On external debt sustainability and the Argentine crisis.

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Abstract

BOP crises, currency crises, debt crises; problems involving external debt sustainability (EDS) are anything but rare in the international financial system. This paper develops two refinements to the standard EDS assessment tools, and it uses them to discuss the Argentine crisis. Capital flight and return spread are introduced into a debt dynamics analysis. Effects on EDS of interactions between return spread, debt accumulation, output growth, and imports are explored. An *ad hoc* model emphasizing foreign exchange market behaviour in developing countries analyzes the macroeconomic effects of an international liquidity crisis and the adjustment policies available. The paper discusses alternative hypothesis explaining the Argentine crisis. On the basis of stylized facts and analytical results, it is argued that the Argentine crisis was a consequence of inconsistencies between the fixed-exchange rate regime, trends in external sector variables, and the pattern of international integration.

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Introduction

Lord Polonius taught Laertes:

> Neither a borrower nor a lender be;
> For loan oft loses both itself and friend,
> And borrowing dulls the edge of husbandry.[1]

Around 400 years later, the Argentine crisis adds a new piece of evidence in support of Lord Polonios' wisdom. When Argentina devalued and defaulted at the beginning of 2002, the country was both an international borrower and lender. Foreign liabilities and external assets had been piling up since the adoption of a fixed-exchange rate regime in 1991. A real exchange rate overvaluation, a liability dollarization, and a pro-cyclical fiscal stance increased vulnerability to external and financial shocks. When adverse shocks materialized in 1999-2000, macroeconomic performance turned quite disappointing, delivering an unprecedented recession, high unemployment, and low growth. In a context of runs against domestic currency and banks, the system collapsed in 2001. After the country stopped servicing its foreign liabilities, many members of the international financial community that had been close friends of the Argentine authorities when the fixed-exchange rate regime and structural reforms were in place, became fierce enemies blaming the fiscal sector for spending too much and adjusting too little.

The Argentine case illustrates clearly what external debt unsustainability is about. According to the IMF, a debt is sustainable when "a borrower is expected to be able to continue servicing its debts without an unrealistically large future correction to the balance of income and expenditure"[2]. Thus, a country whose *external* debt is sustainable is not expected to face problems like a current account adjustment, a currency crisis, and a default. Needless to say, Argentina faced all of them. In fact, problems regarding external debt sustainability (EDS, hereafter) are anything but rare

[1] William Shakespeare; "The Tragedy of Hamlet, Prince of Denmark"; act 1, scene 3.
[2] IMF (2002, p.4).

in the international financial system. For developing countries, the empirical evidence suggests that EDS problems are the normal state of affairs[3].

This paper deals with EDS issues. Specifically, the paper develops two refinements to standard EDS assessment tools, and uses them to discuss the Argentine crisis. To motivate these refinements, two criticisms should be made of the EDS assessment tools. First, they do not treat properly the capital flight and the spread between the external debts' interest rate and the external assets' rate of return[4]. By introducing external assets and return spread into a debt dynamics analysis, the paper shows that a debt burden arises. This burden influences the intertemporal budget constraint and the *ad hoc* restrictions on indebtedness ratios that are often used to assess EDS. Second, the EDS assessment tools treat many macroeconomic variables as exogenous, understating the effects on EDS of the causal relationships between them[5]. The paper explores these effects at an empirical level by estimating a vector autoregression (VAR) model using Argentine data for return spread, debt accumulation, output growth, and imports. The VAR model's estimates allow designing consistent scenarios to undertake EDS assessments taking those relationships into account.

At a theoretical level, the paper analyzes the linkages between variables associated with EDS by developing an *ad hoc* macroeconomic model. Asset accumulation and growth rates are treated as endogenous variables in a simple framework built on a Neoclassical AK production function adjusted to allow for idle capacity, a Tobinian portfolio model, and Structuralist notions of investment-savings gap and external gap. By placing analytical emphasis on the foreign exchange market behaviour, the model shows how a shortage of international liquidity imposes a current account adjustment with negative effects on output, investment, and growth. Alternative policies to cope with the international liquidity shortage are explored in this framework.

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[3] For low- and middle-income countries, Milessi-Ferretti and Razin (1998, p.11) count more than 100 BOP crises in the period 1973-1994. For middle-income countries, including the ex-communists, Reinhart, Rogoff, and Savastano (2003, p.16) count 33 debt crises in 1970-2001.

[4] Subject to this criticism is IMF (2002 and 2003). Obstfeld and Rogoff (1996, p.66), and Deutsche Bank (2000, Appendix) take capital flight into account as they focus on net foreign assets when discussing EDS; nevertheless, their analysis assumes a single rate of return.

[5] IMF (2003), and Hostland and Karam (2006) introduce macroeconomic linkages into an EDS analysis by using stochastic simulation methods to perform sensitivity tests. But these works postulate a quite general correlation structure, and lack a theoretical model rationalizing the observed relationships. Garcia and Rigobon (2004), and Tanner and Samake (2006) use stochastic simulations to analyze public debt sustainability.

The Argentine case is discussed analyzing the macroeconomic performance in 1991-2001 with the refined EDS assessment tools and the *ad hoc* model. In this regard, the paper is motivated by the fact that EDS problems have been understated by many works dealing with the Argentine crisis. Some works have argued that the root of the problem was a fiscal mismanagement delivering an unsustainable public indebtedness[6]. This paper supports an alternative view: the Argentine crisis was a consequence of inconsistencies between the fixed-exchange rate regime, trends in external variables, and the pattern of international integration. It argues that the foreign indebtedness allowed sustaining the exchange arrangement for foreign liabilities provided foreign exchange to a market hungry for internationally liquid resources to finance current account deficits and capital flight. However, the macroeconomic dynamics brought about by the foreign indebtedness and real exchange overvaluation proved to be at odds with EDS in both economic expansion and contraction. When external shocks made investors aware of the EDS problems, international financing stopped and the fixed-exchange rate regime was doomed to collapse[7].

The paper is divided into four sections. Refinements to EDS assessment tools are introduced in section 1. Section 2 develops the *ad hoc* macroeconomic model. An analysis of the Argentine case is undertaken in section 3. Section 4 summarizes and concludes. An Appendix presents results referred in the main sections.

[6] Notably Mussa (2002), and Teijeiro (2001).
[7] This paper shares many arguments with Damill, Frenkel, and Rapetti (2005), Fanelli (2003), and Perry and Servén (2003).

I. Refining EDS assessment tools

This section provides analytical background for an EDS assessment. It discusses the notions of EDS, solvency, and liquidity, emphasizing the role played by foreign exchange (FOREX, hereafter) flows. To improve upon the standard EDS assessment tools, capital flight and return spread are incorporated into a debt dynamics analysis. In addition, the effects on EDS of interactions between macroeconomic variables are explored.

I.1 EDS, solvency, and liquidity:

Since developing countries' external debt is denominated in foreign currency, it is useful to characterize the notion of EDS in relation to FOREX flows[8]. A country's external debt is sustainable when two conditions are fulfilled: (i) the expected FOREX flows associated with foreign trade and finance are balanced for a given time horizon, and (ii) the FOREX flow mismatches that may arise within that horizon are expected to be financed by international capital markets.

The conditions (i) and (ii) are related to the familiar notions of solvency and liquidity. In theoretical EDS models, a debtor country is solvent when it satisfies an intertemporal budget constraint requiring a balance between the face value of the external debt and the present discounted value of the expected trade surpluses for a given time horizon[9]. This constraint is consistent with the fact that trade surpluses are a genuine source of FOREX resources needed to service foreign currency-denominated liabilities. Furthermore, since the constraint does not require a period-by-period balance between trade surplus and debt service, it is also consistent with the fact that developing countries often run current account deficits.

