for period one investment efforts ⁶.

It is worthwhile to compute the effect of debt relief on the debtor and, more interestingly, on the creditors' welfare. By the envelope theorem:

$$(2.7) dW^*(I^*(X), X)/dX = \partial W^*(I^*(X), X)/\partial X = \beta H > 0 ,$$

which can hardly come as a surprise in this simple model (policy debates instead often focus on this issue as a controversial one, as they typically bring in dynamic and interactive considerations).

Denoting by V^* the market value of the claims held by the creditors, and assuming they know the investment schedule faced by

⁶ It can also be checked, using the implicit function theorem, that an increase in the riskiness of the distribution of ϵ (in the Rothschild-Stiglitz sense) may increase or reduce I^* . If ρ is the increasing risk parameter in G , total differentiation of (2.4) with respect to I^* and ρ yields :

$$\frac{dI^*}{d\rho} = \frac{U'_1 \theta \int_{\epsilon_L}^{\epsilon_C} dG_\rho(\epsilon, \rho)}{[1-\theta \int_{\epsilon_L}^{\epsilon_C} dG(\epsilon, \rho)] [S.O.C.]}, \text{ which has the sign of } - \int_{\epsilon_L}^{\epsilon_C} dG_\rho(\epsilon, \rho) = -G_\rho(\epsilon_c, \rho);$$

but the latter has a sign that varies according to the location of ϵ_c on its support. A small ϵ_c , i.e. a low probability of default, implies $G_\rho(\epsilon_c, \rho) > 0$, and thus $dI^*/d\rho < 0$: indeed, shifting some weight towards the tails then increases the likelihood of default. Conversely, a large ϵ_c will imply $dI^*/d\rho > 0$, as spreading the mass of the distribution then diminishes the odds of default.

the debtor, we have:

$$V^*(X) = E[\inf(\theta(f(I^*(X))+\epsilon), D-X)]$$

$$= \int_{\epsilon_L}^{\epsilon_C} \theta[f(I^*(X))+\epsilon]g(\epsilon)d\epsilon + (D-X)H$$

Thus:

$$(2.8) \quad dV^*(X)/dX = \theta(1-H)f'(I^*(X))\frac{dI^*(X)}{dX} - H$$

For the creditors to end up better off, we need $dV^*(X)/dX > 0$. When $H \rightarrow 1^-$, $dV^*(X)/dX \rightarrow -1$. When $dI^*(X)/dX \rightarrow +\infty$, which is obtained for U_1 and f just concave enough for the above second order condition to be satisfied, $dV^*(X)/dX \rightarrow +\infty$. Therefore, the creditors will benefit from debt relief provided $\theta(1-H)f'(I^*)(dI^*/dX)$ is big enough, that is if the increase in expected payments due to a higher investment effort more than compensates for the fraction of payments dX forgone in good states of nature. This will occur all the more as H is small, i.e. as the probability of default is large, or X is small. Note also that the creditors' marginal gain increases with the impact on investment of a unit of debt relief. The value of their claims $V^*(X)$ is maximized when $dV^*(X)/dX=0$ (as $d^2V^*(X)/dX^2 < 0$). V^* being concave in X , we obtain a humped-shaped curve in the (X, V^*) plane (see figure 2), which is nothing but the mirror image of the DRLC (recall figure 1).

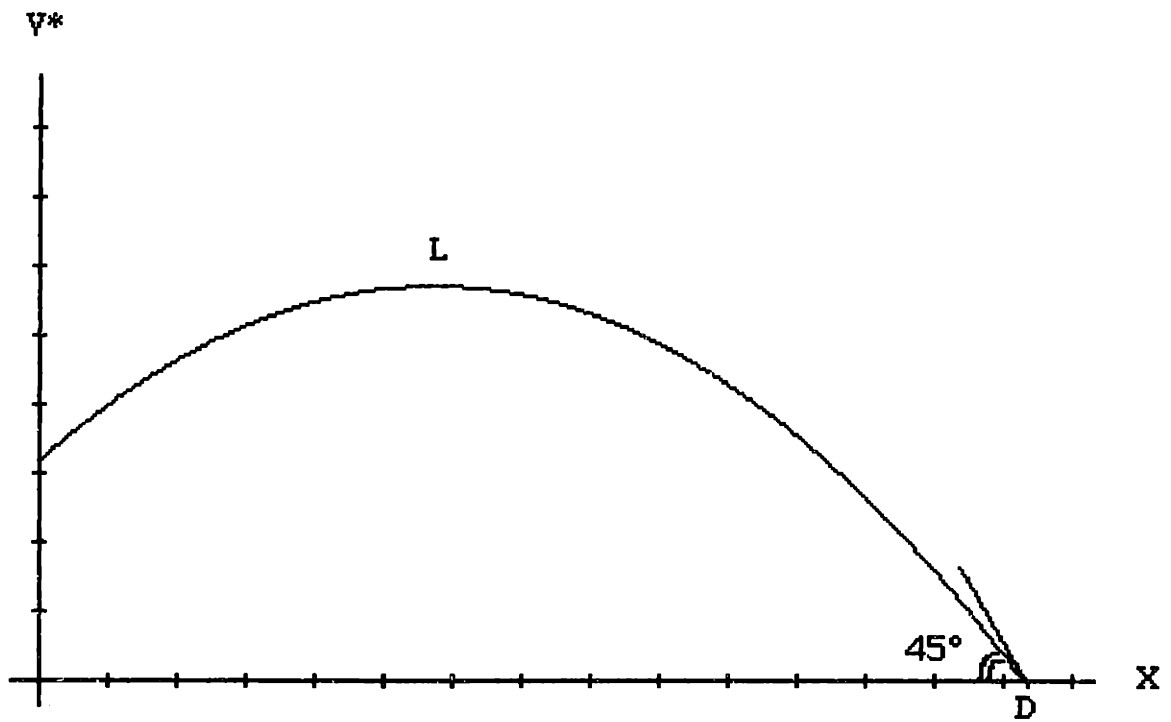


FIGURE 2: DEBT RELIEF AND THE VALUE OF THE CREDITOR'S CLAIMS

When the country is on the left of L, $dV^*(X)/dX > 0$ and debt relief benefits both sides, i.e. is directly Pareto improving. Aggregating creditors however should not hide the underlying free rider issue: even when it is in the collective interest of the creditors to forgive a fraction of their claims, it remains in a small individual creditor's interest to try and avoid participation in a relief scheme.

On a theoretical level, a careful comparative analysis of the various debt reduction schemes among other things requires to classify them according to the financing source and to contrast aid from foreign governments (example: a sponsored buyback such as the Bolivian ⁷), future output of the debtor (exit bonds) and period one endowment (self financed buybacks). A whole strand of the recent debt literature, surveyed by DIWAN and CLAESSENS[1989], focuses on the a priori trade-offs involved. A general lesson seems to be that the market-based schemes leave little room for Pareto improvement, which depends on a set of fairly restrictive assumptions, among which the position of the debtor on his DRLC.

Still on an abstract level, it can be shown that in the context of the above type of model, optimal relief is state contingent: incentives should be structured in such a way that adverse future shocks will not deprive the debtor of all the fruits of his adjustment efforts (see KRUGMAN[1988b] or FROOT *et alii*[1988]). More

⁷ Although there seems to be some controversy about the effective additionality of the funds used for that purpose.

specifically, future repayments should be indexed to some exogenous variable, such as the price of a small producer's primary commodity exports, growth in the industrialized countries or some international interest rate. Adding asymmetric information, or more plausibly "misrepresentation" considerations, may however lead to base indexation on some endogenous variable as well, such as the debtor's output or exports, despite the associated moral hazard drawbacks.

ii) Debt overhang and liquidity constraints

Up to now, only the incentive distortion has been formalized. However, most if not all heavily indebted countries face credit rationing as well as skewed incentives. As a matter of fact, incentives are partly determined by credit availability, as rationing implies that a debtor country will have to cut consumption to finance a socially desirable investment project instead of relying on foreign resources, which further discourages investment and adjustment efforts. Therefore, the liquidity constraint must be built into the above model (another reason is that cancellation of a fraction of the principal due in the future proportionally reduces the current interest burden, an effect ignored to this point)⁸. Plugging an L (for liquidity relief) into the debtor's first period budget constraint, which thus becomes $K+L = I+C_1$, leads to a first order condition analogous to (2.4):

⁸ But it should be acknowledged that some of the debtors, especially among the Sub-Sahara Africa countries, have already been granted (nearly) full debt relief on their current external obligations to (public) creditors.

$$(2.4') \quad f'(I) = \frac{U'_1(K+L-I)}{\beta[1-\theta(1-H)]}$$

As U_1 and f are concave, liquidity relief in addition to a given level of debt relief implies a higher level of optimal investment I^* . Dropping uncertainty and setting $\theta=1$, FROOT[1989] shows that the optimal relief package, from the creditors' point of view, combines debt and liquidity relief. In terms of the DRLC, the injection of L shifts it upwards, implying that for a given level of outstanding debt obligations D_0 , liquidity relief moves a debt-distressed country towards the side of the curve where debt relief is no longer Pareto improving (see figure 3), thus narrowing the scope for incentive-based relief (note that a similar shift could be brought about by recontracting the existing debt along the lines suggested by LESSARD[1989]).

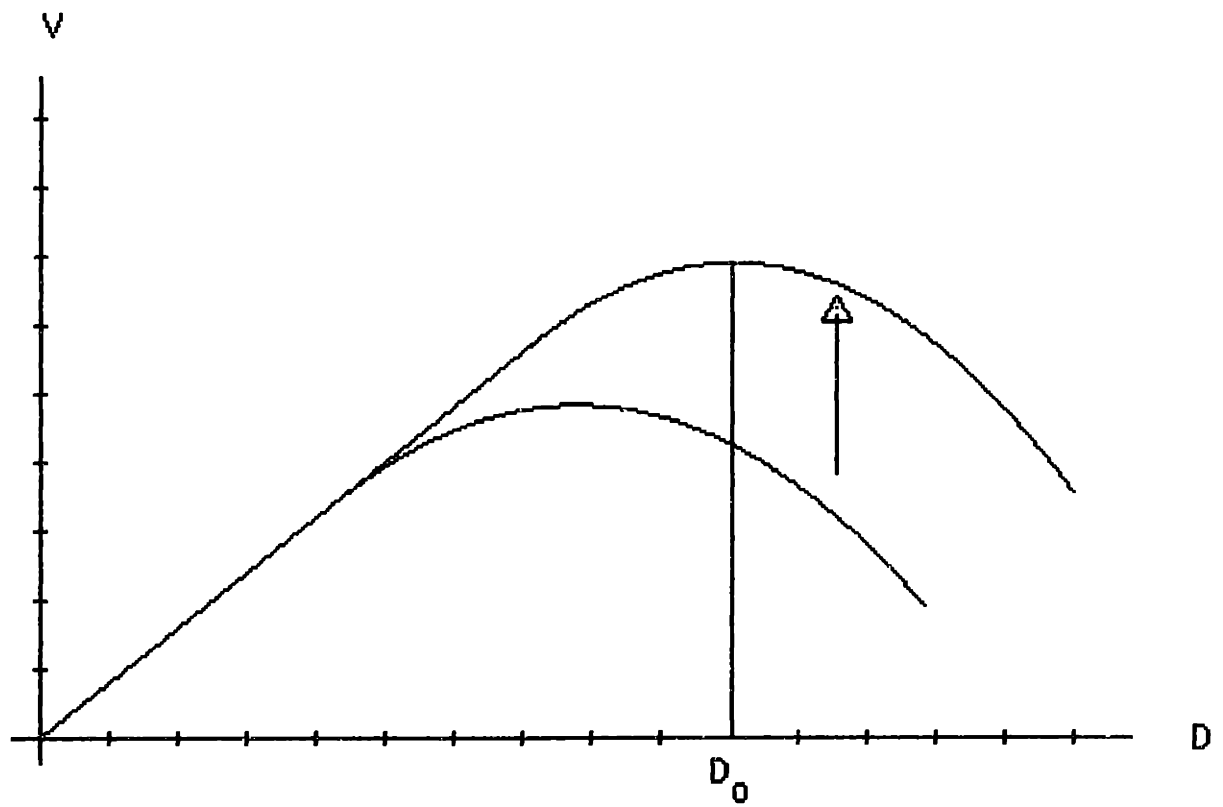


FIGURE 3: EFFECT OF LIQUIDITY RELIEF

A more general theoretical model still remains to be constructed, encompassing uncertainty, plausible default penalties, credit rationing and strategic interaction among debtors (debtor cartels, although the 'G8' has not as yet proved very effective) and creditors. More ambitiously, a full-fledged model should articulate these features with a description of the debtor's economy, instead of treating the latter as a black box. This would allow to simultaneously assess the interrelated internal (fiscal) and external (balance of payments) transfers, the capital flight issue, and other crucial aspects of the debt overhang problem (progress in this direction is achieved by HELPMAN[1988], who integrates uncertainty, taxation, capital mobility, risk aversion and degree of cooperation among creditors).

3. TESTING (*multi sunt vocati pauci vero electi ?*)

The idea of debt overhang has undergone little econometric investigations up to now. Some casual testing however is carried out in I.M.F.[1989], suggesting the data are not inconsistent with the hypothesis but that many other factors must be brought into the picture to explain poor investment and growth performance. Exogenous shocks and macroeconomic mismanagement may have caused both excessive debt accumulation and low investment levels. In other words, spurious correlation might turn out to be a serious problem.

Considering the sometimes depressing quality of the available data, be it for the secondary market prices or for some of the right-hand side variables, it seems wise to try a number of alternative routes in order to assess the empirical relevance of the debt overhang hypothesis. One might indeed suspect that the position of a number of countries on their DRLC will be sensitive to the specification used for the secondary market price equation. The sample of countries as well as the data used are described in the appendix.

Among the questions that are likely to arise in the following regressions (in addition to the data's shortcomings emphasized in the appendix), let us mention beforehand that:

- the following approach does not allow any distinction between types of creditors, whereas secondary market prices are for part of the privately owned debt only. Thus it is implicitly assumed that these prices reflect the valuation of the whole external debt;
- simple cross-sectional equations will not capture all the relevant differences between countries and therefore it is hazardous to use them to predict the value of the external debt for any particular country when its characteristics differ from those of the "average country";
- as the unit of analysis is the country, it will be difficult to identify truly exogenous variables that vary across units, as stressed by EATON, GERSOVITZ and STIGLITZ[1986] e.g. when they review econometric studies of country creditworthiness.

To start with, we regressed the prices prevailing on the secondary market at the eve of the Brady plan announcement, i.e. as of mid-February 1989, on a variety of potential explanatory variables sets. We used as large a country sample as possible, thus taking into account 42 countries ⁹.

As a preliminary check of the meaningfulness of secondary market prices, we compared them with the ratings displayed by *Institutional Investor* at the time: the simple correlation coefficient is 0.78 and regressing P (expressed in percentage points) on RATING yields:

$$(3.1) \quad P = -2 + 1.8 * \text{RATING} \quad (N=39, R^2=.61)$$

(0.36) (7.65)

with the absolute values of the t-statistics in parentheses. But RATING is not a legitimate right-hand side variable of course, since it represents itself a measure of overall creditworthiness.

Regressions were first run with "economic fundamentals" variables on the right-hand side, and then with "financial" variables.

A natural starting point is to try and explain P by the debt burden (as of end 1987) and some measure of adjustment effort, say average 1985-87 export growth (in percentage points):

⁹ Ideally, it would be preferable to use average prices, say over the last three months, as some prices may be temporarily affected by a rumor or a punctual deal. But data availability constraints precluded such an approach.

$$(3.2) \quad P = 51.2 - 0.14 \cdot D/GNP + 0.86 \cdot AVXGR \quad (N=42, R^2=.24, \bar{R}^2=.20)$$

$$(7.82) \quad (2.76) \quad (2.11)$$

or similarly:

$$(3.3) \quad \log P = 5.89 - 0.57 \cdot \log(D/GNP) + 0.035 \cdot AVXGR \quad (N=42, R^2=.27, \bar{R}^2=.23)$$

$$(6.57) \quad (2.91) \quad (2.57)$$

or else:

$$(3.4) \quad \log P = 7.47 - 0.69 \cdot \log(D/X) + 1.83 \cdot AVXGR \quad (N=38, R^2=.38, \bar{R}^2=.35)$$

$$(7.60) \quad (4.13) \quad (1.62)$$

The log-log form allows to read the elasticity of the price with respect to the (weighted) debt directly ($E = -0.57$ or -0.69 respectively in (3.3) and (3.4)). This parameter is crucial as one way to test whether the "average country" might be on the "wrong side" of the DRLC is to ask whether $|E| > 1$. A disadvantage of the double logarithmic form however is that in the case of $E < -1$, it assumes a convex downward sloping curve in the (D,V) plane, whereas the DRLC is supposed to be concave. It should also be stressed at this point that different countries may well have different DRLCs, which means that a cross-section estimate of the elasticity could be quite misleading, due essentially to the omitted variables that would account for the position of each specific curve.

Another noteworthy problem is that AVXGR might be partly endogenous, in particular if a debt overhang exerts disincentive effects.

Concentrating temporarily on the debt/GNP ratio for comparison purposes, and adding average 1982-87 inflation (GDP deflator) on the right-hand side, as a (partly endogenous) measure of stability, produces:

$$(3.5) \quad P = 55.7 - 0.15 * D/GNP + 0.83 * AVXGR - 0.10 * AVINF$$

(8.65) (2.99) (2.15) (2.43) (N=42, R²=.34, \bar{R}^2 =.29)

An a priori attractive alternative would be to try and replace export growth by 1985-87 investment as a measure of future, as opposed to present, capacity to repay. Adding the latest available terms of trade figure (1987), which is an indicator of the differential impact of world conditions on the debtor countries, yields:

$$(3.6) \quad P = 1.19 - 0.12 * D/GNP + 1.26 * AVINV/GDP + 0.35 * TOT$$

(0.06) (2.53) (2.45) (1.84)

(N=42, R²=.31, \bar{R}^2 =.26)

Expliciting the disruptive effects of the civil wars under way in some of the countries leads to:

$$(3.7) \quad P = 4.43 - 0.12 * D/GNP + 1.32 * AVINV/GDP + 0.31 * TOT - 17.8 * WARDUM$$

(0.23) (2.57) (2.62) (1.69) (1.67)

(N=42, R²=.36, \bar{R}^2 =.29)

Both in (3.6) and (3.7), the signs of all the slope coefficients are as expected, and at a decent confidence level, they are all

significant. This contradicts D. COHEN's claim that P is poorly correlated to macroeconomic variables [1989, p.11].

A more "structuralist" approach, in the spirit of BERG and SACHS[1988], would be to introduce per capita GNP, an income distribution ratio and an indicator of outwardness, which brings ¹⁰ :

$$(3.8) \quad P = 20.8 - 0.09 * D / GNP + 0.41 * AVINV / GDP + 0.17 * TOT - 0.01 * PCI$$

$$(0.62) \quad (1.15) \quad (0.39) \quad (0.56) \quad (1.96)$$

$$- 1.27 * INEQ + 22.6 * OUTW$$

$$(2.38) \quad (3.45) \quad (N=19, R^2=.69, \bar{R}^2=.54)$$

which suggests that the price may indeed be affected by some structural (and largely exogenous) variables. The sign of the per capita GNP coefficient is intriguing: PCI may de facto proxy for the absent regional dummies, or one might hypothesize that wealthier debtors are less trustworthy. The significance of the (3.6) variables is completely diluted. Note also the particularly strong influence of outwardness, which can be interpreted in at least two ways: one (game theoretical) view is that a more open economy is more vulnerable to retaliation measures in case of default (such as drying up of trade credits, or a substantial increase in their cost); another (say

¹⁰ Plugging in structural variables such as INEQ and OUTW dramatically reduces the number of observations. One standard method to deal with this problem would be to carry out a first-stage regression of these variables on the other right-hand side variables (for the available observations), and to use the fitted values thus obtained in a second-stage regression. This procedure however has uncertain net effects on estimation efficiency and affects the reliability of the t-statistics. Therefore, synthetic inequality and outwardness variables were not introduced here.

"Balassian") view is that more outward-oriented economies perform better, which implies a higher creditworthiness.

Geographical dummies were also tried, but proved fairly irrelevant.

Replacing the effort variable in (3.2) by a sustainability measure, such as estimated average 1986-88 output per capita growth, and combining it with the debt/exports ratio, generated:

$$(3.9) P = 58.7 - 0.04 * D/X + 1.1 * CGDPGR$$

$$(10.04) \quad (3.66) \quad (1.70)$$

$$(N=38, R^2=.32, \bar{R}^2=.28)$$

The sign of the new variable's coefficient suggests that the valuation of the debt increases with the sustainability of adjustment efforts.