A current account deficit coupled with maturing foreign liabilities may give rise to a FOREX flow mismatch in a point in time. To fill the gap, additional sources of FOREX resources should be available for the debtor country. In this regard, the

[8] Goldstein (2003, p.9) and Williamson (2002, p.8) emphasize the importance of FOREX flows in an EDS analysis. For empirical evidence on the currency-denomination of foreign liabilities, see Eichengreen, Hausmann, and Panizza (2003a and 2003b), and Eichengreen and Hausmann (2003). These works have introduced the notion of *original sin*: developing countries are unable to issue external debt denominated in their own currencies.

[9] See IMF (2002, p.5).

country is liquid when international capital markets are willing to provide it with those resources by rolling over maturing foreign liabilities and lending fresh funds. Although international financing helps to cope with the FOREX flow mismatch in the short-run, it increases debt services in the future. Thus, for the debtor country's long-run solvency not to be called into question, the terms of financing, i.e. interest rates, quantities, and maturities, must be in keeping with expected trade surpluses. Provided that FOREX imbalances are financed consistently with the intertemporal budget constraint, events at odds with EDS are unlikely to happen, i.e. a current account adjustment, a currency crisis, or a default.

The notions of solvency and liquidity have implications on the external debt dynamics that constitute the analytical foundations of standard EDS assessment tools. Liquidity drives the debt dynamics as the stock of foreign liabilities grows over time when international capital markets lend FOREX resources to a debtor country needing financing. On the other hand, solvency constrains the indebtedness process because an intertemporal FOREX flow balance prevents the debt dynamics from being explosive. Consistently with these implications, the basic idea of a standard EDS assessment is that an apparently unbounded growth of the foreign liabilities is a signal warning about EDS problems. While theoretical EDS models use the intertemporal budget constraint to rule out an explosive external debt growth, applied EDS models introduce *ad hoc* restrictions on the time path of an indebtedness ratio, say external debt-to-GDP or external debt-to-exports.

I.2 EDS assessment, capital flight, and return spread:

To analyze the external debt dynamics, the standard EDS models focus on the debtor country's financing needs associated basically with the current account deficit and maturing foreign liabilities. But these models miss a crucial phenomenon influencing the foreign indebtedness of developing countries: the capital flight. In these countries, domestic investors make portfolio decisions involving domestic assets as well as external assets, and their investment opportunities have broadened along with financial liberalization[10]. Since FOREX resources are needed to purchase assets abroad, capital flight has implications on FOREX flows and EDS. On the one hand,

[10] For empirical evidence on capital flight in developing countries, see Collier, Hoeffler, and Pattillo (1999), and Powell, Ratha and Mohapatra (2002).

investments abroad widen a FOREX imbalance brought about by the current account deficit and maturing foreign liabilities; on the other hand, repatriation of capital invested abroad is an alternative, but limited source of FOREX resources. Therefore, by leaving capital flight aside, the standard EDS models underestimate the magnitude of the FOREX flow mismatch that international financing should compensate in a point in time.

Another stylized fact related to the developing countries' foreign indebtedness is that interest rates charged on foreign liabilities are higher than return rates on external assets, and that global factors as well as domestic issues explain the return spread[11]. Thus, a simultaneous accumulation of assets abroad and external debt gives rise to FOREX imbalances in the future by increasing net factor income payments and financing needs. In addition, this accumulation reduces the country's wealth computed in present discounted value (PDV) terms. Consider a country whose current account is balanced in a point in time, so its *net* external debt remains unchanged. Under these circumstances, while some domestic agents may be borrowing funds from abroad, others must be allocating the same amount of funds to capital flight. Since there is a return spread, the PDV of future debt services paid to foreign creditors is higher than the PDV of future financial services received from investments abroad. Therefore, wealth decreases and EDS weakens[12]. Not taking the capital flight and return spread into account, the standard EDS models cannot capture these effects.

The observations made above suggest that the standard EDS assessment tools can be improved by introducing capital flight and return spread into the analysis of the external debt dynamics. The dynamic behaviour of the *net* external debt is explored below aiming to identify the effect of those factors on the intertemporal budget constraint, and on the *ad hoc* restrictions for an indebtedness ratio.

Net external debt and the intertemporal budget constraint:

Consider a small open economy integrated to international capital markets where financial instruments are denominated in foreign currency. For the country, the

[11] For empirical evidence on global factors, see González Rozada and Levy Yeyati (2005). Damill and Kampel (1999) discuss determinants of the return spread in the Argentine case.

[12] To compute PDVs, the discount rate should be the interest rate charged on foreign liabilities. Since the debtor country has a stock of external debt, there is an opportunity cost for the FOREX resources devoted to purchase external assets. If these resources were devoted to buy-back foreign liabilities, the country would save on interest payments depending on that interest rate.

external debt stock D_t pays an interest rate r_t, and the external asset stock A_t yields a rate of return i_t [13]. There is a return spread $\sigma_t = r_t - i_t$ representing the excess return rate paid by foreign liabilities over and above the international interest rate. In a period *t,* the FOREX sources are exports X_t, factor income received from abroad $i_t A_t$, capital amortizations of external assets Am_t^A, and issuances of foreign liabilities F_t^D. On the other hand, the FOREX uses are imports M_t, factor income paid to foreign creditors $r_t D_t$, maturing liabilities Am_t^D (i.e. capital amortizations of external debt), and purchases of assets abroad F_t^A. According to BOP accounting, sources and uses of FOREX must be equal *ex post*:

(1) $$X_t + i_t A_t + Am_t^A + F_t^D = M_t + r_t D_t + Am_t^D + F_t^A$$

In this framework, the country borrows funds F_t^D from international capital markets to cover financing needs associated with: (i) the current account deficit $M_t - X_t + r_t D_t - i_t A_t$, (ii) the maturing liabilities Am_t^D, and (iii) the capital flight $F_t^A - Am_t^A$. Thus, the dynamics for D_t and A_t are described by[14]:

(2) $$\dot{D}_t = F_t^D - Am_t^D \quad \text{and} \quad \dot{A}_t = F_t^A - Am_t^A$$

Using (1) and (2), the dynamic equation for the net external debt $D_t - A_t$ is:

(3) $$\dot{D}_t - \dot{A}_t = r_t (D_t - A_t) + M_t + \sigma_t A_t - X_t$$

In (3), the term $\sigma_t A_t$ captures the influence of assets abroad and return spread on the net external debt dynamics. This term accelerates the growth of the net foreign liabilities over time because, as it was mentioned above, capital flight financed by foreign borrowing increases the net factor income payments and financing needs.

Solving (3) for an initial condition $(D_0 - A_0)$ yields the time path of the net external debt[15]:

(4) $$(D_t - A_t) = (D_0 - A_0) e^{\int_0^t r_s ds} + \int_0^t (M_v + \sigma_v A_v - X_v) e^{\int_v^t r_s ds} dv$$

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[13] International reserves should be included in A_t, and FDI in D_t. For simplicity, the current return rates r_t and i_t apply to existing stocks; thus, average and marginal return rates are equal.

[14] Variables are continuous functions of time, and derivatives w.r.t. time are denoted with an upper dot.

[15] See Appendix for a formal derivation.

To rule out a Ponzi game, consider a transversality condition requiring the PDV of the net external debt to be non-positive:

$$(5) \qquad \lim_{t\to\infty}\left(D_t - A_t\right)e^{-\int_0^t r_s ds} \leq 0$$

Using (4) and (5), the intertemporal budget constraint is:

$$(6) \qquad \left(D_0 - A_0\right) \leq \int_0^{\infty} \left(X_t - M_t\right)e^{-\int_0^t r_v dv} dt - \int_0^{\infty} \left(\sigma_t A_t\right)e^{-\int_0^t r_v dv} dt$$

Interpreting (6) is straightforward: a country is solvent if the face value of the net external debt does not exceed the PDV of the trade surpluses *adjusted downwards* by the last term of (6). This term is the PDV of the expression $\sigma_t A_t$ already mentioned, and it can be interpreted as a *debt burden* brought about by the return spread when domestic investors engage in a simultaneous accumulation of assets abroad and external debt.

Expression (6) shows that the computation of the PDV of the trade surpluses suggested by theoretical EDS models is not enough for assessing EDS. On one hand, external assets improve EDS: given the PDV of the trade surpluses, a higher level of foreign liabilities is sustainable when domestic agents hold assets abroad. On the other hand, the return spread weakens EDS: given the PDV of the trade surpluses and the net external debt, a lower level of foreign liabilities is sustainable when the return spread is positive.

Net external debt and ad hoc restrictions in applied EDS models:

To assess EDS, applied models analyze the time path of an indebtedness ratio. The external debt-to-GDP ratio is widely used for policy purposes, assuming that future debt payments are related to the outstanding debt stock, and that domestic income determines the debtor country's ability and willingness to make such payments. By decomposing a dynamic equation for the indebtedness ratio, the analysis focus on the main macroeconomic variables driving the ratio's changes over time, namely growth rates of output, exports, and imports, inflation, interest rates, and nominal exchange rate movements[16]. Under a baseline scenario for these variables, the external debt dynamics is projected for a certain number of periods. If the

[16] See IMF (2002, p.24).

projected time path of the ratio does not grow unboundedly, foreign liabilities are assessed sustainable.

In practice, two additional exercises complement the methodology outlined above. First, when the projected dynamics warns about external debt unsustainability, a *resource balance gap* is computed. Defined as the difference between the current value of the trade balance and the value that stabilizes the indebtedness ratio immediately, this indicator gives an order of magnitude of the trade adjustment that would be needed to resume EDS. Second, sensitivity tests are often conducted to examine the effects on external debt dynamics of alternative macroeconomic scenarios capturing sources of shocks. This is so because, as projections involve judgements on future events that are admittedly uncertain, there are risks surrounding the baseline EDS assessment that should be addressed[17].

To explore the effect of assets abroad and return spread on an *ad hoc* restriction imposed on the net external debt-to-GDP ratio, consider the variable $R_t \equiv (D_t - A_t)/Y_t$, where Y_t is the nominal GDP measured in foreign currency. The dynamic equation for R_t is:

$$\dot{R}_t = \left(i_t - \frac{\dot{Y}_t}{Y_t} \right) R_t + \frac{M_t}{Y_t} + \sigma_t \frac{D_t}{Y_t} - \frac{X_t}{Y_t} \tag{7}$$

In order to simplify formal expressions, assume a constant value for the return rates *r* and *i*, and for the growth rates of $Y_t, X_t, M_t,$ and D_t, denoted by $y, x, m,$ and d, respectively[18]. Solving (7) for an initial condition R_0 yields the time path for the indebtedness ratio[19]:

$$R_t = R_0 e^{(i-y)t} + \frac{M_0}{Y_0} \frac{e^{(m-y)t} - e^{(i-y)t}}{(m-i)} + \sigma \frac{D_0}{Y_0} \frac{e^{(d-y)t} - e^{(i-y)t}}{(d-i)} - \frac{X_0}{Y_0} \frac{e^{(x-y)t} - e^{(i-y)t}}{(x-i)} \tag{8}$$

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[17] See IMF (2003, p.15), and Hostland and Karam (2006). Beyond a basic agreement in terms of methodology, applied EDS models are quite heterogeneous in terms of interpretation of results. For instance, there is no consensus on whether a relevant EDS indicator is the stability of an indebtedness ratio or the level it reaches. On this, see IMF (2002, p.42), Roubini, (2002, p.8), and Goldstein (2003, p.14). Besides, different indebtedness ratio levels seem to be appropriate for different countries, i.e. there is no such thing as a *one-size-fits-all*. In this regard, the notion of *debt intolerance* emphasizes that emerging economies should not exceed low figures for the external debt-to-GDP ratio in order to preserve EDS (see Reinhart, Rogoff, and Savastano, 2003).

[18] For a generic variable Z_t, the time path is given by $Z_t = Z_0 e^{zt}$, where $z = \dot{Z}_t / Z_t$ denotes a logarithmic rate of change.

[19] Expression (8) holds provided that i differs from $y, x, m,$ and d.

To prevent R_t from growing unboundedly in (8), an *ad hoc* restriction establishes that the R_t path must attain a maximum at some point in time T^*, and it must be non-increasing thereafter. For T^* to exist, a value must satisfy the following conditions[20]:

(9a) $$(i-y)(D_0-A_0)+M_0\frac{(m-y)e^{(m-i)T^*}-(i-y)}{(m-i)} \quad \ldots$$
$$\ldots +\sigma D_0\frac{(d-y)e^{(d-i)T^*}-(i-y)}{(d-i)}-X_0\frac{(x-y)e^{(x-i)T^*}-(i-y)}{(x-i)}=0$$

(9b) $$M_0(m-y)e^{mT^*}+\sigma D_0(d-y)e^{dT^*}-X_0(x-y)e^{xT^*}<0$$

(9c) The LHS of (9a) is non-positive for $t>T^*$

Expressions (9a)-(9b)-(9c) show that assets abroad and return spread play a role in determining existence and value of T^*. The expressions also provide a tool to assess EDS in practice. T^* can be computed in a baseline scenario encompassing projections for *y, x, m, d, i,* and σ, and the initial conditions X_0, M_0, D_0, and A_0. If T^* exists and is positive, its value gives an order of magnitude of the time that should elapse until the indebtedness ratio ceases to grow and starts to decrease. If T^* exists and is negative, the indebtedness ratio is already in a decreasing path. Last of all, if T^* does not exist, R_t grows unboundedly and thus EDS does not hold. In this case, the resource balance gap can be computed by setting $T^*=0$ in (9a), solving for the trade surplus satisfying the equation obtained, and checking that (9b)-(9c) hold. The indicator is given by expression (10) below, where the term σA_0 increases the trade surplus required to stabilize R_t immediately[21]:

(10) $$(X_0-M_0)\big|_{T^*=0}=(r-y)(D_0-A_0)+\sigma A_0$$

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[20] These conditions are derived from the properties of $T^*: dR_t/dt\big|_{t=T^*}=0$, $d^2R_t/dt^2\big|_{t=T^*}<0$, and $dR_t/dt\big|_{t>T^*}\le 0$. *Ad hoc* restrictions in the same vein are used by Simonsen (1985, p.105) and Frenkel (2004, p.9).

[21] Obstfeld and Rogoff (1996, p.68) show the resource balance gap without this term since the return spread is not taken into account.

I.3 EDS assessment and macroeconomic causality:

To test sensitivity of the EDS assessment to deviations from the baseline projections, alternative scenarios can be designed for computing different time paths for R_t in (8), and their corresponding T^* according to (9a)-(9b)-(9c). The simplest procedure would be to change one variable at a time for a certain number of periods, calibrating the shocks according to historical values or an arbitrary criterion. But this lacks realism since independent shocks are hardly observed. In fact, shocks are correlated across variables and over time, and so growth rates, prices, exchange rate, debt accumulation, and interest rates are believed to be jointly determined[22].

A simple quantitative exercise is conducted below to design hypothetical scenarios capturing linkages between macroeconomic variables. A VAR model estimated using Argentine data assumes exogeneity for the return spread, and endogeneity for the growth rate of foreign liabilities, real output, and real imports. Computing long-run values of the endogenous variables for different magnitudes of the exogenous variable provides a set of consistent scenarios. Last of all, T^* is computed in these scenarios and the time path of R_t is simulated in some representative cases.