The next step is the introduction of "financial" variables, as is done for instance by SACHS and HUIZINGA[1987], HUIZINGA[1989] or PURCELL and ORLANSKI[1989].

Using the square root of the number of rescheduling years since 1982 (assuming the impact of a marginal rescheduling operation is decreasing), one obtains:

$$(3.10) P = 68.4 - 0.11 * D/GNP - 12.3 * SQRRES \quad (N=42, R^2=.28, \bar{R}^2=.24)$$

$$(7.70) \quad (2.21) \quad (2.54)$$

Alternatively, the imposition of an allocated transfer risk

reserve (ATRR) may be used, in combination with the debt/exports ratio:

$$(3.11) \log P = 6.53 - 0.50 \cdot \log(D/X) - 0.76 \cdot \text{ATRR} \quad (N=38, R^2=.45, \bar{R}^2=.41)$$

(6.37) (2.84) (2.63)

Introducing ATRR and the highly correlated arrears criterion jointly increases the overall fit substantially and suggests the second variable works even better than the first one:

$$(3.12) \log P = 5.99 - 0.37 \cdot \log(D/X) - 0.35 \cdot \text{ATRR} - 0.93 \cdot \text{ARREARS}$$

(8.77) (3.12) (1.72) (6.76)

(N=38, R²=.76, \bar{R}^2 =.74)

As in the above mentioned studies, the financial variables perform quite well. But this should come as no surprise, since they are presumably largely endogenous. The same remark applies when ATRR is introduced on the right-hand side along with an "economic" variable:

$$(3.13) P = 50.00 - 0.10 \cdot D/GNP + 0.72 \cdot \text{AVXGR} - 20.31 \cdot \text{ATRR}$$

(7.99) (1.87) (1.82) (2.22)

(N=42, R²=.33, \bar{R}^2 =.28)

Trying to use the average 1985-87 debt service ratio instead of rescheduling or loan classification variables leads to:

$$(3.14) P = 32.98 - 0.14 \cdot D/GNP + 0.85 \cdot \text{AVDS}/X \quad (N=42, R^2=.26, \bar{R}^2=.22)$$

(3.12) (2.62) (2.34)

This indicates that a high debt service ratio might be

interpreted as the sign that the debtor can and/or is willing to pay and as an indicator of effort. It also suggests that this variable cannot be used as a measure of the liquidity constraint facing the country.

Had detailed data on the amounts of arrears or on the suspension of interest payments been available, the overall fit of the price equation certainly could have been improved ¹¹. But such refinements could be experimented ad nauseam without much added value for the testing of the DRLC hypothesis. A high R^2 may be appealing to market participants, as outliers then become potential profit opportunities (see PURCELL and ORLANSKI[1989] for such an approach). But the financial variables are themselves very responsive to the debt burden, implying we cannot hope to calculate the debt ratio corresponding to the top of DRLC holding them constant ¹².

Nevertheless, and for the sake of comparison with earlier results, we heretically abstracted for a moment from this set of issues, and computed each country's critical debt ratios implied by equations (3.2), (3.5), (3.6), (3.7), (3.8), (3.10) and (3.13).

¹¹ A dummy reflecting the implementation of debt conversion schemes instead performed poorly, probably because its meaning varies a lot across countries (contrast e.g. debt-equity swaps in Mexico with the Bolivian buyback).

¹² Discussing moral hazard issues such as the possible manipulation of the secondary market price of its debt by the debtor himself (or on his behalf), SACHS and HUIZINGA[1987,p.564] stress that to the extent that financial variables proxy for structural "ability to pay" characteristics of a country (political instability, adverse export structure, financial collapse and so forth), they can be considered as given. But better proxies are certainly to be found, which would be less sensitive to the debt ratio.

Subtracting these from the end 1987 observed debt ratios, we found the following, including the borderline cases:

TABLE 1

Country	Specification	[D/GNP-(D/GNP)*]
Argentina	(3.5)	-8
Bolivia	(3.6)	7
	(3.7)	1
Congo	(3.5)	60
	(3.6)	11
	(3.7)	2
	(3.10)	14
	(3.13)	-3
Liberia	(3.2)	-6
	(3.13)	33
Nicaragua	(3.2)	66
	(3.5)	99
	(3.6)	19
	(3.7)	88
	(3.10)	15
	(3.13)	100
Peru	(3.8)	-5
Sudan	(3.13)	11
Zaire	(3.5)	-1
Zambia	(3.6)	161
	(3.7)	159
	(3.8)	136
	(3.10)	120
	(3.13)	211

This list is to be compared to the CLAESSENS[1988] finding that out of 28 countries, only Bolivia, Sudan and Zambia were on the "wrong side" of the DRLC, whereas Peru and Côte d'Ivoire were

borderline cases ¹³. Computations not reproduced here showed that similar results are obtained using D/X instead of D/GNP. Note that if any of the above specifications is assumed to hold beyond the 42 countries sample, it could be used to assess the position of other debtors with respect to their critical debt ratios. Note also that a positive $[D/GNP - (D/GNP)^*]$ represents the amount of debt relief that would shift a country back to the top of its DRLC, i.e. the amount that, ceteris paribus, creditors should be ready to forgive. The debtor of course would ask for more, up to the point on the "right side" of the DRLC where the value of the creditors' claims would equal the current market valuation of the debt.

Another way still to test the DRLC hypothesis is to use a functional form that implies that E, instead of being a constant, depends on the level of P. Setting $LOGISP = \log[P/(1-P)]$, with P expressed as a fraction now, this new variable was regressed on the same type of variables as above. The result most favorable to the debt overhang hypothesis is:

$$(3.15) \text{ LOGISP} = 8.70 - 1.60 \cdot \log(D/X) + 0.15 \cdot \text{AVGDPGR}$$

$$(4.11) \quad (4.40) \quad (2.55)$$

$$(N=38, 35 \text{ degrees of freedom, } R^2=.38, \bar{R}^2=.35)$$

¹³ CLAESSENS used the SACHS-HUIZINGA[1987] equation :
 $P = 77.2 - 9.6 \cdot \text{ATTRR} - 17.2 \cdot \text{SUSP} - 0.15 \cdot D/GNP + 2.2 \cdot \text{GNPGROWTH}$,
 where SUSP is a dummy indicating whether the country unilaterally suspended debt service payments.

Here, $\hat{E} = -1.60(1-P)$, with a standard error of $0.36(1-P)$ ^{14 15}.

This implies that countries with low prices are located on the "wrong side" of the DRLC. More precisely, the assumption of an elasticity smaller or equal to one can be rejected at a level of significance α for the following countries (one-sided test, and assuming (3.15) is valid for the 4 countries for which no D/X figure as of end 1987 was available):

TABLE 2

Confidence level α	Country	(price)	Scope for debt relief (creditors' viewpoint)
70 %	Honduras	(23)	120
80 %	Argentina	(18.5)	304
	Bolivia	(11.5)	556
	Costa Rica	(12)	191
	Côte d'Ivoire	(20)	158
	Dominican Republic	(21)	n.a.
	Ecuador	(13)	256
	Nigeria	(22)	141
	Panama	(19)	40
	Tanzania	(22.5)	360
	Uganda	(23.5)	132
	Zaire	(21.5)	176
	Zambia	(20.5)	278
90 %	Liberia	(7.5)	n.a.
	Nicaragua	(3)	n.a.
	Peru	(6)	380
	Sudan	(5)	1222
	Congo	(22)	167
	Sierra Leone	(8.5)	n.a.

¹⁴ Denoting β the true value of the coefficient of $\log(D/X)$, $\partial \log[P(1-P)]/\partial \log(D/X) = \partial \log P/\partial \log(D/X) - \partial \log(1-P)/\partial \log(D/X) = E + (D/X)(\partial P/\partial(D/X))/(1-P) = E[1+P/(1-P)] = E/(1-P) = \beta \Rightarrow E = \beta(1-P)$. It is also feasible to have the elasticity depend on the debt ratio as well: regressing $\log[P/(1-P)]$ on (D/X) and a set of exogenous variables, and denoting κ the true value of the coefficient of (D/X) leads to: $\hat{E} = \kappa(1-P)(D/X)$. Intuitively, a variable elasticity, with $\partial E/\partial P < 0$ and $\partial E/\partial D > 0$, seems plausible.

¹⁵ Note that the elasticity thus defined is a local measure. Therefore, using it to simulate the effect of large scale debt relief, as D. COHEN[1989,pp.13-4] does, raises a problem.

It should be stressed that this list is much longer than all the ones displayed in the literature up to now, to our best knowledge. It also encompasses all the countries listed in table 1. Moreover, it is relatively conservative in so far as pointwise, all countries for which $1.60(1-P) > 1$, i.e. $P < 0.375$, lie on the "wrong side" (which adds another 4 not unimportant observations to the ones listed in table 2, namely Brazil, Mexico, Poland and Venezuela). Alternative logistic specifications however yield less clear-cut results. Replacing output growth by export growth for instance yields $\hat{E} = -1.32(1-P)$, with a standard error equal to $0.38(1-P)$.

As mentioned earlier, once a specification is accepted, an estimate of the scope for debt relief can be calculated. For illustrative purposes, this is done here on the basis of equation (3.15). Restricting ourselves to the countries listed in table 2, call $(D/X)^c$ the abscissa of the top of the DRLC. Then, expressing V as a function of D/X , $AVGDPGR$ and the estimated parameters (plus the error term \hat{u}), and maximizing V with respect to D/X leads to the result in the last column of table 2, that displays $D/X - (D/X)^c$ (except for the 4 countries for which only D/GNP was available). Similarly, the scope for debt relief from the debtor's viewpoint could be computed. Suffice it to stress here that, by definition, it is even larger.

As one might finally wonder whether the debt ratio and/or the growth rate of output are really exogenous, a version of the three

corresponding Wu-Hausman tests was carried out (using as additional instruments: PCI, WARDUM, TOT, TURK, SUBSAF, CENTRAM, EASTEUR and NORTHAF). In each case, the null hypothesis of exogeneity could not be rejected at a 90% significance level. However, at the 80% level, the hypothesis of growth exogeneity could be rejected.

Dropping a few countries now allows to estimate the price equation over three periods (end 1986, end 1987, end 1988), in order to complement and assess the robustness of the previous results.

Estimating a (3.3)-type equation over the new pooled sample yields (for P_t , $(D/GNP)_{t-1}$ and XGR_{t-1}):

$$(3.16) \log P = 6.51 - 0.67 \cdot \log(D/GNP) + 0.013 \cdot XGR$$

(11.07) (5.13) (2.17) (N=102, $R^2=.26$, $\bar{R}^2=.24$)

It must be emphasized that this equation, like the following ones, is accompanied by a low Durbin-Watson statistic (here 1.14 and in general almost always under 1.3). Despite the fact that no immediate conclusion can be drawn in the context of pooled time-series cross-section data, a strong presumption of positive autocorrelation arises, which will be dealt with later on.

Similarly, replacing last year's export growth by last year's output growth:

$$(3.17) \log P = 6.35 - 0.66 \cdot \log(D/GNP) + 0.081 \cdot GDPGR$$

(11.14) (5.24) (4.22) (N=96, $R^2=.35$, $\bar{R}^2=.34$)

Adding current (CPI) inflation and last year's terms of trade and investment ratio generates:

$$(3.18) \log P = 4.70 - 0.47 \cdot \log(D/GNP) + 0.013 \cdot XGR - 0.0021 \cdot INF + \\ (6.45) \quad (3.86) \quad (2.40) \quad (4.79) \\ 0.0090 \cdot TOT + 0.023 \cdot INV/GDP \\ (2.35) \quad (2.24) \quad (N=92, R^2=.47, \bar{R}^2=.44)$$

Carrying out ordinary least squares on the pooled sample implicitly assumes that intercept and slope coefficients are constant over time. The clear downward trend of prices on the secondary market since its inception suggests however to try and add time dummies allowing the intercept to shift from one year to the next¹⁶. Then (3.17) for instance becomes:

$$(3.19) \log P = 6.46 - 0.64 \cdot \log(D/GNP) + 0.077 \cdot GDPGR - 0.22 \cdot DUM87 \\ (11.29)(5.15) \quad (3.94) \quad (1.31) \\ - 0.28 \cdot DUM88 \\ (1.55) \quad (N=96, R^2=.37, \bar{R}^2=.34)$$

Although the coefficients associated with the dummies have the expected signs, their t-statistics are rather low and their joint significance is far from conclusive ($F = 1.415 < F_{.05}(2,91) \approx 3.95$).

¹⁶ Detailed figures on the accumulation of arrears might have been very useful in this context, in particular to account for the 1988 price drop, as for an increasing number of countries the temporary buildup in interest arrears tended to become a means of obtaining de facto financing (and possibly softer conditions on further lending, in so far as strategic considerations are involved as well). The 1987 price drop instead is conventionally associated with the bank's provisioning move, analyzed e.g. by GUTTENTAG and HERRING[1989].

While the t-statistics come out higher in specifications involving "financial" variables, the 1987 dummy consistently turns out to be smaller in magnitude and less significant than the 1988 one. For example:

$$(3.20) \log P = 6.04 - 0.46 \cdot \log(D/GNP) - 1.30 \cdot ATRR - 0.19 \cdot DUM87 \\ - 0.37 \cdot DUM88$$

(13.88) (4.70) (9.22) (1.43)

$$(2.83) \quad (N=101, R^2=.60, \bar{R}^2=.59)$$

where again, of course, ATRR is as much a reflection of a high debt burden and a low price as an explanation for a depressed valuation of the debt outstanding.

Turning to the logistic form for the left-hand side variable produces:

$$(3.21) \text{LOGISP} = 6.89 - 1.22 \cdot \log(D/X) + 0.13 \cdot GDPGR - 0.35 \cdot DUM87 \\ - 0.43 \cdot DUM88$$

(5.79) (5.96) (3.49) (1.18)

$$(1.34) \quad (N=94, R^2=.38, \bar{R}^2=.35)$$

The relatively low values of the t-statistics associated to the time dummies' coefficients suggest to carry out a Chow test to assess whether the intercept and slope coefficients did shift over time. It then appears that the parameters can reasonably be considered stable over the three years, which might help explain the mixed record of the dummy variables ($F = 0.86 < F_{.05}(6,85) \approx 2.21$).

Positive serial correlation does not affect the biasedness nor the consistency of the point estimates, but it may lead to quite considerably overestimate their precision. Therefore, the presence of autocorrelation should be tested and, if necessary, corrected for. This will be carried out here for a slightly modified version of (3.21). The 1987 dummy has to be dropped, since perfect multicollinearity would otherwise arise in the transformed equation. Moreover, the sample will be restricted to the countries most likely to suffer from a debt overhang (the somewhat arbitrary criterion still being $D/X > 300$), as the number of observations now used makes small sample problems less acute.

Applying ordinary least squares leads to:

$$(3.22) \text{ LOGISP} = 8.18 - 1.45 \cdot \log(D/X) + 0.07 \cdot \text{GDPGR} - 0.62 \cdot \text{DUM88}$$

(3.88) (4.22) (1.54) (1.90)

(for $D/X > 300$) (N=51, $R^2 = .42$, $\bar{R}^2 = .38$)

A single-round estimation of the first-order autocorrelation coefficient yields $\hat{\rho} = 0.56$ (assumed equal across countries). The latter is used to transform the data following the standard Prais-Winsten procedure (as the Cochrane-Orcutt method would entail too large a relative loss of observations, and as the assumption that the same AR process was operative during the immediate pre-sample history seems acceptable):

$$(3.22') \text{ LOGISP} = 10.07 - 1.72 \cdot \log(D/X) + 0.03 \cdot \text{GDPGR} - 0.44 \cdot \text{DUM88}$$

(4.40) (4.74) (0.90) (2.12)

(for $D/X > 300$) (N=51, $R^2 = .15$)

Apart from the low overall fit and the sub-standard t-statistic associated to growth ¹⁷, this result tends to support the one obtained with pure cross-section data. A grid search on ρ showed that the first-round estimate of ρ might be the most favorable one, but not by very much (the point estimate of the debt coefficient varied between 1.54 and 1.72).

The parameters in (3.22') can be used to examine which countries with a large debt/exports ratio presumably lay on the "wrong side" of the DRLC at the end of each of the last three years. The estimated elasticity is $\hat{E} = -1.72(1-P)$, with a standard error equal to $0.36(1-P)$. Table 3 shows how a number of countries shifted to the downward sloping side of the DRLC as the price of their debt declined over time.

¹⁷ An overall significance test yields $F = 2.76$, to be compared with $F_{.05}(3,47) \approx 2.80$ and $F_{.10}(3,47) \approx 2.25$. The significance of the coefficient associated to growth might perhaps be improved if a moving average were to be used for this variable.

TABLE 3

Confidence level	Country (price)		
	end 1986	end 1987	end 1988
70 %		Argentina (34.5) Nigeria (30.5)	Poland (34.5)
80 %		Zaire (21)	Argentina (21.5) Côte d'Ivoire (25) Honduras (23) Nigeria (23) Zaire (22.5)
90 %	Peru (19) Zambia (20)	Bolivia (12) Costa Rica (16.5) Zambia (18)	Bolivia (11) Costa Rica (13) Ecuador (13) Zambia (20)
95 %	Bolivia (7.5) Nicaragua (5.5) Sudan (6)	Liberia (7.5) Nicaragua (4) Peru (8) Sudan (6)	Liberia (7.5) Nicaragua (3) Peru (5.5) Sudan (3.5)

As precedingly, pointwise Brazil (1988), Costa Rica (1986) and Ecuador (1987) could have been added to the list. A comparison with table 2 should take into account the smaller size of the country sample here. In general, one might suspect that other debt-distressed countries virtually lie on the "wrong side" of the DRLC, although the lack of price data does not allow their position to be evaluated by the present approach.

Notwithstanding the indications provided by the exogeneity tests, it seems worthwhile to ask what the endogeneity of growth in equations (3.15) and (3.22') would imply with respect to the estimate of E. A pair of growth and investment equations were estimated, both on a pure cross-country basis (using 1985-87 average data first, then

1982-87 averages) and on a panel data basis (42 countries, yearly data from 1982 to 1987). Two-stage least squares were used in each case, and the significant first-order autocorrelation observed in the time-series cross-section sample was corrected for using the standard Cochrane-Orcutt procedure ¹⁸ .

Regression results vary considerably across specifications and samples. On the whole nonetheless, D/X tends to enter the synchronic growth equations with a negative coefficient. In the cross-section investment equations instead, D/X tends to enter with a positive and non significant coefficient.

Using panel data (with and without smoothing investment, growth and debt figures) allows to introduce more variation on the right-hand side, as growth in the industrialized countries as well as international interest rates can be brought in. The regression results are slightly different from the cross-section ones. The coefficient on D/X in the growth equations varies from -0.0030 to -0.0005, according to the specification, whereas the one in the investment equations takes its values over a strictly negative range, illustrating the fragility of any clear-cut conclusion as to the impact of debt on capital formation.

These somewhat inconclusive results can still be useful to assess

¹⁸ As a "regime switch" might have occurred in 1982 (debt becoming a burden instead of growth's propeller), and as a larger number of observations are available here than in the three-year sample, saving the first observation for each country was not justified anymore.

the possible sensitivity of \hat{E} to the indirect effects of debt relief transiting through growth. Denoting W the vector of exogenous variables and δ the vector of associated coefficients:

$$\hat{G} = \hat{\alpha} + \hat{\gamma}*(D/X) + \hat{\delta}*W$$

Injecting this expression in the price equation:

$$\log[P/(1-P)] = \hat{\lambda} + \hat{\beta}*\log(D/X) + \hat{\xi}*\hat{G} (+ \hat{\mu}*dummy)$$

and differentiating with respect to P and (D/X) yields:

$$\hat{E} = [\hat{\beta} + \hat{\xi}\hat{\gamma}(D/X)][1-P]$$

The additional term is thus $\hat{\xi}\hat{\gamma}(D/X)(1-P)$. Assuming a fairly high debt ratio (600) and considering that the magnitude of γ is in reality on the high side of our estimated range (0.003), the point evaluations of $|E|$ in (3.15) and (3.22') are respectively augmented by a relatively modest $0.27(1-P)$ and $0.05(1-P)$.

At this point, the best guess is thus probably that the conclusions reached on the basis of a single price equation need not be dramatically altered when a more comprehensive systems approach is adopted. Unfortunately, the specifications used to determine the possible effects of the debt burden on investment and growth were far too crude to provide more than an incentive for further research.