VAR model and long-run value estimates:

To begin with, the variables $Y_t, M_t,$ and $X_t,$ which are nominal and measured in foreign currency, should be decomposed into quantities and relative prices. Set $Y_t = Y_t^R / E_t^R$, $M_t = M_t^R \left(P_t^M / P_t\right) / E_t^R$, and $X_t = X_t^R \left(P_t^X / P_t\right) / E_t^R$, where Y_t^R, M_t^R, and X_t^R are real values; E_t^R is the real exchange rate defined as the nominal exchange rate E_t deflated by a general price level in domestic currency P_t; P_t^M and P_t^X are price levels for imports and exports. For the growth rates, set $y_t = \rho_t - \varepsilon_t$, $m_t = \mu_t + p_t^M - \varepsilon_t$, and $x_t = \chi_t + p_t^X - \varepsilon_t$, where ρ_t, μ_t, and χ_t are growth rates of real variables; ε_t is the rate of change of E_t^R; p_t^M and p_t^X are rates of changes of relative prices P_t^M / P_t and P_t^X / P_t.

[22] See IMF (2002, p.30), IMF (2003, p.15), and Hostland and Karam (2006, p.4).

Consider a VAR model for the endogenous variables d_t, ρ_t, and μ_t, with σ_t exogenous:

$$\text{(11a)} \quad Z_t = C + \sum_{l=1}^{3} V_l Z_{t-l} + \sum_{l=0}^{2} B_l \sigma_{t-l} + \Psi_t$$

$$\text{where} \quad Z_t = \begin{pmatrix} d_t & \rho_t & \mu_t \end{pmatrix}^{\mathrm{T}} \quad C = \begin{pmatrix} c_1 & c_2 & c_3 \end{pmatrix}^{\mathrm{T}} \quad \Psi_t = \begin{pmatrix} \phi_{1t} & \phi_{2t} & \phi_{3t} \end{pmatrix}^{\mathrm{T}}$$

$$B_l = \begin{pmatrix} b_{1,l} & b_{2,l} & b_{3,l} \end{pmatrix}^{\mathrm{T}} \quad V_l = \left\{ v_{nj,l} \right\}_{j,n=\{1,2,3\}}$$

The VAR model has been estimated by ordinary least squares using quarterly data from 1993 to 2000 to capture the underlying economic structure during the Convertibility period, excluding the 2001 crisis and the 1991-1992 stabilization phase[23]. In the expression below, the estimated coefficients allow computing long-run values of d^*, ρ^*, and μ^* for alternative values of σ^* [24]:

$$\text{(11b)} \quad Z^* = \left(I_3 - \sum_{l=1}^{3} V_l^{OLS} \right)^{-1} \left(C^{OLS} + \left(\sum_{l=0}^{2} B_l^{OLS} \right) \sigma^* \right)$$

Plugging the estimated coefficients into (11b) yields:

$$\text{(11c)} \quad \begin{pmatrix} d^* \\ \rho^* \\ \mu^* \end{pmatrix} = \begin{pmatrix} 0.28445 \\ 0.16238 \\ 0.43355 \end{pmatrix} + \begin{pmatrix} -3.13255 \\ -2.20123 \\ -5.64549 \end{pmatrix} \sigma^*$$

According to (11c), there is a long-run negative relationship between return spread and the growth of debt, output, and imports, as it would have been expected. Specifically, a one percentage point (pp) increase in σ^* is expected to reduce d^* by 3.1 pp, ρ^* by 2.2 pp, and μ^* by 5.6 pp [25]. Although the VAR model is admittedly simple, it provides rough estimates for two years, 1994 and 1998, in which the

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[23] Ψ_t is a vector of random errors with standard properties. Basic tests on residuals do not reject the model's specification. Three lags have been selected on the basis of information criteria and sample size. Estimated coefficients are reported in the Appendix. Return spread σ_t is the EMBI+ Spread for Argentina elaborated by J.P. Morgan. Growth rates ρ_t and μ_t are annual q.o.q., released by Argentine Ministry of Economy. Series for d_t refers to annual q.o.q growth of market debt, excluding financing provided by official creditors; it is own estimates using International Investment Position (1994-2000) and BOP flows (1993) reported by Argentine Ministry of Economy.

[24] *OLS* denotes a matrix of estimated coefficients, and a star denotes a long-run value.

[25] The estimated return spread-elasticity of output is similar to figures reported by Fanelli (2001) and Argentine Ministry of Economy (2000).

Argentine economy was functioning normally under the Convertibility regime[26]. This observation suggests that the long-run value estimates are reasonable to design hypothetical scenarios for assessing EDS.

Hypothetical scenarios and EDS assessment:

Table 1 shows EDS assessments for a set of scenarios where σ^* runs from 0% to 11%. Assumed values for initial conditions, E^R, and i are consistent with Argentine data in 2001; zero-inflation and a 10% growth rate of real exports are assumed. For those scenarios in which T^* exists, i.e. there is a value satisfying (9a)-(9b)-(9c), its value is highlighted in grey.

TABLE 1: EDS Assessment

Growth rates (%) (*)			Return rates (%) (**)		Dynamics Rt			
y	m	d	r	σ	Value t such that (9a) holds	Value (9b) for t	Rt when t goes to infinite	Value Rt* (%)
16.2	43.4	28.4	5.0	0.0	0.50	0.04	inf +	
14.0	37.7	25.3	6.0	1.0	0.20	0.03	inf +	
11.8	32.1	22.2	7.0	2.0	-0.20	0.03	inf +	
9.6	26.4	19.0	8.0	3.0	-1.00	0.02	inf +	
7.4	20.8	15.9	9.0	4.0	-2.60	0.01	inf +	
5.2	15.1	12.8	10.0	5.0	-7.90	0.00	inf +	
3.0	9.5	9.6	11.0	6.0	91.80	-0.42	inf -	8904.77
0.8	3.8	6.5	12.0	7.0	10.90	-0.02	inf -	78.65
-1.4	-1.8	3.4	13.0	8.0	6.90	-0.02	inf -	60.79
-3.6	-7.5	0.3	14.0	9.0	5.50	-0.03	inf -	56.91
-5.8	-13.1	-2.9	15.0	10.0	4.80	-0.04	inf -	56.34
-8.0	-18.7	-6.0	16.0	11.0	4.40	-0.05	inf -	57.13

* indicates a rate of change computed on logarithm values

** indicates a marginal return rate

Initial conditions (USD bn): Y_0 = 284; X_0 = 31; M_0 = 33; D_0 = 222; A_0 = 153

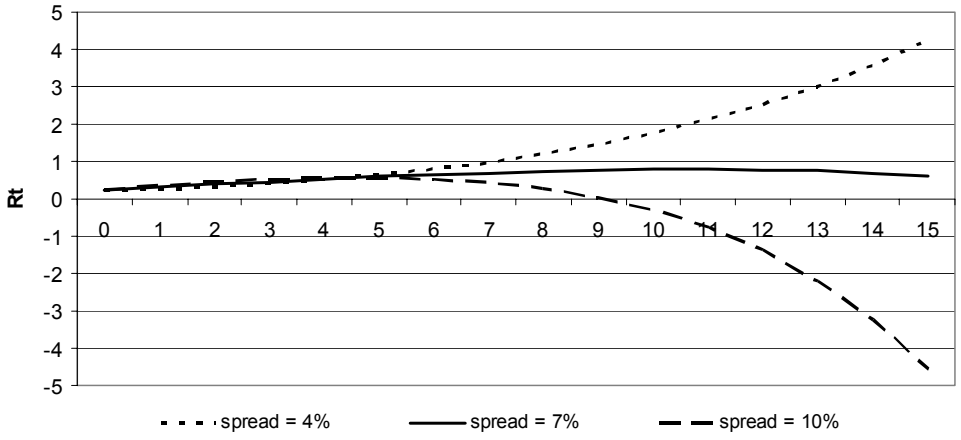
Exogenous variables: Intern.Int.Rate i = 5%; Infl. for Y = 0%; Infl. for X and M = 0%;
Real Exchange Rate E_r = 1 (Index 1993 = 1.1); Real X G.R. = 10%