4. CONCLUSIONS: WHAT RATIONALE FOR DEBT CATHARSIS ?

Obviously, the debt overhang problem should be integrated into a broader analytical framework. Many crucial variables are left out of the picture here, which directly or indirectly play an important role in the debate on the existence of a DRLC. Political stability, as some of the structural variables used suggested, is of course a key element in the investment decision. Overvaluation of the domestic currency (which was reflected - as a weakness - in the outwardness index) and subsequent import binges or capital outflows, as in Chile or in Argentina a decade ago; as well as expectations concerning the next (maxi) devaluation and the correlative capital flight or high real interest rates may also account for low investment levels . Fiscal crises, which often seem as much a cause as an effect of the debt overhang, and the anticipations regarding future tax treatment are equally important. Finally, the liquidity constraints certainly have been underemphasized here, and deserve more modelling and testing.

With respect to the DRLC viewed in relative isolation, additional time-series work would evidently be required, were it only because a, say, 20% debt relief measure will realistically not have a uniform

impact on expected payments across countries. This is quite feasible for the investment and growth equations. It would be harder though for the price equation because of the insufficient data available as yet. And as the debt crisis drags on, coefficients might turn out to be fairly unstable.

The results obtained in this paper are fairly strongly supportive of the DRLC hypothesis, especially in comparison to the (few) previous attempts to test its empirical relevance. The fate of the original Laffer curve should however serve as a reminder and lead us to stress that only one among the numerous specifications experimented with produced a result that unambiguously corroborated the DRLC. Even if this finding appeared reasonably robust, one should not consider it as a final answer.

On the other hand, a rationale for debt catharsis can of course be found elsewhere. Even if the above regressions had discredited the notion of a bell-shaped debt relief curve, debt relief could still be Pareto improving through channels ignored in simple debt overhang models. For instance, more vigorous growth in the debtor countries would expand the demand for industrial countries' exports. Lower debt ratios would reduce the potential instability of the international monetary and credit system, not to mention geopolitical considerations. Other (not uncontroversial) side-benefits of debt reduction would include the signalling of creditworthiness or the exploitation of differences in preferences among creditors.

To conclude on a somewhat paradoxical note, it may be argued that the implementation of debt relief, when there is room for Pareto improvement, raises well-known free-rider problems as well as "contagion" and moral hazard issues which suggest, ironically, that a market-based reasoning such as the one underlying the DRLC has to be supplemented, when it is to be applied, by some form of public intervention.

APPENDIX

Description of the data

Countries

The sample includes the following 42 countries : Algeria, Argentina, Bolivia, Brazil, Cameroon, Chile, Colombia, Congo, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, Egypt, Gabon, Guatemala, Honduras, Hungary, Jamaica, Liberia, Madagascar, Malawi, Mexico, Morocco, Nicaragua, Niger, Nigeria, Panama, Peru, Philippines, Poland, Senegal, Sierra Leone, Sudan, Tanzania, Togo, Turkey, Uganda, Uruguay, Venezuela, Yugoslavia, Zaire and Zambia. The 17 World Bank's highly indebted middle-income countries (HICs) are thus all taken into account. However, some of the variables were not available for some of the countries or some periods, and therefore the number of observations is not automatically a multiple of 42.

The secondary market prices for some other countries (in particular Angola, Iraq, Mozambique, Romania and South Africa) are quoted by ANZ Mc Caughan Merchant Bank Ltd and published in the *I.F.R.* but for various reasons the right-hand side data are not available, which forced us to drop this information.

Main variables

P - price : average bid/ask, rounded to the nearest 1/2 %

Sources: Salomon Brothers (*Indicative prices for LDC bank loans*)
International Financing Review (I.F.R.), various issues.

A short presentation of the secondary market is in order to emphasize the caution that must be exercised when interpreting quoted prices (or volumes).

Two types of transactions dominate the activity in this market: debt for debt swaps and cash sales. The first ones are motivated by the rationalization of the banks' portfolios (concentration of claims on countries where banks have strategic business interests and elimination of costs associated with minor claims on other countries). Cash sales have become more frequent with the advent of debt conversion schemes. Demand mainly emanates from foreign corporations engaged in debt-equity swaps and from residents of the debtor country repatriating flight capital. The public sector may also repurchase part of its bank debt, as Bolivia did. Retail investors, institutional investors and the like are virtually absent instead. Supply is influenced inter alia by the discount on the paper, provisioning levels, tax treatment, accounting practises and capital adequacy considerations.

Restructured sovereign bank claims are the main instruments traded in this market. Interbank exposure and private sector claims are also traded, but less easily, because of their heterogeneity and smaller size. Transaction costs are high, averaging about 1 to 2 percent. Gross turnover, estimated by market participants at some USD 40 to 50 billion during 1988, is much higher than final demand, as matching supply and demand typically requires multiple asset swaps. Spreads between bid and offer prices can be very wide.

Market participants - whose moods are reflected in the weekly commentary published in the *I.F.R.* - usually declare that the prices announced by Salomon Brothers and others for Brazil, Mexico, Chile, Argentina, Venezuela and the Philippines are representative of the levels at which most transactions are taking place. For other paper, this is less true, as trade may be infrequent and as there may not be a significant amount of "benchmark" claims available.

Opinions tend to vary concerning the extent to which prices accurately gauge a country's long-run ability to pay. It is often stressed that demand is essentially short term, linked to conversion schemes and not to any assessment of the true creditworthiness of the debtor. Supply may also be motivated by portfolio requirements rather than by sovereign risk analysis. The authors of the General Accounting Office[1988] report for instance believe prices are upward biased, whereas the supervisory agencies tend to argue the converse. Note finally that the bulk of the paper traded on the secondary market carries variable interest rates, which implies the discount is not significantly affected by the level and variation of world interest rates.

D - total external (i.e. owned to non-residents and repayable in foreign currency, goods or services) public and private debt outstanding and disbursed, denoted EDT in the original tables. Gross debt rather than net (i.e. minus reserves) is chosen because the interpretation of reserves is highly ambiguous, as they perform a strategic role in the context of potential default (see O'CONNELL[1989]).

Note that, in the absence of adequate information, the face value of the debt, as opposed to a measure accounting for the interest rate it carries, is used.

Source: World Bank[1988]

X - exports of goods and non factor services

The ratios D/X and D/GNP are published in World Bank[1988]. Here they are expressed in percentages and rounded to the nearest point. Note that due to large real depreciations, the denominator may decrease substantially when expressed in USD even if the volume of exports or activity remains unchanged, as pointed out by DORNBUSCH[1988].

DS/X - debt service ratio: principal repayments plus interest over exports of goods and services, in percentage points.

Source: World Bank[1988]

GDPGR - growth rate of real gross domestic product, in percentage points, often averaged (AV) over several years in order to mitigate the impact of statistical errors (which may be particularly important in high inflation countries) and of short-term volatility (as the intuition is that GDP growth should stand for a measure of sustainability of adjustment, and therefore that it should reflect the expectation of trend growth).

Sources: World Bank[1989a]
Economist Intelligence Unit *Country reports*

XGR - annual growth of the volume of exports (1980 prices), in percentage points, often averaged for the same reasons as output growth.

Source: Calculated from World Bank[1989a]

INVGR - average growth per annum of gross domestic fixed investment, in percentage points.

Source: Calculated from World Bank[1989a]

INV/GDP - rate of fixed domestic investment, in percentage points, often averaged over several years for the same reasons as XGR and GDPGR.

Source: Calculated from World Bank[1989a]

POPGR - estimated average annual growth rate of the population during the eighties, in percentage points.

Source: VU and ZACHARIAH[1983]

Regional dummies: CENTRAM for Central America, SUBSAF for Sub-Saharan Africa, NORTHAF for Northern Africa, EASTEUR for Eastern Europe, TURK for Turkey and PHIL for the Philippines.

These dummies may capture a number of social, political and economic features characterizing each group of countries and which are ignored in the other right-hand side variables, such as political stability, propensity to save and invest, etc. They may also stand for "contagion" phenomena. Note that the implicit "reference" area is here South America plus Mexico.

WARDUN - (civil) war dummy, set to 1 for Sudan, Nicaragua, Peru and Uganda, 0 for the other countries.

INFL - consumer price index or GDP deflator measure of inflation, in percentage points.

Sources: Economist Intelligence Unit *Country reports* for CPI
Calculated from World Bank[1989a] for GDP deflator

PCI - per capita GNP estimated for 1987, in USD

Source: World Bank[1989b]

OUTW - degree of outward orientation over the period 1973-85, as defined in GREENAWAY and NAM[1988]. Ranking, based on effective rates of protection, the extent of direct import controls and export incentives and the alignment of the exchange rate, is as follows: strongly inward oriented: 1, moderately inward oriented: 2, moderately outward oriented: 3, strongly outward oriented: 4. Note that this variable is based on an assessment of policies rather than of policy outcomes. But it is available for only a limited number of countries.

INEQ - degree of income inequality, as measured by the ratio of the share of household income accruing to the highest quintile over the corresponding share for the lowest quintile (based on surveys carried out at various dates). This variable is also missing for some countries.

Sources: *World development report*, various issues, United Nations[1985], KAKWANI[1980] and JAIN[1974].

TOT - terms of trade: index of average export prices over average import prices, in percentage points (1980 = 100).

Source: World Bank[1989b]

RESC - number of years since 1982 with a multilateral private and/or public debt restructuring agreement.

Source: Computed from World Bank[1988]

ATRR - allocated transfer risk reserves: this dummy takes the value 1 when the loans to the country have been declared value impaired, 0 otherwise.

More precisely, the Federal Interagency Country Exposure Review Committee (including representatives from the Federal Reserve Board,

the Federal Deposit Insurance Corporation and the Comptroller of the Currency) meets three times a year to examine conditions in countries where transfer risk to U.S. banks is significant. Loans to borrowers in a country with protracted arrearages may be declared "value impaired". This necessitates at least two of the following conditions to be met: full interest has not been paid for at least six months; no I.M.F.-supported or similar program has been or is to be adopted; obligations on rescheduled debt have not been met for one year or more; there is no definite prospect for an orderly restoration of debt service. When an asset receives this classification, the lender is required to charge off a certain percentage of the original claim or to establish an equivalent specific reserve, labelled "allocated transfer risk reserve"(ATRR), which is not considered part of the bank's capital when the adequacy of the latter is assessed.

In practice, the required write-off/ATRR has typically been 10% in the first year and 15% in each succeeding year that the loans are judged value impaired. The ATRR had by early 1989 been applied only to 8 of the smaller debtor countries: Bolivia, Liberia, Mozambique, Nicaragua, Peru, Poland, Sudan and Zaire. In June 1989 however, Argentina was added to the list (see MARTISON and HOUPPT[1989] for further details on the regulatory setting and General Accounting Office[1988] for criticisms on the way the rules are in fact applied).

Stricto sensu, the ATRR only applies to U.S. banks, but the latter are often the biggest private creditors. Moreover, the value impaired classification constitutes a strong signal that is no doubt taken into account by all the parties involved.

ARREARS - dummy taking the value 1 if the country was in arrears on its interest payments as of January 1989, 0 otherwise.

Source : SACHS[1989]

(N.B.: the author himself qualifies the list provided as almost surely incomplete)

RATING - *Institutional Investor's* country rating, based on the ratings provided by a sample of 75 to 100 banks, which are weighted according to each respondent's worldwide exposure and the degree of sophistication of its country-analysis system.

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BLACK MARKETS FOR HARD CURRENCY IN EASTERN EUROPE

May 1990

"Dollars are dollars. If you have dollars, you can always change them... With dollars, you never go hungry" (Polish citizen in a line ¹).

For decades, black or grey markets for hard currencies have been a pervasive and important phenomenon in East European countries.

Data are scarce and often fairly unreliable, but some crude estimates will suffice for illustrative purposes. In the Soviet Union, the equivalent of 3 to 4 billion US dollars are thought to be currently held, illegally, in the form of hard currency cash, by the population. In Poland, private holdings of dollars were evaluated at some 5 billion dollars in 1988. In Yugoslavia, domestic hard currency deposits totalled 9.6 billion dollars in the fall of 1986, and unofficial private savings kept abroad were much larger ². The premia on the Greenback in the fall of 1989 stood for instance at 200% in Czechoslovakia, 300% in Poland, 800% in Romania, and 1,500% in the Soviet Union ³.

The existence of such black markets and of hard currency hoarding underscore the misalignment, speaking euphemistically, of the official exchange rate(s). Variations in the black market rates affect the level of official reserves and thus external balance management. Both a symptom and a source of major problems, this phenomenon has been studied rather

¹ Cited in the *Wall Street Journal*, 02.21.1990, p.A1.

² According to *PlanEcon Report*, 09.01.1989, "\$180 billion in U.S. currency eludes tally; is it abroad?", *New York Times*, 02.20.1990, and the Economist Intelligence Unit *Country Profile* for Yugoslavia 1987-88 respectively.

³ Premia are measured here as the ratio of the black market rate to the official rate (both expressed as the domestic price of foreign exchange) minus one.

extensively for developing countries. Little formal and quantitative work has been carried out, however, in the case of Eastern Europe.

The chapter starts with a brief presentation of the specific East European black market context (section 1). A partial equilibrium model of a single hard currency black market is then set up (section 2). The predictions of the model with respect to the premia's behavior are tested econometrically (section 3). The appendix provides supplementary details on the functioning of these markets.

1. THE CONTEXT

The East European centrally planned economies (CPEs), Albania apart, are presently in the process of liberalization and/or stabilization. Therefore, two regimes should a priori be distinguished : the "traditional" one , stretching into the mid or late eighties, and the "transitional" one, observed now.

A number of characteristics and problems are more or less common to both regimes and worth spelling out : the sources of supply and demand of hard currency, the importance of the monetary overhang, and the range of instruments available to hedge against inflation.

The sources of supply of hard currency are numerous and their relative weights vary across countries and time. In general, one should mention foreign tourists, businessmen, diplomats, correspondents and students, who have legal access to hard currency themselves, and are not willing to

abandon the entire premium to the host State. Transfers by relatives and friends living abroad constitute a sometimes substantial source as well. Smuggling activities, "underground" or in official disguise, over and under-invoicing of imports and exports, and various other practices possibly involving government officials or firm managers are also a major source. Miscellaneous channels should be added to the list, such as the hard currency Soviet sailors receive as part of their salary.

Demand stems from an equally broad variety of sources. A crucial one, which will be emphasized later on, is the desire to hedge against inflation or monetary reform by building up a portfolio of safe assets. Another major motive is obtaining access to the hard currency shops or to the black markets for goods, so as to avoid queues and waiting lists (or queues to join waiting lists and waiting lists to join queues) ⁴, or simply to buy items unavailable otherwise. Financing illegal imports constitutes a related demand source. Finally, but not exhaustively, travelling abroad often requires hard currency beyond the official allowance or even for payments to the travel agency.

The first source of demand is closely linked with the "monetary overhang" that characterizes some or all of the CPEs ⁵.

Large budget deficits, rapid growth of bank credit and sometimes of

⁴ "Do you often have queues as long as these?", "No, not very often, only when there are goods in the shops" (Polish wisdom).

⁵ This issue is far from novel. It was raised a decade ago by BIRMAN[1980] e.g. It certainly is not uncontroversial either, as exemplified recently by FARRELL[1989], who argued that the liquidity trend in Eastern Europe is not steeper than what the literature on development and financial systems suggests it should be.

nominal wages, coupled with shortages in the official goods and services markets generate flow disequilibria in the form of excess demand, equal to "intended" purchases minus actual supplies. The intention refers not to the consumers' (naive) expectations regarding the availability of desired items, but to the level of demand corresponding to the official prices if these were to clear the markets. In a trivial sense of course, excess demand in the economy as a whole is likely to be small, insofar as price rises in the second economy absorb the unrealized purchasing power. But the pressure in the official sector subsists, and is referred to as the "inflationary gap".

The cumulation of these gaps, in a context of "repressed" inflation, creates an inflationary or monetary overhang, i.e. a stock disequilibrium between the level of liquid assets in the hands of the population and their demand for them, implying excess household liquidity and "forced savings". Liquidity is excessive as well because of the poor supply of less liquid assets, such as bonds, shares, land or real estate. Savings is all the more compelled as real interest rates on savings deposits are typically negative, inter alia due to an ideological resistance to pay attractive rates that might promote a new "rentier class".

The size of the gaps depends in part on the discrepancy between the effective price increases, also called "open inflation" (in the form of nominal rises, pseudo-product innovations, quality deterioration, biased quantity weights in the official indices and the like) and the notional price adjustments that would eliminate excess demand in the official sector. The effective price hikes often turn out to be much larger than

what official price indices tell ⁶. Open official or unrecorded inflation may call for the accumulation of liquid assets to maintain real balances, and cash requirements relative to purchases may rise as the share of transactions taking place in the second economy increases.

Nevertheless, the price wedge embodying inflation repression remains wide enough for the World Bank[1987] or PlanEcon[09.01.1989] to consider the monetary overhang as a major problem respectively in Poland, for which forced savings estimates are provided, and the Soviet Union, where the build-up of the overhang is proxied by the steady increase of the ratio of savings deposits over retail sales. Earlier on, BIRMAN and CLARKE[1985] provided an alternative set of quantitative guesses for the proportion of Soviet private savings that can be categorized as forced. More recently, the Soviet State Bank and State Committee on Statistics published estimates of excess liquidity ranging between 130 and 165 billion rubles (i.e. between 15 and 19% of GNP) ⁷. In any case, the existence of such an overhang is viewed by the authorities considering price reform as an

⁶ In this respect, there seems to be an informal consensus that official inflation statistics are most reliable for Hungary, followed by Czechoslovakia, East Germany, Bulgaria, Poland and Romania, see NUTI[1986, p.53]. The USSR is not ranked, but its statistics are judged as follows by TREML[1988,p.77] : "regularly published official industrial and consumer retail price indices are faulty to the point of being almost useless in the opinion of most Soviet and Western authors". SHOKIN, GUZANOVA and LIBERMAN[1988] report survey results about the perception of hidden inflation in the USSR.

⁷ See "Modern central banker", in the *Financial Times* 03.12.1990 survey on the USSR. The GNP figure used here was published, in what represented an innovative move, in *Narodnoje khoziajstvo SSSR v 1988 godu* , Moscow, 1989. Note that FEIGE[1990] offers a much higher estimate, suggesting that "the stock ruble overhang is presently between 1.1 and 1.6 times the annual retail sales of the Soviet Union" (p.11). But he thereby considers that the overhang equals the sum of all currency in circulation and all household savings deposits, which of course leads to a large overstatement. At the other end of the spectrum, PORTES[1989] argues that "serious work on household assets and savings in CPEs seems remarkably unanimous in not showing much evidence of forced saving" (p.40).

ominous factor, liable to augment the necessary price rises disproportionately⁸.

In sum, black market premia should be influenced by expected exchange rate devaluations, by official, hidden and repressed inflation, by nominal interest rates, as well as by a variety of factors that are harder to measure, such as the degree of foreign tourist surveillance, the toughness of penalties, the extent of foreign travel opportunities or the authorities' attitude towards emigration.

In practice however, the premium on the dollar cannot be viewed in isolation. Other hard currencies (mostly the Deutsche mark and the Swiss franc), gold and jewelry, even antiques compete with the Greenback as alternative hedging assets⁹. Casual evidence, as recorded in the *World Currency Yearbook* series for instance, suggests fairly active asset substitution within portfolios, involving East European currencies as well (for arbitrage purposes more than as hedges against monetary contingencies though)¹⁰.

⁸ This has been put forward as the motivation underlying the Zl 5,000 billion bond issue launched by the Polish authorities in December 1989. J.SACHS however, in *The Economist* (01.13.1990), argued that in Poland, as opposed to some other East European countries, the excess money growth was dissipated by high inflation and that real balances were low at the start of the stabilization program.

⁹ See e.g. BIRMAN and CLARKE[1985,p.504], or more recently the *Financial Times*, 01.10.1990, reporting that the Soviet authorities raised the price of jewelry and gold by 50%, in an attempt to stop panic buying of these items as a hedge against gathering inflation and rumored monetary reform (in 1947, Stalin decided the compulsory exchange of one new ruble for 10 old ones).

¹⁰ The arbitrage opportunities created by the heterogeneity of subsidization policies across East European countries and by the non synchronization of exchange rate reforms are documented by BLAHA[1989], who shows how a class of "business tourists" exploit them. A recent incident, reported by the *Bratislava Pravda* (06.21.1989), is worth mentioning : two Polish citizens

A final qualification is in order. Over time and across countries, trading and hoarding hard currency may belong to any of the colored cells of KATSENELINBOIGEN[1977]'s market matrix. In Poland for example, it used to be strictly illegal, black market operators facing the menace of capital punishment, whereas it is now fully authorized. But what really matters for modelling purposes is the dual rate structure and the implied premium rather than the shades of grey.

2. A MODEL

The model exposed in this section emphasizes the interaction of stock and flow conditions in the black market for a single hard currency, along the lines of DORNBUSCH et alii[1983]. As a partial equilibrium exercise, it ignores the feedback from the black market to the rest of the economy.