Note: for σ = 6.0, (9a) also holds for -33.0; for σ = 7.0, (9a) also holds for -35.5

For $\sigma^* \leq 5\%$, the time paths of R_t grow unboundedly, so EDS is not attained. For $\sigma^* \geq 6\%$, the time paths of R_t reach a maximum value R_{T*} indicated in the last

[26] In 1994, σ was 4.7%, d 16%, ρ 6%, and μ 19%; from (11c), estimates are d^* 14%, ρ^* 6%, and μ^* 17%. In 1998, σ was 5.4%, d 10%, ρ 4%, and μ 8%; estimates are d^* 11%, ρ^* 4%, and μ^* 12%.

column; thus, EDS is attained. Below, the graph shows three dynamics for R_t with t between 0 and 15, and σ^* set equal to 4%, 7%, and 10%.



A discussion on EDS results:

If the return spread charged on foreign liabilities were associated with EDS, it would be expected to observe a net external debt deemed unsustainable along with a high return spread level, and a net external debt deemed sustainable along with a low return spread level. But this is not what the reported results based on Argentine data show. In table 1, for low return spread levels, net foreign liabilities diverge upwards and thus should be assessed unsustainable; for high return spread levels, net foreign liabilities start to decrease at some point and thus are sustainable. A discussion on these results helps to rationalize them.

A closer observation to table 1 reveals that R_t grows unboundedly for a low return spread due to extremely high growth rates of external debt and imports[27]. This suggests that a debtor country growing with abundant international lending may be unable to attain EDS because its ability to generate trade surpluses may not increase *pari passu* with its financial obligations, i.e. the country's export growth may not make up for the growth of debt services and imports.

[27] In terms of parameters, the return spread-elasticities given by $\left(I_3 - \sum_{l=1}^{3} V_l^{OLS}\right)^{-1}\left(\sum_{l=0}^{2} B_l^{OLS}\right)$ are high.

On the other hand, table 1 shows that R_t attains a maximum for a high return spread because growth rates of external debt and imports are extremely low, even negative. In this case, a debtor country shrinking with scarce international lending could generate the trade surpluses needed to prevent net foreign liabilities from growing unboundedly. However, in a context of low output growth, the country's willingness to pay is likely to be weak, and this justifies the prevailing high return spread level[28].

Two comments deserve to be made regarding this last case. First, the fact that the time path of R_t does not become explosive when interest rates increase significantly may be counter-intuitive for it is a common belief that the debt dynamics diverges upwards for a high interest rate level. Such belief is based on a standard EDS analysis where sensitivity tests change interest rates but do not adjust growth rates accordingly, i.e. the EDS analysis does not take macroeconomic interactions into account. Second, it can be argued that the EDS condition used so far should be somehow widened to encompass the willingness to pay issue. For instance, a country's net external debt would be assessed sustainable provided that the time path of R_t is non-explosive and the real output growth rate exceeds a given positive number. A two-condition definition of EDS will be used in section 3 [29].

[28] IMF (2002, p.3) puts this point forward: "Moreover, the assumption of no expectation of major corrections in income or expenditure captures the notion that there are social and political limits to adjustment that determine willingness (as opposed to ability) to pay, which may be especially important in a sovereign context".

[29] In table 1, if a positive output growth were required, EDS would be attained only for $\sigma^* = 6\%$ and $\sigma^* = 7\%$.

II. An *ad hoc* macroeconomic model

This section analyzes EDS problems from a theoretical perspective. It reviews some ideas in the largely debated issue on liquidity and solvency crises. To rationalize the linkages between macroeconomic variables observed in section 1, an *ad hoc* model is developed on the basis of empirical evidence on Argentina and other developing countries. Comparative-static exercises illustrate the short-run effects of an international liquidity crisis and the adjustment policies available.

II.1 EDS, solvency, and liquidity, revisited:

It has been said before that a solvent debtor country is expected to balance its FOREX flows for a given time horizon. To avoid events at odds with EDS when FOREX imbalances arise, the terms of international financing for the country must be consistent with its long-run solvency. In the literature dealing with recent emerging economies' financial crises, it has been largely debated if the international capital markets may fail to provide adequate financing to a solvent country with sound fundamentals. Models with self-fulfilling expectations argue that coordination failures between foreign creditors can rationalize why capital markets denied financing to apparently solvent countries[30].

On the other hand, fundamentalist models argue that if markets denied financing, it was because those countries were not solvent and had weak fundamentals. Some models hold that implicit guarantees provided by governments to private investors induced overinvestment and overborrowing from abroad[31]. Others highlight the financial fragility brought about by a policy-mix comprising a rapid financial liberalization, a fixed-exchange rate regime, and a lax regulation on domestic financial markets[32]. Finally, some models emphasize the observed risk that

[30] The creditor run argument has been used to explain the Mexican crisis (Tornell and Velasco, 1996) and the Asian crises (Radelet and Sachs, 1998; Chang and Velasco, 1998). For empirical evidence supporting these models, see Detragiache and Spilimbergo (2001).
[31] The moral hazard argument has been used to explain the Asian crises (Krugman, 1999a; Corsetti, Pesenti, and Roubini, 1998a and 1998b).
[32] This argument has been used to explain the Asian crises (Taylor, 1999) and the Argentine crisis (Frenkel, 2001 and 2004).

large adjustments in output and real exchange rate were required to deal with external financial disturbances in countries having a large foreign indebtedness[33].

If for whatever reason the international capital markets do not provide adequate financing, the debtor country will have to undergo a macroeconomic adjustment aimed at adapting its financing needs to the available amount and cost of external lending. In fact, *sudden stops* in capital inflows and interest rate increases exert pressures on financial and FOREX markets, and may end up imposing an adjustment in the current account and/or in the external debt.

In developing countries, *sudden stops* and interest rate increases severely disrupt current economic conditions contracting output and investment[34]. Medium-run effects on EDS are also negative since rising interest rates accelerate the debt dynamics, and the investment contraction deteriorates growth potential. In this context, policies are attempted to cope with the liquidity shortage and to distribute the burden of the adjustment between different groups. A standard policy toolkit includes a fiscal adjustment, a payment standstill forcing foreign creditors to rollover maturing liabilities, controls on capital outflows, and a devaluation of the domestic currency.

When the liquidity squeeze is tight and the economic downturn prolonged, a default on external debt may become the preferred policy option. By definition, a debt crisis occurs if the country stops servicing its foreign liabilities. But even when efforts are made to honour financial commitments for the time being, the disruptive effects of a macroeconomic adjustment can bring about a default in the future. For instance, as the accumulated debt stock distorts incentives to undertake prospective investments, the *debt overhang* problem implies a weak ability to pay in the future[35]. Besides, the willingness to pay is affected negatively by domestic groups exerting pressure on the government to postpone debt payments to foreign creditors. Therefore, it can be argued that a liquidity crisis weakening fundamentals deeply triggers a debt crisis sooner or later[36].

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[33] On the basis of this argument, the Asian crises are revisited by Krugman (1999b).