Such an approach may be justified as long as "dollarization" has not reached too large a scale ¹¹. But it is certainly questionable, as e.g. GUPTA[1980], NOWAK[1984] and OLGUN[1984] have argued in the context of developing or industrializing countries. Moreover, the linkage with the black market for goods is an important one in any case, and is only present

were arrested at the Austrian border while transporting 355,300 rubles, 255,000 forints, 5,990 leva, 30,000 kuronas and 4.8 kilos of gold!

¹¹ In Poland however, the share of foreign currency deposits in total broad money has increased a lot during the eighties and was estimated at 60% by the end of 1989, see I.M.F.[1990,p.58].

in the background here. PITT[1984] for example, in a model where black market currency is in part demanded and supplied by firms engaged in smuggling, shows that an increase in the exogenous demand for black market foreign exchange reduces clandestine imports and enhances clandestine exports. There may also arise a need to explicit a policy reaction function: in Poland e.g., the authorities watch the black market premium closely and take it into account in their decisions. The outcomes of policies based on exchange rate rules involving the black market rate are examined in a general equilibrium model by KHARAS and PINTO[1989].

One crucial advantage of a partial equilibrium approach however is that it bypasses the non trivial problem of setting up a general equilibrium model incorporating the black market for foreign exchange and constituting an adequate representation of a CPE (or an economy in transition, as concerns the more recent period)¹². To our knowledge, such a construct belongs to the vast set of topics left for future research.

Partial equilibrium analysis here translates into the following exogeneity assumptions : the official nominal exchange rate e (say rubles per dollar, using these labels as generic ones for home/soft currency and foreign/hard currency respectively), the ruble value of non dollar financial assets R , as well as foreign and domestic interest rates i^* and i are taken as given. The implicit hypothesis of unicity of the official exchange rate deserves notice : it improves the tractability but should not bias the outcome of the analysis¹³.

¹² Not to mention the data headaches, when it comes to estimating the relevant system of simultaneous equations.

¹³ The role of the official exchange rate is not studied here. WOLF[1985] discusses it for CPEs, focusing on the USSR, Poland, Hungary and East

Stock equilibrium in the black market for dollars requires that demand, assumed to be positively related to their relative yield and to wealth, equals supply¹⁴. Expressing both in rubles using the black market exchange rate b and denoting D the stock of black dollars and $E[\hat{b}]$ the expected rate of depreciation of the ruble in the black market :

$$bD = \theta (i^* + E[\hat{b}] - i) (R + bD) \quad , \quad \theta' > 0 \quad (1)$$

Two qualifiers are in order at this point. If one considers the black market to be illegal, as opposed to the tolerated "quasi-legal" markets encountered in a number of Latin American countries for instance, i^* should be set equal to zero. This is not the case when dollar denominated deposits are accepted by the banking system, although their return may not be the international interest rate¹⁵. Furthermore, the "laundering charge" paid by those who have no right to possess the dollars they sell, as well as the risk premium associated with illegal holding of hard currency on the demand side should be incorporated here. Implicitly, equation (1) relies on the assumption that these elements can be normalized away.

The "premium" can be defined as $p = b/e$ ¹⁶. Then (1) can be rewritten

Germany.

¹⁴ Dollars are thus held as a component of a diversified portfolio. As perfect foresight will be assumed later on, this will raise the issue of the motive for diversification. The standard rationalization is to interpret the overall demand as capturing an aggregation over many consumers with dispersed expectations.

¹⁵ In Poland, dollar denominated deposits have been officially encouraged and served interest. In Yugoslavia as well large amounts of hard currency are openly deposited and remunerated in domestic bank accounts (see appendix).

¹⁶ In the empirical literature however, the premium is usually defined as $b/e - 1$.

as :

$$\frac{pD}{pD + R/e} = \theta (i^* + E[\hat{b}] - i) \quad (2)$$

The rate of change of the premium is :

$$\hat{p} = E[\hat{b}] - E[\hat{e}] \quad , \quad (3)$$

which using (2) leads to :

$$\hat{p} = \phi \left(\frac{pD}{R/e} \right) - (i^* + E[\hat{e}] - i) \quad , \quad \phi' > 0 \quad (4)$$

where $\phi \left(\frac{pD}{R/e} \right) = \theta^{-1} \left(\frac{pD}{pD + R/e} \right)$.

Asset market equilibrium as stated in (4) means that an increase in the relative supply of black dollars bD/R must be matched by a higher relative return, in the form of an enhanced expected official depreciation adjusted interest differential. A contrario, an increase of the latter generates excess demand, calling for a rise in supply induced by a higher premium level or for an offsetting decrease in the rate of change of the premium.

A flow analysis of the black market enables one to write the net increment in the stock as a function of the premium and of the official real exchange rate denoted e_x . Ceteris paribus, a higher premium should stimulate net inflows by reducing tourism abroad, increasing the use of the black market by foreign tourists and the extent of under/over invoicing, etc. For a given premium, a depreciation of the real official exchange rate (i.e. an increase in e_x) should have the same effect, as it tends to limit residents' trips to more expensive hard currency countries, to spur foreign

tourism at home and net exports, etc. Hence ¹⁷:

$$\dot{D} = \psi(p, e_r) \quad , \quad \psi_p > 0, \quad \psi_{e_r} > 0 \quad (5)$$

Assuming, heroically but quite conventionally, that operators on the black market are rational, forward-looking speculators, blessed with perfect foresight, the expectation operator can be dropped ¹⁸, and the dynamics of the system (4)-(5) can be displayed in the (D,p) space as in figure 1.

The ($\dot{p}=0$) schedule is drawn taking the official depreciation adjusted interest differential and R/e as given. The ($\dot{D}=0$) schedule corresponds to a given official real exchange rate. To the North-East of the constant premium locus, the relative supply of black currency exceeds the public's demand at the prevailing return, implying the premium must rise. The symmetric rationale underlies the motion of p South-West of ($\dot{p}=0$). North of the ($\dot{D}=0$) schedule, the premium is high enough to generate excess supply, and thus a growing stock. The converse holds South. Not surprisingly in this type of model, the steady state equilibrium S exhibits saddle-point (in)stability ¹⁹. Rationalizing the hypothesis that the market will travel on the stable arm is not uncontroversial. Nevertheless, it will be assumed

¹⁷This formulation ignores the interest accumulation component i^*D on the right hand side. The short cut is innocuous if $i^*=0$, as will be the case for practical purposes if the bulk of D is "mattress money". If $i^*>0$, additional restrictions on the parameters are required to obtain the results that follow.

¹⁸As is clear from the literature on foreign exchange market efficiency, surveyed by FROOT[1990], this is not a neutral assumption.

¹⁹Linearizing the system (4)-(5) around the steady state and computing the roots of the associated characteristic equation yields two real roots with opposite signs :

$$0.5((bD/R)\phi' + \phi - (i^* + Ee - 1) \pm [((bD/R)\phi' + \phi - (i^* + Ee - 1))^2 + (4p^2 e/R)\phi' \psi_p]^{1/2}).$$

henceforth that it does ²⁰. In that case, starting, say, from a sub-steady state stock D_0 implies a high and declining premium (starting at p_0) that itself drives the net accumulation of black dollars.

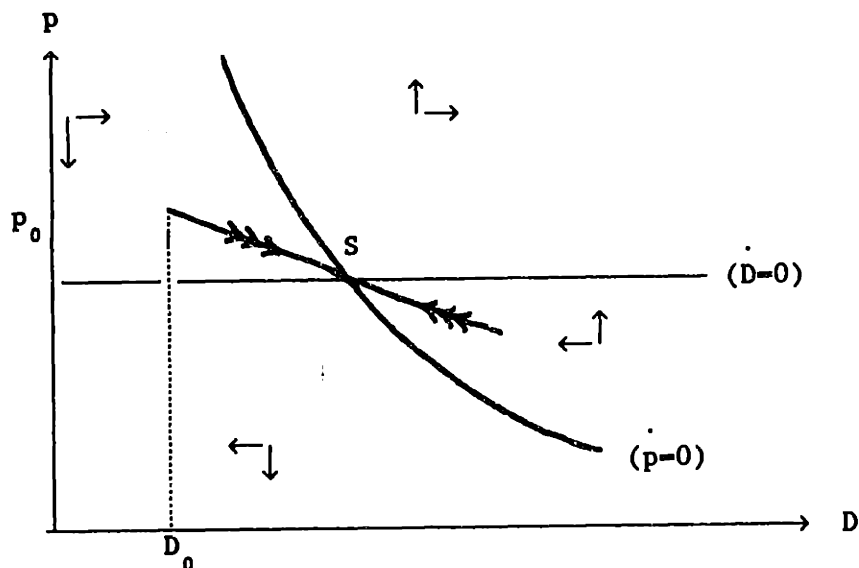


FIGURE 1 : THE UNDERLYING DYNAMICS

In the context of this model, the impacts of a more restrictive domestic monetary policy, of an increase in the flow of Western tourists and of an anticipated maxi-devaluation are three scenarios worth investigating.

An unanticipated domestic interest rate hike, for instance in the

²⁰ Unstable paths may a priori also support rational expectations equilibria. Justifying the simple above solution would require invoking a (distant) violation of the arbitrage equation or the introduction of additional criteria (such as some welfare function, or a minimum variance condition). These and other problems characteristic of rational expectations models were discussed early on by SHILLER[1978,sec.4-5]. A recent, up-to-date exposition of the technical issues raised by this class of models is provided by CHIARINI[1989].

context of a stabilization program, will affect asset market equilibrium by making the ruble less unattractive. The subsequent demand shift out of dollars must be matched by a lower relative supply of hard currency if the premium is to remain constant. Therefore, the $(\dot{p}=0)$ locus moves South-West, as illustrated in figure 2. The $(\dot{D}=0)$ schedule instead is not affected. The premium drops instantaneously (from 1 to 2_p), and the system is governed by the equations of motion associated with 3, meaning that over time the premium will increase and the stock of black dollars fall. However, the 1-2-3 trajectory implicitly assumes agents believe the higher domestic interest rate is a permanent fact (until further notice at least). If it were perceived as transitory, the premium would fall less (from 1 to 2_t), and the system would be governed by the new set of equations of motion only as long as the restrictive policy lasts. Its end would coincide with the landing at 4, where the dynamics of the original system would take over again.

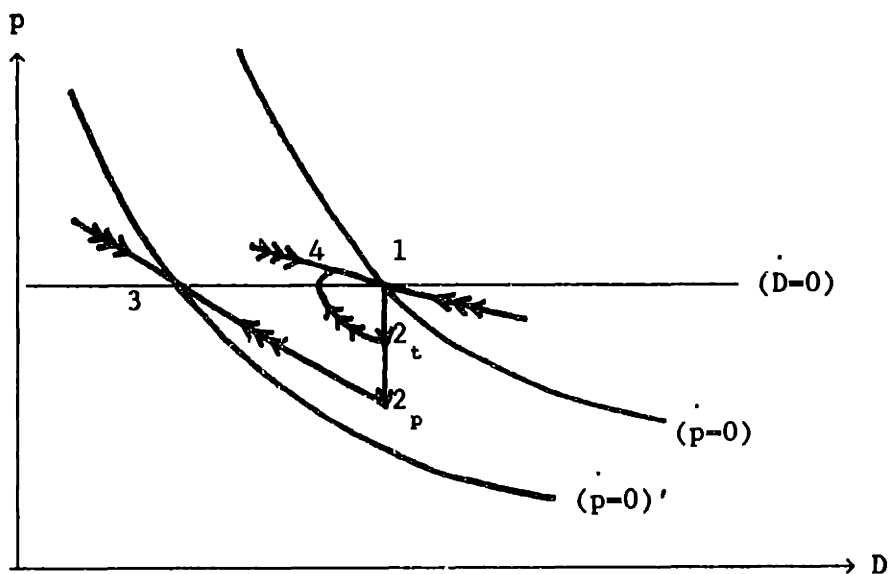


FIGURE 2 : DYNAMIC EFFECT OF A TIGHTENING OF DOMESTIC MONETARY POLICY

Assume now that Western tourism in the economy under consideration increases suddenly, unexpectedly and permanently, all else equal. This would augment the inflow of dollars, shifting the $(\dot{D}=0)$ locus South, as a lower premium would be required to offset it. The $(\dot{p}=0)$ locus instead would be unaffected. As figure 3 shows, the premium would drop immediately from 1 to 2. Over time, the (p,D) couple would travel to 3, the new steady state, which encompasses a higher stock of black dollars and a lower premium. A transitory tourism wave (say in connection with the fall of the Berlin Wall²¹), would lead to a smaller premium drop, to 2_t , and to an eventual return, via 4, to the original steady state.

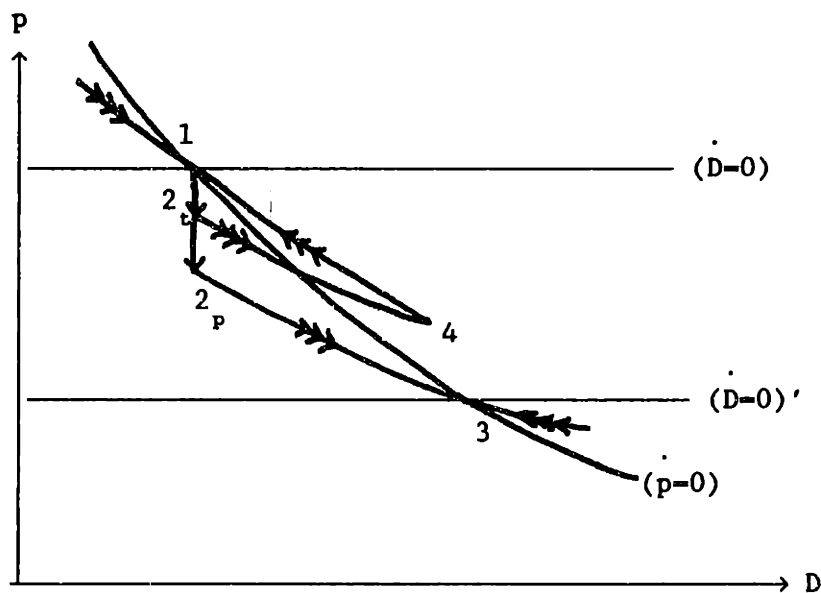


FIGURE 3 : DYNAMIC EFFECT OF AN INCREASE IN WESTERN TOURISM

A future, anticipated and temporary tourism binge - say when the Olympics are decided to be held in Moscow - would induce an immediate drop

²¹ This event however triggered massive flows of people in *both* directions.

in p , followed by a decrease of both p and D till the Games start (not shown graphically). During the Olympics, the system would obey 3's dynamics, so as to land on 1's stable arm on closing day.

Figure 3 also illustrates the consequences of a shift to a more inward oriented strategy in the form of an unexpected increase in export taxes, which would magnify the incentive to underinvoice exports. Perhaps somewhat paradoxically, this would, by augmenting the supply of black dollars, induce a fall of the premium ²².

A third thought experiment is to assess the reaction of the black market to news of a future maxi-devaluation. Assume a *nominal* devaluation is expected now (at t) to occur at time T . Figure 4 illustrates the sequence of events. The $(\dot{D}=0)$ and $(\dot{p}=0)$ loci do not shift as the official ruble rate and the adjusted interest rate differential remain unaffected at t . Thus the original dynamics will govern the system. Pure nominality in the long run means that the eventual stock of black dollars and premium must coincide with the original ones, and that the eventual black market rate depreciation must fully reflect the official devaluation. But in the very short run, this implies a shift in demand towards dollars, as the future increase of b opens up capital gain opportunities. The premium will therefore jump at t from 1 to 2 (correspondingly, b jumps as well). Between t and T , both p and D will grow, following the original equations of motion. At T , p drops from 3 to 4 with the upward shift of e , while b remains unaffected, as the devaluation was fully anticipated. Rational expectations eliminate any predictable capital gain for black

²² PITT[1984] examined the symmetric case of trade liberalization represented by an export tax reduction.

dollar holders, and determine the path of p and b from t to T . From T on, the excess stock of black dollars shrinks back to its steady state level, driven by a sub-steady state premium.

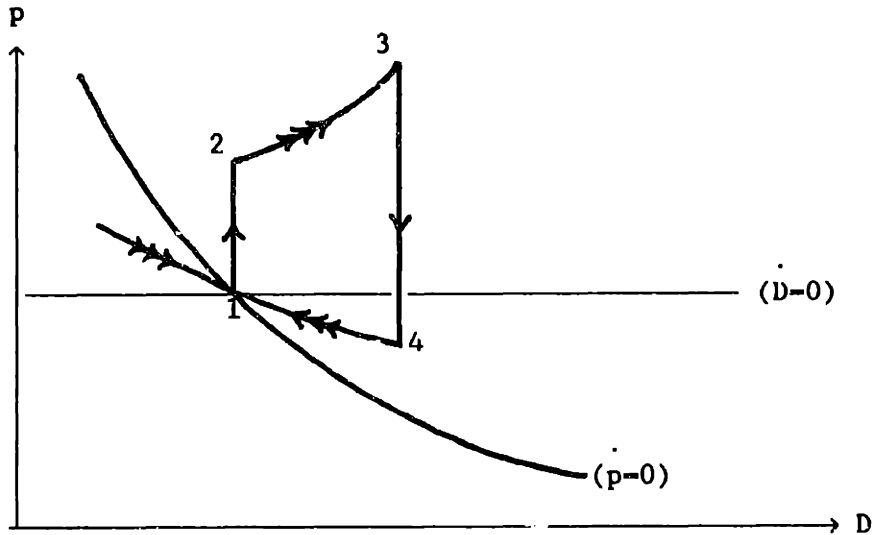


FIGURE 4 : ANTICIPATION OF A FUTURE NOMINAL DEVALUATION

3. EMPIRICAL EVIDENCE

After DORNBUSCH et alii[1983] themselves, who displayed a set of supportive results for Brazil, a handful of authors have tried to evaluate the empirical relevance of this type of model.

A somewhat dismal test was offered by PHILLIPS[1986], who studied the

behavior of the black market premium in South Vietnam between 1962 and 1971, focusing on two maxi-devaluations (1966 and 1970). As predicted by the model, the premium rose sharply once the move was anticipated, and dropped dramatically when it actually occurred, then starting to rise back to its original level. It was also found that the premium was sensitive to war news.

FISHELSON[1988] carried out an international comparison for 19 countries (including only one East European country, Yugoslavia). Using data from the seventies, he regressed the premium on the real official exchange rate and on the adjusted interest differential. His test was analogous to the one in DORNBUSCH et alii[1983], except for two unconvincing amendments. When adjusting the interest differential, he substituted \hat{b} for \hat{e} , arguing that the former was a better indicator of official devaluation expectations : this is likely to be true in countries displaying a relatively active exchange rate policy, but not in regimes where e remains constant for years. More importantly perhaps, he used the Fisher equation plus a slightly arbitrary assumption on the range in which the real interest rate should lie to compute the domestic nominal interest rate, explaining that this variable was not available or unreliable for most countries in his sample. However, it would seem that one of the motives underlying the demand for black hard currency is precisely the fact that the liquid savings instruments denominated in local currency that are available do not, in many countries, protect the holder from inflation erosion. Therefore, the enthusiastic confirmation of the model FISHELSON arrives at should not be taken for granted ²³.

²³ In particular, his somewhat hasty conclusion that the black market behavior "might be universal" (p.70) lacks moderation.

Using a more sophisticated set of instruments, AKGIRAY et alii[1989] investigated the relationship between the Turkish official and black rates for the US dollar and the Deutsche mark in the mid eighties. They concluded that, on a daily basis, \hat{b} does lead (Granger cause) \hat{e} , whereas the relation is one of contemporaneity for weekly and monthly intervals. This pattern was interpreted as an empirical justification for the type of reasoning underlying the theoretical exercise on an anticipated devaluation.

So far, the evidence did thus support the model. Nevertheless, it is a priori worthwhile to assess whether the latter displays similar robustness for East European countries, where black markets for hard currency are an old and widespread phenomenon.

Statistical series are but one of many scarcities for most East European countries. The price, money stock, interest rate and growth data used are on the whole mediocre, and had to be assembled, especially for non IMF members, using a disquieting variety of sources (detailed at the end of the paper). The black market exchange rates are drawn from the series computed by International Currency Analysis, Inc. which, given the practical constraints faced, are considered a reliable source²⁴. The official exchange rates are those that are considered to be effectively used, as opposed to the inoperative standard that is maintained in a number of cases for purely symbolic purposes. Ideally, they reflect the rate at which firms or private citizens can officially sell (and within limitations buy) dollars.

²⁴ See the discussion in AKGIRAY, BOOTH and SEIFERT[1988].

Time series data on the stock of black dollars are of course unavailable. Therefore, only the predictions of the model with respect to the premium can be tested here. Assuming that $\phi(\cdot)$ is linear, using a first order Taylor expansion around the steady state relation between p and e_r and the approximation $\hat{p} \approx \log(p_t) - \log(p_{t-1})$, the following testable reduced form obtains :

$$\log(p_t) = \beta_0 + \beta_1 e_r + \beta_2 (i^* + \hat{e} - i) + \beta_3 \log(p_{t-1}) \quad (6)$$

where one would expect $\beta_1 < 0$ and $\beta_2, \beta_3 > 0$ ²⁵.

As alternative hedging assets were ignored in the model, they do not appear in (6). However, it may a priori seem sensible to add the price of gold (g) and/or the value of the dollar in terms of the two other main black market currencies - the Deutsche mark (dem) and the Swiss franc (chf) - on the right hand side of (6). Because of the possibly wide underestimation of domestic inflation by the consumer price indices used (be it from domestic sources, *IFS* or the *CIA Handbook*), it might seem worth to also try and add a measure of excess liquidity growth, in the admittedly crude form of the difference between the rate of growth of the money stock (or some proxy of this variable) and real output growth. This monetary overhang indicator is denoted $liqgr$. Interestingly, the resulting augmented equation is fairly close to the reduced form obtained in a general

²⁵ FISHELSON[1988] implicitly used the approximation $\log(p) \approx p-1$, but p is typically too large in this context for it to retain validity. Even the above approximation is a bit far-fetched when the premium jumps from one period to the next. Besides, given the frequency of the data used, the adjusted interest rate differential actually plugged in the regressions is $(1+i^*)(1+e)/(1+i) - 1$.

equilibrium context by GUPTA[1980, p.244]. Moreover, seasonal dummies are tried out, as casual descriptions suggest that supply and demand of black dollars may often display seasonality ²⁶.

Before reporting the results, a number of obvious caveats should be mentioned. Some of the right hand side variables barely move over protracted periods, so that one should expect high standard errors : the official exchange rate is virtually frozen for years at a time in some of the East European countries; likewise, the typical financial intermediaries in Soviet-type economies are the savings banks, which pay a (low) rate of interest that has remained unchanged for decades (at 2% for sight and 3% for time deposits in the USSR, as established in a 1954 decree) ²⁷. In addition, measurement errors are likely and might have perturbing implications. Besides, "news" is left out here, whereas it certainly does heavily influence the premium (for example when rumors of monetary reform surface), which should depress the R-squares. A final candidate rationale for explaining the failure or disappointing performance of the tested equation is of course the underlying hypothesis regarding expectations.

The selected period stretches from the mid seventies onwards. Cross country variations in that respect solely reflect relative data dearths. Whenever monthly series were available, regressions were run on a monthly basis. Otherwise, quaterly observations were used. The results are

²⁶ Seasonal behavior can be formally incorporated into the model at the cost of somewhat more sophisticated algebraic computations.

²⁷ In such circumstances, the reasons for depositing money in the savings banks, from which it can be withdrawn on demand, are more likely to be the concern for security, and the hope of more favorable treatment of deposits than cash in the event of a monetary reform, than the desire to earn interest, as stressed by BIRMAN and CLARKE[1985].

presented for each country in turn, with the absolute values of the t statistics in parentheses, the Durbin-h statistic for autocorrelation (as the lagged dependent variable is present on the right hand side), and Q1, Q2, Q3 or JF, MA, MJ, JA and SO the self-explanatory seasonal dummies, respectively for quaterly and monthly regressions. The choice of i^* is specified at the bottom of each table. The appendix provides elements of interpretation for some of the revealed patterns.

YUGOSLAVIA : 1985.1-1989.6 (monthly)

inter -cept	e_r	$\hat{i^*+e-i}$	$\log p_{t-1}$	dem	g	JF	MA	MJ	JA	SO	R^2	\bar{R}^2	h
.3044	-.00098	.0140	.3407								.48	.44	2.63
(3.49)	(2.84)	(2.59)	(2.59)										
.2388	-.00089	.0155	.3296		.00012						.48	.43	4.45
(1.35)	(2.17)	(1.23)	(2.44)		(0.43)								
.3144	-.00104	.0105	.3051	.00003		.024	-.038	-.010	.069	.013	.57	.47	0.15
(3.53)	(1.95)	(0.67)	(2.18)	(0.00)		(0.61)	(0.99)	(0.26)	(1.70)	(0.32)			

53 observations, i^* =Fed funds rate, $e_r = (e^*US \text{ wholesale price index})/Yugoslav \text{ cpi}$

As previously mentioned, Yugoslavia is the only country in the sample for which earlier results are available. The sign and significance of FISHELSON's estimates are roughly similar to those displayed in the first equation : in its simplest form, the relation derived from the model does hold. Adding one or more of the alternative hedging assets on the right hand side causes serious deterioration²⁸. Except for the summer months,

²⁸ In the table, only two combinations are shown. Similar results obtain with the other possible singletons, pairs or triplet. As dem, chf and g are

during which the premium tends ceteris paribus to be higher, no clear seasonal pattern seems to emerge.

Quarterly runs on the period 1977.IV-1989.II (not exhibited) show that the monetary overhang indicator performs rather badly : although it has, as expected, a positive sign, it turns out to be significant for only one of the specifications.

POLAND : 1980.I-1988.IV (quarterly)

inter -cept	e_r	i^{*+e-i}	$\log p_{t-1}$	dem	g	liqgr	Q1	Q2	Q3	obs	R^2	\bar{R}^2	h
0.9550 (3.89)	-.0065 (2.18)	.5770 (2.60)	.5084 (4.21)							34	.62	.59	1.48
1.3623 (2.55)	-.0050 (1.40)	.6553 (2.72)	.4204 (2.65)	-.150 (0.86)						34	.63	.58	3.04
1.0051 (3.96)	-.0088 (2.19)	.6006 (2.68)	.4682 (3.60)		.00027 (0.85)					34	.63	.58	1.87
0.9917 (3.74)	-.0076 (2.19)	.5987 (2.66)	.5306 (4.30)			-.0018 (0.54)				31	.64	.58	0.80
0.9879 (3.75)	-.0063 (2.02)	.5492 (2.33)	.5251 (4.11)				-.102 (0.92)	-.058 (0.55)	-.098 (0.93)	34	.64	.56	1.75

$i^{*}=5\%$ (see appendix), $e_r = (e^{*}US \text{ wholesale price index}) / \text{Polish cpi}$

Poland clearly is one of the countries where equation (6) performs best, despite the fact that large scale dollarization may weaken the case for a partial equilibrium approach. Additional ingredients do not markedly improve the relation. The regressions shown are based on the assumption

highly correlated, the true standard errors of the associated coefficients will increase a lot when they are jointly introduced, accounting for poor t statistics.

that $i^*=5$ throughout the eighties, which was the rate paid on dollar denominated current accounts for most of the period ²⁹.

Despite their low level of significance, the seasonal coefficients point to a pattern that to a reasonable extent matches the description by TAIGNER[1987] of the seasonal behavior of supply and demand.

HUNGARY : 1982.1-1989.8 (monthly)

inter	e_r	i^*+e-i	$\log p_{t-1}$	dem	chf	g	JF	MA	MJ	JA	SO	R^2	\bar{R}^2	h
.2031	-.0015	.1664	.7121									.60	.59	0.96
(2.50)	(1.94)	(0.77)	(8.91)											
.2964	-.0034	.2524	.6999	.0361								.60	.59	0.62
(2.71)	(2.02)	(1.12)	(8.73)	(1.27)										
.3258	-.0040	.2641	.6883		.055							.61	.60	0.63
(2.98)	(2.37)	(1.20)	(8.56)		(1.66)									
.2564	-.0018	.1866	.7076		-.00007							.60	.58	0.66
(1.87)	(1.84)	(0.85)	(8.76)		(0.48)									
.3556	-.0038	.3987	.6800	.0410		-.043	-.039	-.048	-.053	-.014		.66	.62	1.22
(3.17)	(2.25)	(1.79)	(8.19)	(1.46)		(2.22)	(2.07)	(2.52)	(2.71)	(0.70)				

90 observations, i^* =Fed funds rate (see appendix), e_r is the real effective exchange rate index computed by the IMF (using a bilateral rate, as for the other countries, yields analogous results)

Equation (6) holds somewhat less neatly for Hungary, where the adjusted interest rate differential enters with the expected sign but sub-standard significance. This may be attributable to the fact that the Fed funds rate is too bad a proxy for i^* here. Alternative hedging assets do better for Hungary than for Yugoslavia and Poland, although the

²⁹ Quaterly information on this variable was not available, hence the simplifying assumption.

associated t statistics are well below conventional thresholds. Seasonality plays a noticeable role, displaying the same pattern for any combination of alternative assets added to (6). An F test formally confirms this ³⁰. Quarterly regressions over the same period (not displayed) indicate that liqgr is not a relevant explanatory variable.

USSR : 1976.I-1989.I (quarterly)

inter -cept	e_r	i^*+e-i	$\log p_{t-1}$	g	liqgr	Q1	Q2	Q3	R^2	\bar{R}^2	h
.3056 (1.38)	-.231 (1.40)	-.027 (0.06)	.921 (10.59)						.77	.75	-0.32
.2248 (0.98)	-.125 (0.68)	.047 (0.10)	.922 (10.68)		.0043 (1.32)				.77	.75	-0.58
.3206 (1.37)	-.208 (1.17)	-.107 (0.23)	.928 (9.46)	.00001 (0.08)		-.067 (1.60)	-.094 (2.28)	-.029 (0.69)	.80	.76	-0.60

51 observations, $i^*=0$, $e_r = (e^*US \text{ wholesale price index})/USSR \text{ cpi}$

Not surprisingly perhaps, the theoretical predictions do not hold for the USSR. The coefficient associated with the real exchange rate displays the expected sign, but insignificantly so. The adjusted interest rate differential essentially reduces here to the capital gain or loss \hat{e} , as it is assumed that $i^*=0$ and as i does not move at all over the period. Obviously, this is not a relevant explanatory variable. Gold, the Deutsche mark and the Swiss franc perform equally badly. Excess liquidity instead works relatively well, possibly reflecting the acuteness of the monetary overhang problem in the USSR. The results also point to seasonal regularities, but we lack independent evidence with which to confront the

³⁰ For the exhibited equation, $F = 2.35 > F_{0.05}(5,80) \approx 2.33$.

suggested pattern.

ROMANIA : 1976.I-1987.IV (quarterly)

inter -cept	e_r	i^*+e-i	$\log p_{t-1}$	dem	g	liqgr	Q1	Q2	Q3	obs	R^2	\bar{R}^2	h
.2331	-.012	-.444	.969							46	.91	.90	-1.32
(1.32)	(1.19)	(1.61)	(19.30)										
.2877	-.046	-.626	.810	.1816	.0006					46	.93	.92	-2.12
(1.85)	(3.65)	(2.54)	(13.19)	(3.16)	(3.68)								
.0095	-.012	-.357	.918	.1042		.0037				43	.90	.89	-1.22
(0.04)	(1.04)	(1.24)	(12.32)	(1.68)		(0.94)							
.0396	-.010	-.255	.938	.0940		.0044	-.042	.034	.080	43	.92	.90	-1.41
(0.18)	(0.91)	(0.91)	(12.84)	(1.55)		(1.16)	(0.85)	(0.70)	(1.64)				

$$i^*=0, i=2, e_r = (e^* \text{US wholesale price index}) / \text{Romanian cpi}$$

In the absence of data on domestic interest rates served on deposits, it has been assumed, for Romania as well as for the countries that follow, that i is a constant, equal to 2 (as it is indeed in the Soviet Union). This hypothesis may be partly responsible for the dismal results obtained for the adjusted interest rate differential in this group of countries (except for East Germany, for which this information was available).

For Romania, the real exchange rate coefficient displays the expected sign, but not in a consistently significant way. Like in the USSR, the premium is remarkably inert, accounting for a high R^2 . The Deutsche mark enters with the expected sign, and almost convincingly so. Gold (as well as the Swiss franc) insistently display an unexpected behavior. Liqgr appears with the right sign, but not significantly. No clearcut seasonal pattern emerges, except for a summer peak, that comes out any time seasonal dummies are introduced.

CZECHOSLOVAKIA : 1976.I-1988.IV (quarterly)

inter -cept	e_r	i^*+e-i	$\log p_{t-1}$	g	Q1	Q2	Q3	R^2	\bar{R}^2	h
.624	.0112	.0358	.5684					.35	.31	-0.12
(3.07)	(0.96)	(0.11)	(4.06)							
.355	.0036	.1675	.7533	.00003	-.062	.048	.057	.65	.59	-2.06
(1.87)	(0.37)	(0.61)	(5.82)	(0.42)	(2.80)	(1.95)	(2.57)			

50 observations, $i^*=0, i=2, e_r = (e^*US \text{ wholesale price index}) / \text{Czechoslovakian cpi}$

In the case of Czechoslovakia, neither the real exchange rate nor the adjusted interest rate differential show up in the way suggested by the model. The only suggestive right hand side variables are the seasonal dummies, although no convincing evidence has been independently found to justify the apparent seasonal pattern³¹.

EAST GERMANY : 1976.I-1988.IV (quarterly)

inter -cept	e_r	i^*+e-i	$\log p_{t-1}$	dem	liqgr	Q1	Q2	Q3	obs	R^2	\bar{R}^2	h
.259	-.0123	-.302	.8599						50	.68	.66	-1.06
(1.68)	(0.43)	(1.17)	(9.84)									
.396	.115	-.048	.8136	-.185	.0114	-.019	.110	.082	47	.76	.71	-1.37
(1.53)	(1.36)	(0.19)	(6.62)	(1.63)	(0.97)	(0.50)	(2.82)	(2.21)				

$i^*=0, i=3.25\%, e_r = (e^*US \text{ wholesale price index}) / \text{East German cpi}$

For East Germany, the same comments apply as concerns the real exchange rate, the adjusted interest rate differential, the monetary

³¹ Summer tourism of nationals abroad stimulates demand for black dollars, but it is a priori unclear to what extent Western (and especially German) visitors' supply of hard currency counterbalances this bullish influence.

overhang indicator ³² and the seasonal dummies. A major difference, perhaps not coincidentally, is the behavior of the Deutsche mark, which appears at odds with the implicit heuristics maintained so far (to which we shall soon return).

BULGARIA : 1976.I-1988.IV (quarterly)

inter -cept	e_r	i^*+e-i	$\log p_{t-1}$	dem	Q1	Q2	Q3	R^2	\bar{R}^2	h
.147	-.0251	-1.71	.902					.77	.76	-0.31
(0.60)	(0.11)	(1.86)	(11.95)							
.069	.0688	-.369	.966	-.030	-.128	-.020	.106	.86	.83	-1.33
(0.23)	(0.14)	(0.45)	(14.71)	(0.29)	(2.74)	(0.43)	(2.32)			

50 observations, $i^*=0$, $i=2$, $e_r = (e^*US \text{ wholesale price index})/Bulgarian \text{ cpi}$

Finally, the same type of results are obtained for Bulgaria (except that no monetary overhang indicator could be constructed).

³² WOLF[1990] argues that, at least for the period under consideration, East Germany does not exhibit a genuine monetary overhang. Other sources though evaluate the overhang at 10 to 20% of the money stock, see H. SIEBERT: "Am Gelde hängt nicht alles", *Frankfurter Allgemeine Zeitung*, 02.17.1990.

4. CONCLUSIONS

It is not difficult to find plausible reasons for the mixed performance of the tested relationship. On top of those mentioned beforehand, one could for example invoke the inadequacy of the (mostly) annual measurements of the monetary overhang indicator. The behavior of the variables standing for alternative hedging assets may also be rationalized: the comments made so far relied on the idea that a weak dollar should be perceived as a less attractive buy for hedging purposes ³³, whereas one could argue that, depending on expectations with respect to the value of the dollar in Deutsche marks, Swiss francs or gold, agents may prefer to acquire Greenbacks when those are relatively cheap. Furthermore, shortages or comparative abundance on the black and official markets for goods no doubt exert a strong influence on the premium, but are conspicuously absent in equation (6). Finally, but not exhaustively, the official exchange rate may constitute an inadequate benchmark because of the system of subsidies and taxes embodied in the multiple conversion rates used in practice ³⁴. If their impact is not uniform over time, as will be the case if their rates change and/or if the shares of the different types of transactions varies, the measure used above is a distorted one. One should then expect equation (6) to perform best in those countries where exchange discrimination is minimal or time invariant.

To variable degrees, these reasons are certainly important. However, a

³³ Note that this interpretation leads to a normal/pathological dichotomy identical to the one that follows from the general equilibrium model proposed by GUPTA[1980].

³⁴ These are described for instance in BRABANT[1985].

deeper and more general explanation should be brought forward. The regressions as well as casual evidence suggest that conformity with the behavior laid out in the model increases as the black market for hard currencies becomes more widespread, less fragmented ³⁵ : the postulated relation appears most sturdy in the countries where the holding of hard currency is least restricted and dollarization most developed. This comes as no surprise : effective arbitrage through currency substitution requires the existence of a sufficiently active market. Not coincidentally, these countries are also characterized by high official inflation rates, which one would expect to induce people to become more efficient arbitrageurs.

Quantitative work could be extended, for Poland in particular, to the analysis of the bid-ask spread, as was done for Brazil by DORNBUSCH and PECHMAN[1985], the expected pattern being that of a positive relation to the interest rate (standing for inventory costs) as well as to the variance of the black market rate (i.e. to a measure of risk). More ambitiously, the efficiency of the black market for dollars could be tested along the lines of GUPTA[1981]. Both types of analyses must however rely on decent, high frequency data, which we have been unable to collect so far.

In conclusion, one might want to step back from theoretical and econometric intricacies to observe that recent developments in Eastern Europe suggest that premia on hard currencies will remain high as long as domestic money is not fully 'internally convertible' into goods and services. In the meantime, they constitute an important though distorted signal that the authorities will presumably watch closely.

³⁵ In principle, the dispersion of the premium at any given date and across locations would be a relevant measure here.

APPENDIX

BACKGROUND INFORMATION ON EXCHANGE RATES AND BLACK MARKETS FOR FOREIGN CURRENCIES IN EASTERN EUROPE

This appendix offers a cursive overview of some of the main features of the black markets for hard currency in Eastern Europe, as of early 1989, except otherwise specified. Further up to date information on the official exchange rate(s) and payments regulations can be found in the annual reports on *Exchange arrangements and exchange restrictions* published by the IMF. A synoptic table is followed by a brief country by country description.

Black market premia for the US dollar *

	Dec 1977	Dec 1980	Dec 1983	Dec 1986	Sep 1989
ALBANIA (lek)	851	1,112	809	1,112	n.a.
BULGARIA (lev)	201	213	289	319	1,079
CZECHOSLOVAKIA (koruna)	375	387	423	426	191
EAST GERMANY (mark)	328	324	411	500	821
HUNGARY (forint)	67	40	22	34	43
POLAND (zloty)	482	287	815	343	283
ROMANIA (leu)	63	81	230	294	808
USSR (ruble)	431	359	480	512	1,479
YUGOSLAVIA (dinar)	2	13	23	20	10

* (p-1) in the model's notation, end of period, in percent, vis-à-vis the commercial rate (except for East Germany, for which the non trade valuta mark rate was used).

N.B. : premia are homogeneous diachronically, but not across countries, due to heterogeneous exchange rate segmentations.

Clearly, Yugoslavia and Hungary stand out as low premia countries, which is due to a large extent to their more active exchange rate policies. Consider the configuration in December 1986. In their neighborhood appear e.g. South Africa (24%) and Costa Rica (31%). The high premia group is characterized, with the exceptions of Poland and to a considerably lesser extent East Germany, by a very inert official exchange rate. Developing countries in these premia ranges include Algeria (246%), Uganda (268%), Guatemala (270%), Sudan (300%), Burma (397%) and Iran (977%), to name a few. Albania is "outperformed" by only ten countries, including North Korea (1,175%), Mongolia (1,369%), Vietnam (1,588%), Cuba (3,520%), Laos (5,850%) and Nicaragua (7,186%).

ALBANIA

A black market for hard currency and gold exists, although on a limited scale. Some monetary smuggling occurs via Greece or by sea. Government officials and foreign diplomats are believed to be more than sporadically involved.

In the mid eighties, the lek's quotation in the black market was fluctuating between the indicative rates of L 30 and L 40, to be compared with an official effective rate of L 3.30.

BULGARIA

The Bulgarian black market for hard currencies has been operating

since the end of World War I. Smuggling of foreign banknotes and gold coins into the country has increased over the years, enriching many border officials and a number of foreign diplomats. The black market has also served as a transit station for receipts generated by the traffic in drugs and arms.

A frozen reference rate, an official effective rate and a tourist rate (become a premium rate) are paralleled by a considerably higher black rate.