[34] For empirical evidence on *sudden stops,* see Calvo, Izquierdo, and Talvi (2002). On current account adjustment, see Milessi-Ferretti and Razin (1997 and 1998), and Guidotti, Sturzenegger, and Villar (2003). On recent defaults, Sturzenegger (2002).

[35] The *debt overhang* notion is developed in Sachs (1984), and Krugman (1988).

[36] The Latin American debt crisis illustrates this point. At the beginning of the eighties, countries facing liquidity problems underwent a severe adjustment that caused low growth levels and debt arrears for years. For those countries that had had a solvency problem before the liquidity crisis, solvency *was not regained* due to the disruptive consequences of the adjustment; and for those that had not had a solvency problem, solvency *was lost* due to the adjustment. See Damill, Fanelli, and Frenkel (1994).

II.2 A model:

To analyze linkages between variables involved in EDS and issues on liquidity crisis, consider the following *ad hoc* model.

Real side: output, imports, and exports

Assume a country's potential output $Y_t^{R,P}$ to be produced using a physical capital stock K_t^R in an AK production function $Y_t^{R,P} = \gamma K_t^R$. For simplicity, K_t^R does not depreciate. Actual output Y_t^R may fall short of $Y_t^{R,P}$ as a consequence of a macroeconomic adjustment; the ratio $u_t = Y_t^R / Y_t^{R,P}$ measures the output gap associated with idle capacity. Then, $\rho_t = \upsilon_t + \kappa_t$, where υ_t is the output gap's rate of change, and κ_t is the capital accumulation rate.

International prices are normalized to one and purchasing power parity holds, so $P_t^M = P_t^X = E_t$ and $p_t^M = p_t^X = \varepsilon_t$. Imports supply capital and intermediate goods that cannot be produced at home since the production structure is not developed[37]; so, it is assumed $M_t^R = \theta_K \dot{K}_t^R + \theta_Y Y_t^R$, and $\mu_t = \left[\theta_K \left(\dot{\kappa}_t + \kappa_t^2 \right) + \theta_Y \rho_t u_t \gamma \right] \left[\theta_K \kappa_t + \theta_Y u_t \gamma \right]^{-1}$. Exports are strongly influenced by international goods market conditions, so χ_t is deemed exogenous.

Financial side: markets and portfolio decisions

A simple framework inspired by Tobin's work models portfolio choices[38]. Two sets of markets are of analytical relevance: financial markets where *funds* are intermediated, and FOREX markets where *internationally liquid* resources are traded, i.e. resources accepted as a means of payments to service foreign liabilities and purchase imports and assets abroad. In financial markets, the demand for funds is

[37] For empirical evidence on imports, investment, and capital stock in Argentina, see Fanelli and Keifman (2001), Maia and Nicholson (2001), and Argentine Ministry of Economy (2004).
[38] See Tobin (1969 and 1982). Tobin's papers deal with portfolio models for *desired asset stocks,* while this model is for *desired asset flows.*

represented by domestic investors issuing liabilities to raise resources needed to carry out investment and capital flight. Domestic savers and foreign lenders supply the funds. In FOREX markets, the demand side is represented by domestic investors needing FOREX to service debt and pay for imported goods and external assets. FOREX is supplied by foreign investors lending to domestic agents and by exporters selling output abroad. Investors take the return spread σ_t into account when making portfolio decisions. In an *ad hoc* fashion, this variable captures the agents' perceptions on EDS, i.e. their expectations on the debtor country's ability to raise FOREX resources and willingness to service foreign liabilities. Details on portfolio choices are presented below.

Domestic savers' desired savings $S_t^{R,d}$ are a constant proportion *s* of current real income; savings funds are supplied inelastically in local financial markets[39]:

(12) $$S_t^{R,d} = sY_t^R$$

Domestic investors make decisions on asset accumulation, demanding funds and FOREX accordingly. Desired changes in the stock of physical capital $\dot{K}_t^{R,d}$ and assets abroad $\dot{A}_t^d$ are proportional to the available sources of finance; the proportions depend on σ_t and u_t:

(13) $$\dot{K}_t^{R,d} = h^K_{(\sigma_t, u_t)}\left(S_t^R + E_t^R \dot{D}_t\right) \qquad \text{with } h_1^K < 0 \text{ and } h_2^K > 0$$

$$\dot{A}_t^d = \left(1 - h^K_{(\sigma_t, u_t)}\right)\left(S_t^R / E_t^R + \dot{D}_t\right)$$

Adding $\dot{K}_t^{R,d}$ and $E_t^R \dot{A}_t^d$ yields the investors' demand for funds in real terms. In (13), $\dot{A}_t^d$ is expressed in nominal terms and represents FOREX demand for carrying out capital flight. The effect of σ_t on $\dot{K}_t^{R,d}$ and $\dot{A}_t^d$ is consistent with the role of foreign borrowing as a source of finance for domestic investment[40].

[39] The upper script *d* denotes a *desired* or *ex ante* value chosen by domestic agents.

[40] For empirical evidence on foreign borrowing, investment, and capital flight in Argentina, see Bebczuk, Fanelli, and Pradelli (2002), and Fanelli (2003).

Foreign investors' portfolio choices determine capital inflows to the country. Desired debt flows $\dot{D}_t^{d*}$ are proportional to the outstanding external debt stock; the proportion depends on σ_t [41]:

(14) $\dot{D}_t^{d*} = g^D_{(\sigma_t)} D_t \qquad \text{with } g^D_1 < 0$

In (14), $\dot{D}_t^{d*}$ is expressed in nominal terms and represents a supply of funds and FOREX. The effect of σ_t on $\dot{D}_t^{d*}$ is consistent with *pull/push* factors inducing capital inflows to developing countries, and with the credit rationing emerging economies face frequently in international capital markets[42]. In this context, foreign investors' decisions determine d_t [43]:

(15) $d_t = g^D_{(\sigma_t)}$

Model closure: market equilibrium, gaps, and market adjustment

The *ad hoc* behavioural hypotheses introduced so far determine desired values according to the agents' decentralized decisions. To close the model, equilibrium conditions for financial and FOREX markets should be specified requiring individual decisions to be mutually consistent. In addition, it is necessary to postulate adjustment variables set in motion when there is market disequilibrium.

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[41] The upper script $d*$ denotes a magnitude *desired* by foreign investors.

[42] For the *pull/push* factor debate, see Calvo, Leiderman, and Reinhart (1996), Fernández-Arias (1996), Fernández-Arias and Montiel (1996), and Taylor and Sarno (1997). For empirical evidence on credit rationing faced by Latin American economies in the eighties, see Díaz Alejandro (1984 and 1985). In a credit rationing event, two facts are observed. First, foreign investors are reluctant to provide the debtor country with its desired amount of financing at the prevailing interest rate r_t charged on foreign liabilities; and second, a higher interest rate does not induce them to increase their lending. The model captures the essence of the second fact by assuming $g^D_1 < 0$. Notice that this means desired lending actually decreases when the return spread increases because EDS problems are perceived as more likely. To be consistent with the first fact, the model postulates supply-rationed international capital markets by assuming that domestic investors take capital inflows as a given variable, $\dot{D}_t$ in (13), whose value is chosen by foreign investors, $\dot{D}_t^{d*}$ in (14).

[43] In practice, contractual terms on foreign liabilities set limits on the aggregate debt flows. For instance, a reduction in debt stock cannot exceed capital amortizations already established, unless the debtor country engages in buyback operations. If foreign investors want to reduce exposure, at most they can reject debt rollovers setting $F_t^D = 0$, and exposure will be reduced by Am_t^D. Thus, provided no default, $d_t = \max\left(g^D_{(\sigma_t)}, Am_t^D / D_t\right)$. The model does not consider this complication.