In January 1986, the authorities abolished public access to some 300 "Corecom", or hard currency stores, in an attempt to curtail black market operations on the lev.

CZECHOSLOVAKIA

Traditionally, the black market for hard currencies operates with official tolerance. Over time, the Deutsche mark has become increasingly popular. An active market for "Tuzex coupons" (or "bony") has also developed.

In the late seventies, two noteworthy patterns were to be observed:

. During 1977, a profitable arbitrage business started along the Czech-Polish border. Poles were exchanging zlotys for korunas in Czech banks at the official rate, converting the proceeds into dollars on the Czech black market. The hard currency was then sold in the Polish black market with a substantial benefit, or used for purchases in Pewex shops.

. In 1978, as the dollar weakened and amidst rumors of an impending

currency reform, American cigarettes and whiskey started to replace Greenbacks as stores of value (in 1953, a currency reform involving a 50 to one banknote exchange had taken place).

Following a simplification of the currency structure in January 1989, three different exchange rates coexisted by late 1989 : a formal commercial rate, a non commercial rate, and the black market rate.

Complete exchange rate unification and eventual free convertibility of the koruna are on the agenda, but for the moment the premium remains high. Incidentally, it increased markedly in the summer of 1989, following the liberalization of travel regulations applicable to nationals.

EAST GERMANY

Over the period under consideration, four official exchange rates coexisted with the black market rate : a (frozen) basic rate, two valuta-mark rates (one for foreign trade transactions, the other for other transactions), and a tourist rate.

The premium on the dollar has been structurally high, although, not surprisingly, the West German mark tends to crowd out the American currency. Gold is also an important hoarding item.

Like in the other CMEA countries, there is a system of hard currency shops, called Intershops.

Since last fall's events, speculations about monetary unification with West Germany have gained momentum. In January 1990, the Bundesbank openly discarded these as premature, stressing besides the current need for a more competitive Ostmark. In February however, political considerations seemed bound to prevail over the West German central bank's legendary prudence.

HUNGARY

The black market for hard currencies, which is part of a broader unofficial market encompassing Soviet-bloc monies, is tolerated by the authorities. An illegal black market for gold also exists, motivated by a certain distrust of paper money (in 1946, Hungary experienced one of the most vertiginous hyperinflations in history).

Since the exchange rate unification in the fall of 1981, the premium on the dollar has been consistently much smaller than in the other CMEA countries, due to an active exchange rate policy, to the fact that the forint is much nearer a truly convertible currency, and to a better range of goods available for purchase in forints. The Deutsche mark and the Swiss franc are also widely traded and hoarded (in 1978, they were both preferred to the dollar).

Subject to some requirements concerning their source, residents are allowed to hold amounts of hard currency in cash or in foreign currency accounts with banks in Hungary. The deposits may be used for foreign travel or to purchase foreign goods through the Konsumex and other specialized

shops. Deposits of more than one year maturity earn interest at rates prevailing on international markets. Residents can also hold "BC" accounts, on which only transfers from non-residents to residents to finance residents' expenses while traveling abroad can be deposited. The amounts placed in these accounts earn nontaxable interest at international rates provided their maturity is at least six months.

It should also be noted that since 1983, Hungarians can invest their savings in bonds and, since 1988, in certificates of deposits and T-bills as well. However, the Budapest exchange, which was the first one to open in Eastern Europe, two years ago, in many ways remains an educational exercise³⁶.

Interestingly, the 1988-89 eightfold increase in the number of Hungarians travelling abroad (and the acceleration of domestic inflation) coincided with a considerable increase in the premium on the dollar.

POLAND

Like in Hungary, the black market for hard currencies in Poland might better be called a grey one, as citizens and firms are allowed to hold these currencies in domestic bank accounts. Poland probably is the most "dollarized" East European country. In the mid-eighties, no less than an odd 20,000 professional hard currency dealers were estimated to be operating

³⁶ The daily average trading volume is only 5 million forints (80,000 dollars at the official exchange rate), and the exchange operates only three days a week, see "Lonely days for traders at Budapest exchange", *New York Times*, 02.20.1990.

all over the country. And in the late eighties, more than half of the domestic liabilities of the banking system were denominated in foreign currency.

In 1987, Bank PKO (controlled by the Ministry of Finance), and on a smaller scale the NPB (i.e. the Polish central bank) and Bank Handlowy had some 3.4 million household accounts denominated in foreign currencies, primarily in dollars. Bank PKO offered "A" accounts (paying 5% for demand, 9% for one year, 10% for two year and 11% for three year deposits, irrespective of currency) to individuals able to prove that the origin of their foreign exchange was legal, and "N" accounts (paying no interest and precluding withdrawals for remittance abroad) with no questions asked. After one year, deposits in "N" accounts could be transferred to "A" accounts. To discourage cross-currency speculation, Bank PKO charged a 4% commission for conversions across hard currencies.

Enterprises were entitled to hold "M" accounts at any Polish foreign exchange bank in US dollars, Deutsche marks, French francs, Swiss francs, British pounds and Austrian schillings as non-interest bearing current accounts or as term accounts (paying 3, 4 or 5% for 1, 2 or 3 year deposits respectively). The hard currencies in the "M" accounts were tradable through fortnightly auctions organized by the Export Development Bank.

In July 1988, the "N" accounts were merged with the "A" accounts, under the latter's regime: the funds can be used freely (except, in theory, to effect settlements between individuals). Interest, paid in foreign exchange, is earned at the following annual rates : for accounts maintained in French francs, British pounds and US dollars, 4% on call deposits, and

8, 9 and 10% respectively on 1, 2 and 3 year deposits; for Deutsche marks and Swiss francs, one percent less in each category.

Ownership of gold is also legal, and banks officially buy it from individuals against hard currency payments.

Hard currency can be exchanged instead for vouchers ("bonys") denominated in dollars, which can be traded domestically or used for purchases in Pewex shops (along with hard currency itself).

The unofficial valuation of these vouchers and that of gold scrap are published weekly in *Veto* by the Polish Consumer Association. In May 1987, the price of dollar vouchers hovered round Zl 950, and the margin between the buying and selling rates stood at a stable Zl 20 (suggesting efficient intermediation). The black market rate for banknotes was about Zl 20 higher than that of vouchers, reflecting their slightly greater liquidity.

In March 1989, the NPB and certain branches of Bank PKO started buying³⁷ and occasionally selling dollars alongside legalized private foreign exchange bureaux, thus further reducing the scope of the black market *stricto sensu*.

The number of different exchange rates has decreased over time. Despite frequent devaluations, the zloty has long remained overvalued. Hence the consistently high premium on the dollar. Like elsewhere in Eastern Europe, the variations of the black market rate, and therefore of

³⁷ Paying Zl 2,700 per dollar, against a black rate of 2,900.

the premium, are bounded below by the purchasing parity of the zloty with respect to the Pewex price of vodka (in a World Bank 1987 report it is argued that raising the dollar price of vodka should nudge the black market rate down).

In January 1990 however, after a 31% devaluation coupled with the restoration of full convertibility of the zloty for trade purposes, black market money-changers for the first time were finding it hard to match the official exchange rate of 9,500 zlotys to the dollar.

It should be stressed that while the above considerations indicate the importance of Pewex-type demand for the black market rate, another strong demand factor for foreign currency is undeniably inflation hedging. In that role, the dollar and other hard currencies compete with gold, real estate, land and art.

ROMANIA

Since the exchange rate unification in 1981, three official rates exist alongside the black market rate in Romania. A basic valuta rate (revalued (sic) once over the period under consideration), a commercial rate (applicable to all foreign trade and capital transactions in convertible currencies) and a tourist/non commercial rate (for tourism and personal allowances).

All are substantially overvalued, as reflected in a high and rising premium on the dollar. The Swiss and West German currencies constitute

alternative hoarding instruments. When the authorities tried to suppress the black market, American-made "Kent" cigarettes became a hard currency as well (a pack costed 120 lei, or 14 dollars at the official exchange rate, early in 1989).

To a limited extent, hard currencies earned or received from outside Romania can be held in foreign currency accounts with the Romanian Bank for Foreign Trade or the National Bank, and used to purchase a house, a car or items sold at special hard currency stores.

Compared to other East European countries however, dollarization is not widespread.

Interestingly, Bucharest, like other East European countries, has not been reluctant to dumping freshly printed Leu banknotes in Beirut (Place des Canons), Vienna and Zurich, whenever the central bank has been temporarily short of cash to pay maturing debts.

Early in February 1990, a large devaluation of the leu coupled with a simplification of the exchange rate structure were announced. The new rate of 21 lei to the dollar however was still far below the black market figure.

USSR

The Soviet Union is covered with an illegal network of hard currency and gold trading, involving smuggling syndicates trafficking in foreign

exchange, the yellow metal and contraband imports of Western luxuries.

An official system of "valuta-checks" or "kupons" that can be used for purchases in beryozka stores exists since 1961, with occasional variations in the rules determining the access to this surrogate hard currency. The kupons themselves are not numbered, and thus anonymous, which makes them an adequate vehicle for black market transactions. In the mid eighties, kupons were changing hands at 6 to 10 times their nominal value. From time to time, all outstanding kupons are unexpectedly recalled overnight in exchange for new ones. But the following day, there are always new sellers and buyers of kupons (as one would expect : the day after is in a sense the least risky one in this context).

The premium on the dollar has been high and rising over the studied period, the official effective rate being quite inert (notwithstanding small periodical revisions).

Recently however, the Soviet exchange rate policy has changed course.

On November 1, 1989, the non-commercial exchange rate for travel purposes was devalued by 90% to 6.26 rubles per dollar. Two obvious reasons for the action taken by the Gosbank were the desire to cut illegal imports based on the permission to exchange 320 dollars per trip at the official rate, and to shift the sales of foreign currency cash by foreigners back to official channels.

Incidentally, the devaluation was poorly managed. The announcement took place while the banks were still open, which triggered runs by those

entitled to buy foreign exchange. The resulting queues at the Vneshekonombank during the last days of October were longer than at vodka counters! The news also exacerbated the increase in demand for jewelry and other items made out of gold and silver.

It was also expected at the time that the single commercial exchange rate (0.62) would soon be replaced by two new rates for Soviet exporters - one for fuels and raw materials, the other for manufactured goods - implying devaluations of 25 and 50% respectively (Soviet importers already paid twice the commercial rate for hard currency imports).

In early November as well, the first Soviet hard-currency auction took place, involving a select group of State firms. On average, the latter paid 9.5 rubles per dollar (i.e. somewhat below the black market rate), but some enterprises, possibly stimulated by their "soft budget constraints", have been reported to have offered up to 22 times the official rate (i.e. 13.6, which is roughly the black market rate). The rumor had it that in order to avoid official embarrassment, the State provided additional funds, beyond the planned supply of foreign exchange (*Financial Times*, 11.06.1989, *PlanEcon Report*, 11.24.1989).

The once official timetable of moving to a realistic unique official exchange rate on January 1, 1991 (implying inter alia the abolition of thousands of conversion coefficients used so far and thus a radical domestic price reform), may now be abandoned. A freely convertible ruble is even harder to foresee in the short run. More generally, schemes of the ABALKIN variety (see *Financial Times*, 11.20.1989) sound over-ambitious these days.

YUGOSLAVIA

The black market for hard currencies has traditionally been tolerated by the Yugoslav authorities as a means to provide residents with moderate amounts of foreign money for travel to the West. This does not hold however for large-size transfers of flight capital through the black market by syndicates, organized by emigrant workers, to dummy firms established in hard-currency countries.

Smuggled dinar banknotes are converted mainly into dollars or Deutsche marks in Trieste, Vienna and Zurich, which are then remitted back to a resident foreign account in Yugoslavia. Private hard currency deposits totalled 9.6 billion dollars in September 1986, as compared to an estimated 23 billion dollars of unofficial private savings kept abroad, which incidentally do not include large quantities of unreported enterprise funds.

The possession and trading of gold is legal.

After several years of high followed by hyperinflation³⁸, a drastic monetary reform was implemented in January 1990 : 10,000 old dinars were replaced by a new one, officially tied to the Deutsche mark at the rate of 7 dinars to the mark. A securities and money market was to start operating at the same time.

³⁸ In August 1989, a 2 million dinar banknote was put in circulation, with a 5 million dinar due soon. A common conundrum at the time was : "What's the difference between one dollar and one dinar ?", "One dollar" (reported by Bozidar Djelic).

DATA SOURCES

. The nominal exchange rate series (e and b) are extracted from the *World currency yearbook*, *International financial statistics (IFS)* and *Statistische Beihefte zu den Monatsberichten der Deutschen Bundesbank (Reihe 5: Die Währungen der Welt)*. The real official exchange rate series (e_r) are either taken from *IFS* or computed using the country's consumer price index (gathered from *IFS* and the *CIA Handbook of economic statistics*) and, as a proxy for world prices, the US wholesale price index displayed in *IFS*. More recent data on black market rates are obtained from the monthly newsletter *Currency Alert*. The gap in the black market rates series appearing between the last edition of the *World currency yearbook* and *Currency Alert's* first issue was filled by purchasing the unpublished April 1987-December 1988 series directly from International Currency Analysis, Inc.

. Interest rates served on domestic deposits are obtained from *IFS* and, for the USSR, from the State Bank's Monetary and Economic Research Department.

. The international interest rate is proxied, when applicable, by the average Federal funds rate as listed in *IFS*.

. "Excess" money supply growth ($\hat{M}-\hat{Y}$) is computed using *IFS*, the World Bank's *World tables*, the estimates in *East European economies: slow growth*

in the 1980's (Joint Economic Committee, Congress of the US, October 28, 1985), various issues of *PlanEcon Report* and of the *IA Handbook*, the *Statistical yearbook of the member states of the Council for Mutual Economic Assistance* (London, IPC Industrial Press, Ltd, 1979), the *Concise statistical yearbook of Poland* (Central Statistical Office, Warszawa, 1982), various issues of the *Statistical pocketbook of the German Democratic Republic* (Central Statistical Board, Berlin), the *Statistická ročenka Československé Socialistické Republiky* (Federální Statistický Úrad, Praha, 1988) and the series of annual *Bulletins* of the Czechoslovakian central bank. Except for hyperinflation episodes, these figures are yearly averages. They are expressed in percentage points.

. The price of gold is a monthly average of daily rates at the London afternoon fixing, in US dollars per troy oz of 99.5% fine metal, as published in *IFS*.

. The DEM/USD and CHF/USD rates are extracted from *IFS*. Like the above mentioned exchange rates, they are end of period rates.

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THE "FELDSTEIN-HORIOKA PUZZLE" REVISITED

July 1990

"Origine du haut prix de l'argent à Angoulême : il est aisé de comprendre que la circonstance d'un commerce également susceptible de gros risques et de gros profits, et celle d'une place dégarnie de capitaux, se trouvant réunies dans la ville d'Angoulême, il a dû en résulter un taux courant d'intérêt assez haut, et plus fort, en général, qu'il ne l'est dans les autres places de commerce."

TURGOT, 1770

1. THE PUZZLE IS A HARD FACT

In a world free of distortions, where capital is perfectly mobile, a small open country should conform to the following separation theorem : consumption/saving decisions on the one hand, and domestic investment decisions on the other hand, should be independent. Any increment in domestic savings should join the world savings pool and then be allocated internationally according to differential worldwide investment opportunities ¹.

The derived proposition that domestic savings and investment should display zero correlation was tested by FELDSTEIN and HORIOKA[1980] (henceforth FH) ². Rather intriguingly, they uncovered a close to unity estimated slope coefficient when running the canonical ordinary least-squares cross-country long run regression :

¹ An example of an open economy Ramsey model that displays this feature is offered by BLANCHARD[1983].

² An alternative approach is to focus on rates of return equalization. See HARBERGER [1980], FRANKEL [1986,1989], and the opening excerpt from TURGOT.

$$(I/Y)_1 = \alpha + \beta(S/Y)_1 + \epsilon_1, \quad (1.1)$$

or instrumental variables and other variations on the same equation correcting for endogeneity, spurious correlation, large-country bias and other econometric shortcomings. As the synoptic table in appendix 1 shows, their finding is a sturdy one, notwithstanding the technical qualifications that some of the subsequent studies have called for, and despite the fact that more recent data sets lead to significantly lower estimates for the correlation coefficient. A recent update of the original paper, carried out by FELDSTEIN and BACCHETTA[1989], confirms that an increase in domestic savings does have a substantial effect on the level of domestic investment across OECD countries ³.

The FH finding suggests that the degree of financial insularity of the industrialized countries is de facto much greater than assumed in textbook open economy models with perfect capital mobility. The international capital market would be more segmented than what casual observation of the frenetic financial arbitrage industry might indicate. Economic and financial integration would lag far behind the slogans on "globalization" commonly encountered since the seventies.

The policy implications are of course quite dramatic. On the effective degree of capital mobility depend answers to questions such as : do measures that stimulate a nation's saving rate increase its domestic capital stock or "improve" the current account ? Will a hike in corporate taxes cause an outflow of capital that shifts the burden to labor and

³ See also the evidence reported in AGHEVLI *et alii*[1990].

land ? The extent of crowding in (out) and the issue of tax incidence are matters serious enough for the FH enigma to deserve yet another reexamination.

As a benchmark, start with the financial autarky extreme. In a somewhat dismal world where cross-borders intertemporal trade is banned, say due to universal reciprocal mistrust, current accounts would have to be balanced in each and every period. For each country,

$$CA = (S_h - I_h) + (S_c - I_c) + T - G = 0 \quad (1.2)$$

where T and G denote taxes and government expenditures respectively, and the subscripts h and c distinguish households from corporations. Let $D = G - T$ be the public deficit. Then equivalently, private net savings equal public net dissavings :

$$(S_h + S_c) - (I_h + I_c) = D \quad (1.3)$$

For a given deficit, $dI = dS$: any shock on saving fully translates into a variation in investment. Hence in the absence of foreigners investing at home and of domestic agents investing abroad, the FH regularity must hold in its strongest form. Thus it is not surprising that one of the main clues put forward has been the existence of protean capital controls, which indeed may substantially insulate national economies.

However, if anything, the operative restrictions on capital movements between OECD countries have been very limited in the recent past. Despite the erosion of the saving retention ratio that seems to have accompanied the easing or lifting of controls since the mid-seventies, the correlation remains very high, and begs for alternative rationalizations.

As a first step, the short run indeterminacy of the saving-investment correlation will be illustrated in a simple non-optimizing framework suitable for the analysis of co-movements between innovations in saving and investment (section 2). The FH puzzle however primarily involves the long run relationship between these two aggregates. The bulk of the paper is thus devoted to an overlapping generations model that delivers the positive correlation. Not unexpectedly perhaps, the catch is to introduce some form of non-tradeability into the traditional setting. As opposed to previous attempts though ⁴, the non-tradeability does not come as a range of goods excluded from international trade, but rather as a category of country specific assets that are typically owned essentially by residents, namely the housing stock (section 3). This channel, as well as long run demographic or productivity changes, which are also modelled within this framework, may plausibly account for part of the FH correlation, but obviously it can only constitute a partial explanation (section 4).

⁴ Exemplified by MURPHY[1986], TESAR[1988], ENGEL and KLETZER[1989] and WONG[1990]. ZEIRA[1987] starts from the polar hypothesis that the capital stock is completely non-tradeable, international finance being restricted to the exchange of riskless bonds.

2.SHORT RUN SAVING-INVESTMENT CORRELATIONS: THE CURRENT ACCOUNT AS A BUFFER

Over short horizons, the savings retention phenomenon is less striking, as the results of time-series regressions displayed in appendix 2 and the yearly figures for current account balances of the major industrialized countries listed in appendix 3 indicate. These suggest that the current account functions as a buffer in the face of unexpected shocks. Running VARs to test an intertemporal consumption smoothing model of open economies, GHOSH[1990] has even argued that the current account of some of the G5 countries have exhibited "excess volatility" over the 1960-88 period.

It seems worthwhile to briefly examine the issue of short run saving-investment correlation, as the long run is after all the temporal aggregation of high frequency movements. A consistently high short run correlation coefficient would thus imply a high long run one. In contrast, a more erratic short run behavior would a priori be compatible with a low secular savings retention ratio. The stochastic framework used for this purpose is as stripped down as possible, and is based on plausible short run relationships rather than derived explicitly from intertemporal optimization ⁵.

⁵ The initiated reader will identify it as a variation on the OBSTFELD[1989] variation on FELDSTEIN[1983,sec.4]. An alternative, non stochastic, optimizing, time-series covariation model, focusing on the effects of temporary productivity shifts, is developed in OBSTFELD[1986, sec.IV].