To begin with, financial market equilibrium requires equality between supply of and demand for funds:

$$(16) \qquad S_t^{R,d} + E_t^R \dot{D}_t^{d*} = \dot{K}_t^{R,d} + E_t^R \dot{A}_t^d$$

Expression (16) is the investment-savings equality in an open economy. It is often interpreted in the sense that *the* relevant constraint on a country's asset accumulation is the aggregate availability of domestic and foreign savings. However, the Structuralist literature has made a criticism on (16) arguing that this equality conceals a composition problem[44]. In the right-hand side, investment is a demand for real resources that might be produced domestically, but capital flight is a demand for assets abroad that must be purchased using FOREX that cannot be printed at home. In addition, if imported goods are required by production and capital accumulation, FOREX resources are also needed for such purposes. There is a similar problem in the left-hand side: both domestic and external savings provide funds, but only foreign borrowing provides international liquidity. Therefore, these sources of financing are far from being perfect substitutes. More generally, the Structuralist argument emphasizes that it is not just the aggregate sources and uses of funds that matters but also the funds' liquidity composition[45].

FOREX market equilibrium requires equality between supply of and demand for foreign exchange; using (1), (2), (12), (13), (14), and the functions for M_t^R and Y_t^R, the equilibrium condition can be written as[46]:

$$(17) \quad X_t^R + i_t A_t + g_{(*)}^D D_t = \theta_K h_{(*)}^K \left(su_t \gamma K_t^R + E_t^R g_{(*)}^D D_t \right) + \theta_Y u_t \gamma K_t^R + \ldots$$
$$\ldots + \left(i_t + \sigma_t \right) D_t + \left(1 - h_{(*)}^K \right) \left(su_t \gamma K_t^R / E_t^R + g_{(*)}^D D_t \right)$$

Expression (17) is the BOP seen as an *ex ante* FOREX market equilibrium. Structuralism asserts that (17) is *the* crucial constraint on a developing country's asset accumulation: there must be a FOREX supply strong enough to provide the international liquidity needed to carry out such accumulation and to service foreign

[44] See Bacha (1982 and 1990), Taylor (1994), and Frenkel and Rozenwurcel (1988).

[45] Notice that the Structuralist argument does not apply to developed countries whose own currencies have international purchasing power. Besides, the funds' liquidity composition is a notion that goes beyond the funds' currency-denomination composition. In dollarized economies, domestic savings could be denominated in foreign currency, but it does not mean they have international liquidity. Moreover, as bank runs in Argentina have shown, those savings may not be converted immediately into liquid FOREX resources. On this point, see Fanelli and Pradelli (2002), and Levy Yeyati, de la Torre, and Schmukler (2003).

[46] To simplify notation in (17), $g_{(*)}^D$ and $h_{(*)}^K$ denote $g_{(\sigma_t)}^D$ and $h_{(\sigma_t, u_t)}^K$, respectively.

liabilities. The FOREX constraint (17), known as the *external gap,* should be analyzed jointly with the *investment-savings gap* (16). This is so because portfolio decisions may be mutually consistent in financial markets, but not in FOREX markets. For instance, if domestic investors attempt to increase capital flight and reduce investment in an identical amount, no disequilibrium will be observed in (16), but there will be an excess demand for FOREX in (17). In a similar fashion, if agents intend to increase domestic savings and reduce foreign lending in an identical amount, (16) will be in equilibrium, but (17) will show an excess demand for FOREX.

Financial market equilibrium in (16) is attained for any u_t and E_t^R since it has been assumed that domestic investors adapt their demand for funds to the available sources of finance[47]. This simplification allows placing analytical emphasis on FOREX market equilibrium. As the model is to be applied to the Argentine case, it makes sense to focus on a credible fixed-exchange rate regime coupled with short-run nominal rigidities in domestic prices. In this context, the real exchange rate E_t^R is an exogenous variable and the output gap u_t is the short-run adjusting variable. An equilibrium value for u_t is determined in (17), given predetermined variables $\left(K_t^R, A_t, D_t\right)$, exogenous variables $\left(\sigma_t, E_t^R, X_t^R, i_t\right)$, and parameters $\left(\theta_Y, \theta_K, s, \gamma\right)$.

Adjustments in u_t are straightforward. When a disturbance breaks FOREX balance in (17), a change in u_t restores short-run market equilibrium because FOREX demand for imports and capital flight depend on u_t. For instance, if agents attempt to increase capital flight and reduce investment, the excess demand for FOREX is corrected by a recession, i.e. a lower u_t, bringing imports and capital flight to a level consistent with FOREX supply. There are spill over effects between markets to the extent that the change in u_t causes a change in demand for and supply of funds in financial markets.

II.3 Comparative-static analysis: liquidity crisis and policy choices

The model is useful for analyzing a liquidity crisis and the adjustment policies in the short-run. Suppose foreign investors suspect that an EDS problem has arisen

[47] To see this, plugg (12), (13), and (14) into (16).

when a debtor country attempts to cover its financing needs. Since σ_t increases, interest rate r_t rises and desired debt flows decrease; a *sudden stop* is defined as a change in capital inflows $d\dot{D}_t = g^D_{1(*)} D_t d\sigma_t$ [48].

A higher σ_t does not disturb financial market equilibrium: in the supply side, lower capital inflows are available; in the demand side, domestic investors reduce the aggregate desired asset accumulation proportionally. In contrast, a higher σ_t causes FOREX market disequilibrium: FOREX supply decreases due to lower capital inflows, while FOREX demand may increase or decrease. The effect of σ_t on FOREX demand depends on three factors: (i) the increase in debt services; (ii) the reduction in investment-related imports associated to a lower external financing and a lower desired proportion allocated to physical capital accumulation; and (iii) the change in capital flight depending on two conflicting forces, the lower financing and a higher desired proportion allocated to the accumulation of assets abroad.

If a FOREX excess demand arises, a recessionary adjustment is needed to restore FOREX market equilibrium. A lower u_t reduces output-related imports and domestic financing, and changes desired proportions for asset accumulation. Hence, investment-related imports decrease, but the effect on capital flight is ambiguous. A comparative-static derivative summarizes the effects mentioned[49]:

$$(18)\quad \frac{du_t}{d\sigma_t} = \frac{\Theta}{\Delta} = \frac{-\left(1+\left(\theta_K E^R_t - 1\right)\left(h^K_{1(*)} g^D_{(*)} + h^K_{(*)} g^D_{1(*)}\right)\right) D_t - \left(\theta_K E^R_t - 1\right) h^K_{1(*)} s u_0 \gamma \dfrac{K^R_t}{E^R_t}}{\left(\theta_K E^R_t - 1\right) h^K_{2(*)} g^D_{(*)} D_t + \left(\theta_Y E^R_t + s\left(1+\left(\theta_K E^R_t - 1\right)\left(h^K_{(*)} + h^K_{2(*)} u_0\right)\right)\right)\gamma \dfrac{K^R_t}{E^R_t}}$$

For plausible parameter values, the numerator Θ is negative and the

[48] In the literature, a *sudden stop* is a change in net capital inflows; in the text, it refers to a change in gross capital inflows because financing needs include both current account deficit and capital flight. A technical point should be mentioned: the model uses the return spread to formalize a change in perceptions on EDS already priced in the country's external debt instruments. That is the reason why the model focuses on portfolio decisions concerning changes in asset stocks. This method of formalization is consistent with a Tobinian approach to market price- and quantity-adjustments (see Tobin, 1969). Foreign investors take EDS into account when pricing the country's external debt instruments, say bonds trading in international capital markets. Prices react to incoming new information on EDS faster than quantities do. As the bond stock supply is fixed in the very-short-run, a change in foreign investors' demand causes a price adjustment that restores portfolio stock-equilibrium. It is only when debtors attempt to rollover their maturing liabilities and/or to issue new bonds that investors have a chance to adjust the aggregate bond stock. As the model formalizes desired asset flows, it refers implicitly to the stage when the quantity-adjustment takes place.