Normalizing all macroeconomic aggregates by GDP and expressing them as deviations from their unconditional means, we can posit a set of linearized functions for domestic investment i , domestic saving s , and net foreign investment $(b_{t+1} - b_t)$, supplementing these by the external balance constraint. Letting all coefficient be positive,

$$i_t = -dr_t + \nu_t \quad (2.1)$$

$$s_t = ar_t + gx_t + \mu_t \quad (2.2)$$

$$b_{t+1} - b_t = -m[r_t - r_t^* - E_t(e_{t+1} - e_t)] + \omega_t \quad (2.3)$$

$$b_{t+1} - b_t = s_t - i_t \quad (2.4)$$

where r_t and r_t^* stand respectively for the home and world real interest rate both in terms of domestic output, e_t for the logarithm of the real exchange rate, and b_t for the stock of foreign assets held by residents. The Greek letters denote exogenous disturbances. Finally, x_t is an exogenous shift variable that influences saving but is in principle uncorrelated with ν_t , μ_t and ω_t . For example, x_t may be some demographic indicator, or an index reflecting the impact of existing consumer credit and mortgage arrangements, or else the ratio of military expenditures to GDP (which would be less likely to display endogeneity than the budget deficit itself).

Note that equation (2.3) allows for varying degrees of capital mobility. As $m \rightarrow \infty$, perfect capital mobility is approached, and $r_t = r_t^* + E_t(e_{t+1} - e_t)$.

Equation (2.3) describes capital in or out-flows, but looking at the current account from the trade side leads to another behavioral relation :

$$b_{t+1} - b_t = qe_t + \zeta_t \quad (2.5)$$

The system (2.1)-(2.5) is explicitly solved in appendix 4 under the convention of rational expectations, which leads to :

$$e_t = h \sum_{j=0}^{\infty} h^j E_t \eta_{t+j} \quad (2.6)$$

$$\text{where } h = \frac{(a+d)m}{(a+d)(q+m)+mq} \quad \text{and } \eta_{t+j} = \eta_{t+j}(r_{t+j}^*, x_{t+j}, \mu_{t+j}, \nu_{t+j}, \omega_{t+j}, \zeta_{t+j})$$

Assume now that capital is perfectly mobile ($m \rightarrow \infty$), that ν_t , μ_t , ω_t and ζ_t are white noise, while x_t represents a transitory shock to the savings function and follows an AR(1) process :

$$x_t = \rho x_{t-1} + \epsilon_t, \quad 0 < \rho < 1, \quad E_{t-1} \epsilon_t = 0 \quad (2.7)$$

In this case, the real interest rate becomes ⁶:

$$r_t = \frac{-g(1-\rho)}{(a+d)(1-\rho)+q} x_t + (1-h) \sum_{j=0}^{\infty} h^j E_t r_{t+j}^* + hr_t^* - \frac{(\mu_t - \nu_t - \zeta_t)}{a+d+q} \quad (2.8)$$

and the reduced form investment and saving equations are :

$$i_t = \frac{d(1-\rho)g}{(a+d)(1-\rho)+q} x_t - d[(1-h) \sum_{j=0}^{\infty} h^j E_t r_{t+j}^* + hr_t^*] + \frac{d(\mu_t - \zeta_t)}{a+d+q} + \frac{a+q}{a+q+d} \nu_t \quad (2.9)$$

$$s_t = \frac{[d(1-\rho)+q]g}{(a+d)(1-\rho)+q} x_t + a[(1-h) \sum_{j=0}^{\infty} h^j E_t r_{t+j}^* + hr_t^*] + \frac{a}{a+d+q} (\nu_t + \zeta_t) + \frac{d+q}{a+d+q} \mu_t \quad (2.10)$$

It is now straightforward to determine the co-movements of savings

⁶ See the derivations in appendix 4.

and investment in response to various types of shocks. The immediate impacts of positive temporary shocks can be summarized as follows ⁷:

shock impact on	savings function	investment function	trade balance
investment	+	+	-
savings	+	+	+

Note that the impact of a shock on the savings function is smaller the larger the degree of persistence ρ : in the limit, if x_t follows a random walk, domestic investment is totally unaffected, a result at odds with the FH regularity.

Note also that an instrumental variable estimated coefficient $\hat{\beta}$ in (1.1) will in this context converge to $d(1-\rho)/[d(1-\rho)+q]$. Hence the less integrated the *goods* markets, i.e. the smaller the responsiveness of the current account to deviations of the real exchange rate from its mean, the closer this coefficient is to one. Even if *capital* markets are perfectly unified, the fact that goods markets fail to be helps explain the FH pattern (to the extent though that $\rho < 1$).

Temporary shocks might thus in abstracto account for a substantial positive correlation between saving and investment in the short run. But it must be stressed that the outcome depends on the origin of the shock as well as on its degree of persistence: a positive realization of ζ_t e.g.

⁷ Shocks on the capital account (ω_t) are abstracted from as perfect capital mobility has been assumed.

increases r_t (see (2.8)) and through this channel boosts savings (provided $a \neq 0$) and depresses investment. Monetary shocks, if introduced in this setting, would similarly generate opposite movements in saving and investment. Conversely, a slump in world demand or an adverse supply shock would probably produce a drop of both aggregates.

Extending the horizon, it therefore seems hazardous to build a rationalization of the FH long run cross-section regularity on some necessarily quite special combination of temporary shocks.

3.LONG RUN SAVING-INVESTMENT CORRELATIONS IN AN OLG FRAMEWORK

Three long run channels through which a consistently positive saving investment correlation obtains are highlighted in this section. An OLG framework is used, as opposed to some Ramsey-type model, for technical rather than substantive reasons⁸. The first two mechanisms have already been recognized in the literature⁹, and are briefly reformulated in the first subsection. The third one is new, and is examined in more detail in the next sub-section.

i) Permanent demographic and productivity shocks

Consider the canonical small, open, mono-good economy, populated by selfish two-period lived individuals, who save out of their first period wage income in order to smooth consumption over time, and leave no bequests. Their number grows at rate n , and cross-border migration is ruled out. Each unit of saving may be invested in internationally traded bonds or may costlessly become one unit of installed capital in the next period

⁸ A previous version of this section, based on a transmuted Ramsey model, showed that comparative statics are restricted by the incontrovertible steady state equality between the world interest rate, identical for all countries, and the demographically adjusted national rate of time preference (to overcome this problem, one must indulge in Uzawa preferences and assume people become more impatient as their living standards improve, or work with finite horizons).

⁹ See OBSTFELD[1986] and TESAR[1988].

(adjustment costs being uninteresting for long run purposes). Without loss of generality, depreciation is assumed away. The world interest rate is a fixed r^* . Let k denote capital, l labor, and let A be the multiplicative productivity factor. Firms produce :

$$y_t = f(k_t, l_t) = A_t k_t^\alpha l_t^{1-\alpha} \quad (3.1)$$

Given perfect capital mobility, the first-order conditions are $f_k = r^*$ and $f_l = w$. Normalizing $l_0 = 1$, they imply :

$$k_t = (1+n)^t \left(\frac{\alpha A_t}{r^*} \right)^{\frac{1}{1-\alpha}} \quad (3.2)$$

$$w_t = (1-\alpha) A_t \left(\frac{\alpha A_t}{r^*} \right)^{\frac{\alpha}{1-\alpha}} \quad (3.3)$$

$$y_t = (1+n)^t A_t \left(\frac{\alpha A_t}{r^*} \right)^{\frac{\alpha}{1-\alpha}} \quad (3.4)$$

The partial derivatives with respect to n , A and r^* display the conventional signs. Note that in (3.2) k_t is the desired capital stock. Let i_t denote investment. If k has attained its desired level at t :

$$i_t = k_{t+1} - k_t = (1+n)^t \left\{ (1+n) \left(\frac{\alpha A_{t+1}}{r^*} \right)^{\frac{1}{1-\alpha}} - \left(\frac{\alpha A_t}{r^*} \right)^{\frac{1}{1-\alpha}} \right\} \quad (3.5)$$

In steady state, $A_t = A$, hence :

$$i_t = i = n(1+n)^t \left(\frac{\alpha A}{r^*} \right)^{\frac{1}{1-\alpha}} \quad (3.6)$$

and the rate of investment $\frac{i}{y} = \frac{\alpha n}{r^*} \quad (3.7)$

Individuals, indexed by 1 when young and 2 when old, inelastically supply one unit of labor in the first half of their life; and thereafter become rentiers. They ignore their descendants' utility, discount their own

at rate β , and maximize :

$$\begin{aligned}
 & U(c_{1t}) + \beta U(c_{2t+1}) \\
 & \text{subject to : } w_t = c_{1t} + \frac{c_{2t+1}}{1+r^*}
 \end{aligned} \tag{3.8}$$

The first-order condition is nothing but the standard Euler equation:

$$U'(c_{1t}) = (1+r^*) \beta U'(c_{2t+1}) \tag{3.9}$$

with the usual associated arbitrage interpretation.

Let $A_t = A$ until further notice. Then, if $\beta = 1/(1+r^*)$, the intertemporal consumption profile of each individual is flat :

$$c_{1t} = c_{2t+1} = c = \left(\frac{1+r^*}{2+r^*} \right) w \tag{3.10}$$

When $\beta \neq 1/(1+r^*)$, agents display a tilted consumption schedule, but i/y is unaffected. Accordingly, shocks on the rate of time preference would not produce a positive saving-investment correlation here ¹⁰.

Aggregate savings AS_t equal the fraction of wages not consumed by the young generation minus the dissaving of their parents :

$$\begin{aligned}
 AS_t &= (1+n)^t (w-c) + (1+n)^{t-1} [r^*(w-c) - c] \\
 &= \left(\frac{n(1+n)^{t-1}}{2+r^*} \right) w
 \end{aligned} \tag{3.11}$$

As expected, aggregate savings are zero when population stagnates.

¹⁰ Shocks on r^* are irrelevant for our purposes, since all countries are assumed to face the same world interest rate.

The aggregate saving rate is :

$$\frac{AS}{y} = \frac{(1-\alpha)n}{(1+n)(2+r^*)} \quad (3.12)$$

Equations (3.7) and (3.12) immediately show that a lasting shift in n translates into a shift of the steady state saving and investment rates. The underlying rationale is quite conventional : AS/y is increasing in n for the standard life-cycle reasons (lower weight of the old dissavers in the aggregate savings ratio), whereas $1/y$ is increasing in n because the capital/labor ratio must ensure equality between the marginal product of capital and r^* (interestingly, this implies that it is the immobility of labor, in a world where capital freely moves around, that drives the result). Empirically however, this channel remains a controversial one ¹¹.

The other obvious candidate is technology. In order to evaluate the effects on the long run saving-investment correlation of a permanent productivity shock, it is necessary to study the transition path in response to such a disturbance. The saving of the old do not react, being a predetermined variable. Consequently, $\Delta AS_t = \Delta s_{1t}$. The savings of the young at t are :

$$s_{1t} = w_t(A_t, n) - c_{1t}(\beta, w_t(A_t, n)) \quad (3.13)$$

Under standard circumstances :

$$\partial s_{1t} / \partial A_t = \partial w_t / \partial A_t (1 - \partial c_{1t} / \partial w_t) > 0 .$$

Permanent productivity shocks materializing at the beginning of

¹¹ See the discussion in FELDSTEIN and BACCHETTA[1989].

period t come in two versions. Consider first the anticipated sort, starting from steady state ($\Delta A > 0$). By (3.3) and (3.4), w_t and y_t immediately rise to their new steady state levels. The young's savings increase at t , while the old's dissavings remain unchanged. Thus AS/y undergoes a one period rise : from $t+1$ onwards, the old have caught up and AS/y is back to the level indicated by (3.12). As the shock is expected, investment adjusts at $t-1$, so that the desired capital stock is installed when it actually takes place (the algebraic expression is given by (3.5) lagged one period). At t , both i and y reach their new steady state levels, implying that the increase in i/y is confined to period $t-1$. The current account therefore deteriorates in $t-1$ and improves in t , acting as the buffer described in section 2.

The short run saving-investment correlation coefficient is zero in this case, but averaging over $t-1$ and t (plus possibly a few more adjacent periods) will lead to an unambiguously positive coefficient.

Let us now turn to the unanticipated variety of shocks. Again, w_t and y_t immediately increase to their new long run levels. Investment reacts at t instead of $t-1$, but i/y again displays a single period rise. The young save more at t , leading to an increase in AS_t/y_t (since the old do not alter their dissavings). But wages and output increase a second time at $t+1$, when the larger capital stock begins to operate. Hence AS_{t+1}/y_{t+1} as well is higher than the aggregate steady state savings ratio, to which the observed rate returns at $t+2$. In this case, the FH pattern obtains both in period t and for a multi-period average.

In sum, even in the absence of any regulatory barriers or other

market imperfections, the distinctive empirical co-movement of domestic saving and investment rates can be generated in a simple theoretical model ¹².

ii) The role of housing as a non-traded durable good

A slightly more disaggregated approach to the FH puzzle seems a priori worth exploring. Decomposing (fixed) investment into construction and machinery/equipment, and construction into residential versus non-residential shows that a significant fraction of additional long run savings consistently ends up in housing ¹³. Besides, cross-country variation in the long run rate of residential investment is substantial with regard to the size of current account balances, as illustrated in appendix 5 ¹⁴. Housing constitutes quite special an investment vehicle, since it enters the individuals' utility function as the major durable good. In addition, housing traditionally appears as an asset that is barely traded internationally. Finally, residential construction is a sector characterized by extensive government subsidization in various guises, which often strongly biases the allocation of domestic savings towards domestic investment.

¹² Evidence supporting a rationale based on highly persistent productivity shocks is provided in a fairly different setting by CARDIA [1988].

¹³ See the figures exhibited in DORNBUSCH [1989] for 23 OECD countries and 1960-86 country averages.

¹⁴ "There are unexpectedly large cross-country differences in key housing market indicators, such as housing costs, quantity of housing consumed, or ownership and mobility rates...", reports STAHL [1989,p94].

Our OLG model can be readily amended to incorporate housing. A realistic approach would explicit two features that for the sake of simplicity will be abstracted from here. First, an individual's housing consumption may differ from his housing investment demand : as we work with a representative agent or family however, the associated distinction between renting and housing is ignored ¹⁵. Secondly, housing wealth is the single most important component of bequeathable wealth ¹⁶, suggesting that intergenerational transfers of real estate property might have to be modelled : here, we will assume that houses die with their owners ¹⁷. Furthermore, we will leave the dynamics of productive capital in the background, as absent population growth changes and productivity shocks, it obeys the Fisherian separation theorem. The focus here will be on housing and bonds, and the wage will be treated formally like an exogenous endowment.

Savings now can be sub-divided into a financial (b) and a non-financial (h) component. There is no lag between the decision to save for housing and the subsequent investment and availability of the home, which is not too far-fetched an assumption given the temporal structure of the model. Then :

$$s_1 = w - c_1 - h_1 + b \quad (3.14)$$

$$s_2 = br^* - c_2 = -b + h_2 \quad (3.15)$$

where h_1 denotes the purchase of housing by a member of generation 1. Note

¹⁵ See HENDERSON and IOANNIDES [1983] for a detailed model emphasizing this distinction.

¹⁶ See HURD [1990,p.623].

¹⁷ No significant loss of generality is incurred. A previous version of the model including (non-altruistic) bequests lead to the same conclusions, but at the cost of considerable algebraic cluttering. The only exercise ruled out by our assumption is comparative statics on the depreciation rate.

that lasting national debt accumulation or decumulation is ruled out in this setting. At the beginning of his retirement age, a representative individual owns h_1 (first period depreciation being ignored) and must decide by how much (h_2) he wants to adjust his real estate property given that it will vanish with him at the end of the period.

Aggregate savings $AS = s_1 + s_2 = h_1 + h_2$ ¹⁸ in the absence of population growth (which is abstracted from as well in order to separate its impact from that of the mechanism envisioned here).

Choosing a separable functional form¹⁹, the young maximize :

$$U(c_{1t}) + \gamma V(h_{1t}) + \beta [U(c_{2t+1}) + \gamma V(h_{1t} + h_{2t+1})] \quad (3.16)$$

$$\text{subject to : } w_t = c_{1t} + h_{1t} + b_t$$

$$(1+r^*)b_t = c_{2t+1} + h_{2t+1}$$

Letting λ_1 denote the Lagrange multiplier associated with the budget constraint for age i , the first-order conditions are :

$$c_{1t} : U'(c_{1t}) = \lambda_1 \quad (3.17)$$

$$c_{2t+1} : \beta U'(c_{2t+1}) = \lambda_2 \quad (3.18)$$

$$b_t : \lambda_1 = (1+r^*)\lambda_2 \quad (3.19)$$

$$h_{1t} : \gamma V'(h_{1t}) + \beta\gamma V'(h_{1t} + h_{2t+1}) = \lambda_1 \quad (3.20)$$

$$h_{2t+1} : \beta\gamma V'(h_{1t} + h_{2t+1}) = \lambda_2 \quad (3.21)$$

Using (3.17)-(3.19), we recover the Euler equation (3.9) expressing

¹⁸ This is also equal to total depreciation in each period.

¹⁹ Which for $U(\cdot)=V(\cdot)=\log(\cdot)$ boils down to a monotonic transform of a standard constant returns to scale Cobb-Douglas functional. The model becomes analytically intractable for more general, non-separable, specifications.

intertemporal substitution in consumption of non-durables. If $\beta = 1/(1+r^*)$, each individual's non-durable consumption path is flat again. Conditions (3.19)-(3.21) combined show how individuals substitute housing across periods in their own lifetime :

$$\frac{V'(h_{1t})}{V'(h_{1t} + h_{2t+1})} = \beta r^* \quad (3.22)$$

Similarly, (3.17) and (3.19)-(3.21) yield an equation specifying the intra-first-period substitution between consumption of non-durables and housing :

$$\frac{V'(h_{1t})}{U'(c_{1t})} = \frac{r^*}{\gamma(1+r^*)} \quad (3.23)$$

Solving the system (3.9), (3.14), (3.15), (3.22) and (3.23) for c_{1t} , c_{2t+1} , h_{1t} , h_{2t+1} and b_t as functions of r^* , β , γ and w requires to select a functional form for U and V . The explicit solution will then lend itself to comparative statics gymnastics in a straightforward manner.

A relatively "neutral" and easily tractable choice is the logarithmic form for both U and V . It can be checked that :

$$c_{1t} = \frac{w}{(1+\gamma)(1+\beta)} \quad (3.24)$$

$$c_{2t+1} = \frac{\beta w(1+r^*)}{(1+\gamma)(1+\beta)} \quad (3.25)$$

$$h_{1t} = \frac{\gamma w(1+r^*)}{(1+\beta)(1+\gamma)r^*} \quad (3.26)$$

$$h_{2t+1} = \frac{\gamma w(1+r^*)(\beta r^* - 1)}{(1+\beta)(1+\gamma)r^*} \quad (3.27)$$

$$b_t = \frac{w[\beta + \beta\gamma - (\gamma/r^*)]}{(1+\beta)(1+\gamma)} \quad (3.28)$$

Note that for reasonable values of β and r^* , $h_{2t+1} < 0$, i.e. retiring individuals move into a smaller house²⁰, and $b_t \leq 0$ depending on the values taken by β , γ and r^* . If the young are patient or if the world interest rate is high, they will lend ($b_t > 0$), and vice-versa. Note also that steady state residential construction $h_{1t} + h_{2t+1} > 0$, as it should be.

Imagine now that new legislation providing better protection of homeowners' interests is irrevocably passed and boosts the ownership ethos in the country under consideration, translating into a permanent increase in γ . Let this shock occur at the beginning of period t and concern only the young and their descendants. Inspection of (3.24)-(3.28) shows that with respect to the initial steady state :

- in period t , c_{1t} falls, h_{1t} increases, b_t falls and $s_{1t} = w - c_{1t}$ rises, as would be expected, implying investment and savings both increase (note that the current account deteriorates though, since b_{t-1} is unaffected);

- in period $t+1$, c_{2t+1} and h_{2t+1} fall, $c_{1t+1} = c_{1t}$ i.e. remains lower, $h_{1t+1} = h_{1t}$ i.e. remains higher, $b_{t+1} = b_t$ i.e. stays lower and $s_{1t+1} = s_{1t}$ i.e. stays higher. But $s_{2t+1} = b_t r^* - c_{2t+1} \geq s_{2t}$ a priori, meaning the net effect on the old's dissaving is ambiguous²¹. However, aggregate savings

²⁰ Empirically, such downsizing is not implausible. The evidence is far from clear-cut though, see HURD [1990] and the references cited therein. In contrast, when bequests and first period depreciation are taken into account, steady state investment in housing by the old turns out to be positive.

²¹ Computing the exact value of s_{2t+1} using (3.25) and (3.28) shows $s_{2t+1} \geq s_{2t}$ depending on $\beta \geq 1/(1+r^*)$.

are up whatever the parameter values. Total residential investment $h_{t+1} = h_{1t+1} + h_{2t+1}$ also displays an ambiguous behavior a priori. But writing it out shows that h_{t+1} increases with γ . Hence both investment and savings are up again in $t+1$, which is the date at which the new steady state regime starts.

In sum, the FH regularity does obtain in this framework through a "taste" shock. Although the result is by no means surprising in the above context, this channel deserves to be added to the list of possible sources of the observed saving-investment relation.

An alternative experiment is to shock β upwards, starting with the young at t , assuming that for some reason the country's inhabitants become more patient. Examination of (3.24)-(3.28) shows that c_{1t} and h_{1t} fall while s_{1t} and b_t rise. Thus we observe a negative saving-investment correlation in period t . In period $t+1$, c_{2t+1} and h_{2t+1} rise, s_{2t+1} falls²², s_{1t+1} remains higher and h_{1t+1} lower. Computing AS_{t+1} and h_{t+1} one finds that aggregate savings are up with respect to the initial steady state and housing investment as well. Later periods are identical to $t+1$, implying that across steady states, the FH pattern does obtain once more, an outcome that follows from the fact that the sub-sphere of the economy looked at here functions as a closed system in the long run.

Yet another comparative statics exercise would be to subsidize housing permanently from the young at t onwards, for example by offering

²² For all plausible parameter values, the condition for a rise being $\gamma(1+r^*) > 1$, where a sensible guess for γ would hover around 0.2 (this corresponds to a budget share of one sixth for housing expenditures, which according to POTERBA [1990,p.1] is the U.S. order of magnitude).

new tax exemptions on mortgage interest payments ²³. In this case, the budget constraints become :

$$w_t = c_{1t} + (1-s)h_{1t} + b_t \quad (3.14')$$

$$(1+r^*)b_t = c_{2t+1} + (1-s)h_{2t+1} \quad (3.15')$$

where s denotes the (small) subsidy. The system (3.24)-(3.28) is then slightly modified : $(1-s)$ now enters multiplicatively in the denominator of (3.26) and (3.27). In period t , the introduction of the subsidy causes h_{1t} to rise, while c_{1t} and b_t remain unaffected (due to the choice of the logarithmic form, which ensures cancellation of income and substitution effects). The after-"tax" nominal value of savings and investment remains unchanged by (3.14'). But the volume of residential construction has increased, as has the purchasing power of savings. In period $t+1$, h_{1t+1} is up, h_{2t+1} down, and h_{t+1} up, while the nominal value of s_{2t+1} , s_{1t+1} and hence AS_{t+1} is unaffected. The purchasing power of AS_{t+1} however is higher. Consequently, one might be tempted to argue that the FH regularity may also follow from a twist in the relative price of housing. This inference would be valid if the purely exogenous subsidy ²⁴ were to be supplemented by a consumption tax such that the government budget stay equilibrated.

In summary, this section has argued that the FH pattern can be generated in a crude model, devoid of uncertainty and other complications,

²³ POTERBA [1990] e.g. argues that the changes in the U.S. tax laws in the eighties will have substantial long run effects on the fraction of national income devoted to housing.

²⁴ In this single good model, the subsidy would have to be donated by some foreign philanthropist concerned with the housing conditions of the natives.

through several plausible channels ²⁵. One remains entitled, nevertheless, to wonder whether these are the most relevant ones.

²⁵ A slightly more detailed model would allow additional comparative statics exercises : incorporating liquidity constraints in the form of *i*) the impossibility to borrow to finance non-durable consumption and *ii*) a required downpayment for real estate acquisition, would allow these and provide further rationales for cross-country differences, see e.g. the simulation model set up by HAYASHI *et alii* [1987].

4. THE MERITS OF AN ECLECTIC VIEW

Eclecticism is frequently despised by theorists. Almost by definition, it excludes the possibility of a self-sufficient model. In some circumstances nevertheless, sticking to the ideal of the quintessential model may be quite misleading. In our case, an explanation of the FH puzzle based on durable, non-traded assets can only be a partial one, all the more as housing finance is becoming increasingly delocalized through the international trade of mortgage-backed securities. A quantitative decomposition of the sources of the saving-investment correlation would have to take into consideration several other channels as well. Four routes at least seem particularly relevant in this regard.

An obvious and frequently mentioned rationalization is based on the presence of cross-border capital controls, regulatory barriers or tax discrimination. As these have progressively been eased since the mid-seventies, the FH regularity has indeed weakened somewhat. Casual empiricism suggests that restrictions on direct and portfolio investment abroad have in a number of cases constituted binding constraints on private investors' behavior²⁶. Similarly, tax relief associated with the purchase of domestic securities, preferential treatment for income from domestic bonds and stocks, as well as measures to encourage the purchase of securities of domestic companies by their their employees are pervasive and

²⁶ A striking example would be the UK before and after 1979 : British direct investment abroad was financed mainly by foreign savings as long as it was forced to be, much less so afterwards; British portfolio investments abroad increased massively in the wake of the liberalization.

bias the allocation of domestic savings towards domestic uses. Also, deductions on Social Security and pension funds contributions, or on insurance premia, coupled with the restrictions on portfolio composition applicable to financial institutions mentioned later on, work in the same direction. Plausible reasons for these barriers include the desire to preserve sources of tax revenues (by avoiding large outflows) and nationalism in various guises (avoiding "excessive" inflows).

Even in a world where such impediments are being dismantled, the risk of their reappearance subsists, along with other sources of uncertainty (long run exchange rate misalignments, asymmetric information about investment opportunities, etc). This dimension has been rightly stressed in portfolio models that attempt to formalize home asset preference patterns²⁷.

A third class of arguments relies on the existence of external balance constraints, which can take the form of limitations imposed by the market or of a policy reaction function. The notion of current account constraints (if not targets) is implicit e.g. in much of the I.M.F. policy literature on the sustainability of external imbalances (as anyone of the (recent) issues of the *World Economic Outlook* will attest). Governments may not feel over-concerned by short-lived external net flows, and hence tolerate non-trivial high-frequency movements in the current account balance (or they may simply not be able to avoid these). But they might want to set fairly tight limits on cumulative net capital flows and adopt monetary or fiscal policies designed to reverse the external deficits or surpluses. Policy-based explanations of the saving-investment correlation

²⁷ See the discussion in KOEN [1990].

have often been put forward informally ²⁸. The evidence is not uncontroversial ²⁹. Modeling has been surprisingly scarce so far ³⁰.

A fourth approach, suggested by FH (p.326) and stressed by DORNBUSCH[1989], but underemphasized in the literature is the lack of domestic capital mobility. Firms tend to finance a substantial portion of their investments by retained earnings, due to informational asymmetries à la MYERS and MAJLUF[1984] ³¹. Then part of corporate savings remains home no matter how liberal government imposed capital controls ³². Besides, many industrialized countries have placed restrictions on the allowed portfolio composition of some categories of major investors, or even more directly have administratively allocated part of domestic savings to specific domestic uses ³³. The wave of financial liberalization that characterized the eighties however has relaxed many of these constraints.

²⁸ Inter alia by Von FURSTENBERG[1980], FIELEKE[1982] and TOBIN[1983].

²⁹ See the comments of FELDSTEIN and BACCHETTA[1989] on SUMMERS[1988]. Alternative evidence in favor of the endogenous policy rationalization is provided by ARTIS and BAYOUMI[1989] and BAYOUMI[1990].

³⁰ ROUBINI[1988] generates a positive saving-investment correlation in an infinite horizon tax and consumption smoothing model. EPSTEIN and GINTIS[1988] propose a credit rationing model where reluctant borrowers interact with reluctant lenders, but their construct seems more applicable to LDCs than to OECD countries.

³¹ MURPHY[1984] offers empirical support for this thesis.

³² This line of reasoning applies to some firms more obviously than to others. See FAZZARI, HUBBARD and PETERSEN[1988] and WHITED[1990] for evidence on the US case, and HOSHI, KASHYAP and SCHARFSTEIN[1990] for evidence on Japanese corporations.

³³ Two conspicuous cases are France (see FERRANDIER and KOEN [1988]) and Japan (see OSUCI [1990]). As concerns the U.S., FH pointed out e.g. the legal obligation for savings institutions to invest in mortgages on local real estate (p.316).

Interestingly, several of the rationales listed above have tended to become less compelling since the FH puzzle was first formulated. And in parallel, current account imbalances among the large industrial countries increased during the last decade. But it would seem that this trend might not completely wipe out the significantly positive saving-investment correlation observed since the last World War at least. Financial liberalization and innovation, securitization and other moves towards closer economic and financial integration are likely to weaken the link, but imperfect information, uncertainty surrounding governments' discretionary measures and not least politics presumably will to a substantial extent continue to ensure that much of local savings remains invested locally.

APPENDIX 1 :

CROSS-SECTION STUDIES ON SUB-SAMPLES OF OECD COUNTRIES

The following table is intended to reflect the thrust of the outcome of the cross-section empirical work carried out on the FH puzzle. We refrained from reporting point estimates and standard errors because periods, country groups, statistical definitions and econometric techniques used varied so much across studies that no direct comparison is feasible. Moreover, most authors offer several alternative estimates, implying that a scrupulous transcript of their results would make the table inordinately long. The purpose is here merely to illustrate the extent of the consensus on the robustness of the original finding.

Sub-periods have been explicated when the associated estimates of β changed substantially over time.

Author(s)	Number of countries	Sample period	$\hat{\beta}$	Evolution of $\hat{\beta}$ over time
FELDSTEIN, HORIOKA [1980]	16	1960-74	high	↘
FIELEKE [1982]	13	1971-78	high	n.s.
	18	1968-77	high	n.s.
FELDSTEIN [1983]	17	1960-79	high	↗
MURPHY [1984]	17	1960-80	high	↗
CAPRIO, HOWARD [1984]	23	1963-81	high	↘
PENATI, DOOLEY [1984]	19	1949-59	medium	↗
		1971-81	high	
SUMMERS [1988]	23	1960-64	high	
		1965-69	high	↘
		1970-74	high	—
		1975-79	high	↘
		1980-84	medium	↘
DOOLEY <i>et alii</i> [1987]	14	1960-73	high	
		1974-84	high	—
VOS [1988]	18	1960-65	high	
		1966-72	high	↘
		1973-79	medium	↘
		1980-84	medium	—
TESAR [1988]	24 ^a	1960-84	medium	↘
	23 ^b	1960-84	high	↗
	16 ^c	1960-84	high	↗
FELDSTEIN, BACCHETTA [1989]	23	1960-69	high	
		1970-79	high	↘
		1980-86	medium	↘
BAYOUMI [1990]	8	1880-1913	low	↗↓
	10	1965-86	high	↘
OLIVEIRA M., PLIHON [1990]	20	1960-88	medium	—

Note : n.s.: not specified; a. including Luxemburg; b. excluding Luxemburg; c. FH sample.

APPENDIX 2 :
TIME-SERIES STUDIES ON SUB-SAMPLES OF OECD COUNTRIES

The same set of preliminary remarks as for appendix 1 applies here.

Frequencies are denoted as follows :

D : decade averages

C : business cycle averages

A : annual data

Q : quarterly data

Author(s)	Countries	Frequency	Sample period	$\hat{\beta}^a$	evolution of $\hat{\beta}$ over time
FELDSTEIN [1983]	17 OECD	A	1960-79	high	n.s.
CAPRIO, HOWARD [1984]	23 OECD	C	1963-81	medium	n.s.
FRANKEL [1986]	U.S.	D	1870-1979	high	↗
		A	1930-58	medium	
		A	1958-84	high	↗
FRANKEL [1988]	U.S.	D	1869-1987	high	↘
		A	1929-87	high	↓
		A	1955-79	high	
		A	1980-87	low	↓
OBSTFELD [1986]	Australia	Q	1960.I-84.IV	low	↗
	Austria	Q	1970.II-84.I	low	n.s.
	Canada	Q	1959.I-84.II	medium	↘
	Germany	Q	1960.III-84.II	medium	↘
	Japan	Q	1959.I-83.IV	high	↘
	U.K.	Q	1959.I-84.II	medium	↘
	U.S.	Q	1959.I-84.II	high	↘
	U.K.	A	1871-1912	high	n.s.
ARTUS [1988]	France	Q	1963.I-86.II	medium	↗

(continued)

OBSTFELD[1989a]	Australia	A	1953-66	low	
			1967-84	low	↗
	Austria	A	1949-66	medium	
			1967-84	medium	↗
	Canada	A	1949-66	low	
			1967-84	high	↑
	France	A	1951-66	low	
			1967-82	medium	↗
	Germany	A	1951-66	medium	
			1967-84	high	↗
	Italy	A	1953-66	low	
			1967-84	medium	↗
	Japan	A	1953-66	high	
			1967-84	high	↘
U.K.	A	1949-66	medium		
		1967-84	medium	-	
U.S.	A	1951-66	high		
		1967-84	high	-	
BAYOUMI [1990]	U.S.	A	1961-86	high	↗
	Japan	A	1966-86	high	↘
	Germany	A	1961-86	high	↘
	U.K.	A	1961-86	low	-
	France	A	1961-86	high	-
	Canada	A	1961-86	high	↘
	Norway	A	1966-86	low	↓
	Belgium	A	1961-86	medium	↘
	Finland	A	1961-86	high	↘
	Greece	A	1961-86	medium	↗
OLIVEIRA M. ,PLIHON [1990]	U.S.	n.s. ^b	1960-88	low	n.s.
	U.K.	n.s. ^b	1960-88	low	n.s.
	Japan	n.s. ^b	1960-88	high	n.s.
	Germany	n.s. ^b	1960-88	high	n.s.
	France	n.s. ^b	1960-88	medium	n.s.

a. Or comparable coefficient; b. Presumably annual.

APPENDIX 3 :

CURRENT ACCOUNT BALANCES OF THE G7 COUNTRIES 1965-1990

	Canada	United States	Japan	France	West Germany	Italy	United Kingdom
1965	-1.9	0.8	1.0	-0.6	-1.1	3.4	-0.2
1966	-1.7	0.4	1.2	-1.1	0.3	3.0	0.3
1967	-0.7	0.3	-0.2	-1.0	2.3	2.1	-0.7
1968	-0.1	0.1	0.7	-0.7	2.5	3.1	-0.6
1969	-1.2	0.0	1.2	-1.1	1.5	2.5	1.0
1970	1.2	0.2	1.0	0.0	0.7	0.8	1.6
1971	0.4	-0.1	2.5	0.4	0.4	1.7	1.9
1972	-0.3	-0.5	2.2	1.1	0.5	1.5	0.3
1973	0.2	0.5	0.0	0.6	1.5	-1.6	-1.3
1974	-0.9	0.1	-1.0	-1.4	2.8	-4.4	-3.8
1975	-2.7	1.1	-0.1	0.8	1.0	-0.3	-1.4
1976	-2.1	0.2	0.7	-1.0	0.8	-1.3	-0.8
1977	-2.0	-0.7	1.6	-0.1	0.8	1.0	-0.1
1978	-2.0	-0.7	1.7	1.5	1.4	2.1	0.6
1979	-1.8	0.0	-0.9	0.9	-0.7	1.5	-0.3
1980	-0.4	0.1	-1.0	-0.6	-1.7	-2.2	1.4
1981	-1.7	0.3	0.4	-0.8	-0.5	-2.3	2.7
1982	0.8	-0.2	0.6	-2.2	0.8	-1.5	1.7
1983	0.8	-1.3	1.8	-0.9	0.8	0.4	1.3
1984	0.6	-2.8	2.8	-0.1	1.6	-0.6	0.6
1985	-0.4	-2.8	3.7	-0.1	2.6	-0.9	0.9
1986	-2.1	-3.1	4.3	0.4	4.4	0.4	0.0
1987	-1.7	-3.2	3.6	-0.5	4.0	-0.2	-0.7
1988	-1.7	-2.6	2.8	-0.4	4.0	-0.6	-3.2
1989 ^a	-2.3	-2.6	2.7	-0.6	4.5	-1.0	-3.6
1990 ^a	-2.3	-2.7	3.0	-0.5	4.4	-1.1	-3.0

Source : IMF

a. projections.

APPENDIX 4 :

DERIVATION OF THE SOLUTIONS OF THE SHORT RUN SAVING-INVESTMENT MODEL

The system of equations (2.1)-(2.5) can be solved as follows :

$$b_{t+1} - b_t = gx_t + (a+d)r_t + \mu_t - \nu_t \quad \text{by (2.1), (2.2) and (2.4)}$$

$$\Rightarrow r_t = \frac{(b_{t+1} - b_t) - gx_t - \mu_t + \nu_t}{a + d}$$

$$\Rightarrow qe_t + \zeta_t = -[m/(a+d)](b_{t+1} - b_t - gx_t - \mu_t + \nu_t) + m[r_t^* + E_t(e_{t+1} - e_t)] + \omega_t$$

using (2.3) and (2.5). Replacing $(b_{t+1} - b_t)$ on the right hand side by $qe_t + \zeta_t$ and dividing through by m yields :

$$e_t \left(\frac{q}{m} + \frac{q}{a+d} \right) = \frac{-\zeta_t}{m} - \frac{1}{a+d} (\zeta_t - gx_t - \mu_t + \nu_t) + [r_t^* + E_t(e_{t+1} - e_t)] + \frac{\omega_t}{m}$$

$$\Rightarrow e_t \left(\frac{q}{m} + 1 + \frac{q}{a+d} \right) = E_t e_{t+1} + r_t^* + \frac{gx_t + \mu_t - \nu_t}{a + d} + \frac{\omega_t}{m} - \frac{(a+d+m)}{m(a+d)} \zeta_t$$

Define the composite term $\eta_t = r_t^* + \frac{gx_t + \mu_t - \nu_t}{a + d} + \frac{\omega_t}{m} - \frac{(a+d+m)}{m(a+d)} \zeta_t$

$$\begin{aligned} \Rightarrow e_t &= \frac{(a+d)m}{(q+m)(a+d)+mq} (E_t e_{t+1} + \eta_t) \\ &= h (E_t e_{t+1} + \eta_t) \end{aligned}$$

As $h < 1$, we have a convergent infinite sum :

$$e_t = h (\eta_t + hE_t \eta_{t+1} + h^2 E_t \eta_{t+2} + \dots)$$

If x_t follows a first order autoregressive process and the other disturbances are all white noise, while $m \rightarrow \infty$, η_t and h simplify to :

$$\eta_t = r_t^* + \frac{gx_t + \mu_t - \nu_t - \zeta_t}{a + d}$$

$$h = \frac{a + d}{a + d + q}$$

Hence :

$$\begin{aligned} e_t &= h \left[r_t^* + \frac{gx_t + \mu_t - \nu_t - \zeta_t}{a + d} + h(E_t r_{t+1}^* + \frac{g\rho x_t}{a+d}) + \dots \right] \\ &= \frac{hg}{a+d} \sum_{j=0}^{\infty} (h\rho)^j x_t + h \sum_{j=0}^{\infty} h^j E_t r_{t+j}^* + \frac{h(\mu_t - \nu_t - \zeta_t)}{a + d} \\ &= \frac{g}{(a+d+q)(1-h\rho)} x_t + \sum_{j=0}^{\infty} h^{j+1} E_t r_{t+j}^* + \frac{h(\mu_t - \nu_t - \zeta_t)}{a + d} \end{aligned}$$

This allows us to write r_t as follows :

$$\begin{aligned} r_t &= r_t^* + E_t(e_{t+1} - e_t) \\ &= r_t^* + \frac{(hg\rho - hg)}{(a+d)(1-h\rho)} x_t + (1-h) \left[\left(\sum_{j=0}^{\infty} h^j E_t r_{t+j}^* \right) - r_t^* \right] - \frac{h(\mu_t - \nu_t - \zeta_t)}{a + d} \\ &= \frac{g(\rho-1)}{(1-\rho)(a+d)+q} x_t + (1-h) \sum_{j=0}^{\infty} h^j E_t r_{t+j}^* + hr_t^* - \frac{(\mu_t - \nu_t - \zeta_t)}{a + d + q} \end{aligned}$$

APPENDIX 5 :

CROSS-COUNTRY DISPARITIES IN THE LONG RUN RATE OF HOUSING INVESTMENT :
RESIDENTIAL CONSTRUCTION AS A PERCENTAGE OF GDP 1960-87

United States	4.7	Iceland	6.4
Japan	6.3	Ireland	4.7
West Germany	6.7	Luxemburg	5.2
France	7.2	Netherlands	5.5
United Kingdom	3.8	Norway	4.8
Italy	7.3	Portugal	4.4
Canada	5.8	Spain	5.9
Austria	5.4	Sweden	5.1
Belgium	5.3	Turkey	3.2
Denmark	6.4	Australia	5.2
Finland	6.7	New Zealand	4.7
Greece	6.3		

Source : OECD: *Historical Statistics, 1960-1987*

N.B.: Switzerland does not break down construction into residential versus non-residential and is therefore omitted.

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