[49] In (18), $g^D_{(*)}$ and $h^K_{(*)}$ denote $g^D_{(\sigma_0)}$ and $h^K_{(\sigma_0, u_0)}$, respectively, where σ_0 and u_0 are equilibrium values that would have been observed if the shock had not happened. This notation is used hereafter.

denominator Δ is positive, so the derivative (18) is negative[50]. Therefore, the liquidity crisis has a contractive effect on current output. In addition, it has a negative effect on investment, imports, and debt growth[51]. Thus, this *ad hoc* model rationalizes the macroeconomic linkages observed in section 1 and supports results reported in (11c).

Vulnerabilities and policy choices:

The analysis has emphasized that a liquidity crisis implies a shortage of financing *and* FOREX. To accommodate the *sudden stop* and interest rate increase, a debtor country must reduce financing needs and FOREX imbalances by contracting output, investment, and growth. Expression (18) identifies determinants of the magnitude of the recessionary adjustment that must be undergone. Consistent with fundamentalist models discussed in section 1, (18) shows that output contraction is more severe for a high debt level D_t, low marginal propensities to import θ_Y and θ_K, and a low marginal propensity to save *s*. Intuitively, for a high D_t, an increase in σ_t rises interest payments significantly, and thus increases FOREX demand. For low θ_Y, θ_K, and *s*, a significant contraction in output and investment is needed to reduce imports and FOREX demand. Therefore, a high D_t and low θ_Y, θ_K, and *s*, are factors increasing vulnerability.

A crucial point in the analysis is that the recessionary adjustment is required in order to restore a balance between FOREX supply and demand. It is not a relative scarcity of funds in financial markets but a relative scarcity of funds with international liquidity in FOREX markets that requires an output contraction. Therefore, a liquidity crisis is indeed an international-liquidity crisis. This observation is relevant for a discussion on four adjustment policies available: fiscal adjustment, payment standstill, controls on capital outflows, and exchange rate devaluation. Since the liquidity shortage reduces supply of funds and FOREX, policies should raise other supply

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[50] Sufficient conditions for (18) to be negative are:
i. $\left(\theta_Y E_t^R + s\left(1+\left(\theta_K E_t^R - 1\right)h_{(*)}^K\right)\right)\gamma K_t^R / E_t^R > -\left(\theta_K E_t^R - 1\right)h_{2(*)}^K\left(su_0\gamma K_t^R / E_t^R + g_{(*)}^D D_t\right) \quad \Rightarrow \quad \Delta > 0$
ii. $\left(\theta_K E_t^R - 1\right) < 0,\ \left(h_{1(*)}^K g_{(*)}^D + h_{(*)}^K g_{1(*)}^D\right) < 0,$ and $h_{1(*)}^K < 0 \quad \Rightarrow \quad \Theta < 0$
From now on, it is assumed that these conditions hold.

[51] These results are attained by taking derivatives w.r.t. σ_t and u_t in $\dot{K}_t^R$, M_t^R, and $\dot{D}_t$, and using (18) to replace $du_t / d\sigma_t$. Notice that output growth rate ρ_t decreases for υ_t is negative.

sources, or reduce the demand for these resources, while attempting not to aggravate the output contraction.

Fiscal adjustment:

A fiscal adjustment rising public savings compensates for lower external savings in terms of funds. But if this policy does not increase FOREX supply, a recession is still required to reduce FOREX demand[52]. Suppose savings S_t^R are adjusted in proportion to the *sudden stop,* but no additional FOREX resources are made available; then[53]:

$$(19) \quad \left.\frac{du_t}{d\sigma_t}\right|_{\substack{\text{fiscal}\\ \text{adjustment}}} = \frac{\Theta + \left(1 + \left(\theta_K E_t^R - 1\right) h_{(*)}^K\right) g_{1(*)}^D D_t}{\Delta - \left(1 + \left(\theta_K E_t^R - 1\right) h_{(*)}^K\right) s\gamma K_t^R / E_t^R}$$

For plausible parameter values, (19) is negative; moreover, it may happen that the adjustment in (19) is more severe than in (18)[54]. Therefore, a government unwilling to deepen recession has a weak incentive to undertake a fiscal adjustment.

Payment standstill:

A payment standstill forcing foreign creditors to rollover maturing liabilities reduces FOREX demand associated with debt services. However, this policy cannot change the fact that σ_t is higher and the external financing net of rollovers is lower. Besides, it could induce domestic agents to devote the FOREX resources released to capital flight since a great deal of uncertainty surrounds a payment standstill event.

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[52] Mechanisms through which a fiscal adjustment does increase FOREX supply are largely debated. The intertemporal approach to the current account postulates that higher public savings are converted into higher net exports at a zero-output gap. In models with tradable and non-tradable goods, a trade surplus increase is a result of relative price changes. But this mechanism is quite unrealistic; in practice, there are constraints on export growth in the short-run, tradable and non-tradable goods are not substitutes, prices are rigid, and reallocating resources between sectors is costly (see Obstfeld and Rogoff, 1996, ch.4 and 10). Structuralism postulates an alternative mechanism arguing that higher public savings may increase net exports, but at the cost of a recession. Efforts to increase savings give rise to an output contraction lowering imports (see Taylor, 1979, ch.2 and 3).

[53] For (19), differentiate (17) w.r.t. u_t, σ_t and s imposing $dS_t^R = -E_t^R d\dot{D}_t$.

[54] For this, sufficient conditions are $1 + \left(\theta_K E_t^R - 1\right) h_{(*)}^K > 0$ and $g_{1(*)}^D < 0$.

Suppose a forced rollover on interests is declared after observing the *sudden stop*; then[55]:

$$(20) \quad \left.\frac{du_t}{d\sigma_t}\right|_{\substack{\text{interest}\\ \text{payment}\\ \text{standstill}}} = \frac{\Theta + D_t}{\Delta}$$

For plausible parameter values, (20) is negative; notwithstanding, the recessionary adjustment in (20) is always less severe than in (18). It is straightforward to show that the higher the external debt stock, the lower the output contraction. Hence, a government wanting to attenuate output contraction has a strong incentive to declare a payment standstill.

Capital controls:

Capital controls preventing domestic investors from accumulating assets abroad reduce FOREX demand associated with capital flight[56]. This policy forces investors to allocate available financing to domestic investment even when σ_t is higher. Suppose controls are imposed restricting capital flight in proportion to the *sudden stop*; then[57]:

$$(21) \quad \left.\frac{du_t}{d\sigma_t}\right|_{\substack{\text{capital}\\ \text{controls}}} = \frac{\Theta - \left[\left(h^K_{1(*)} g^D_{(*)} + h^K_{(*)} g^D_{1(*)}\right) D_t + h^K_{1(*)} s u_0 \gamma K^R_t / E^R_t\right]}{\Delta + \left[h^K_{2(*)} g^D_{(*)} D_t + \left(h^K_{(*)} + h^K_{2(*)} u_0 - 1\right) s \gamma K^R_t / E^R_t\right]}$$

For plausible parameter values, (21) is negative and its magnitude is lower than (18). As capital inflows and capital flight decrease *pari passu,* FOREX demand is reduced by output contraction to make up for the rise in interest payments. Therefore, there is a strong incentive to use controls when a liquidity shortage arises.

Devaluation:

By contracting output, exchange rate devaluation reduces FOREX demand associated with imports. In developing countries, several channels have been

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[55] For (20), drop $\left(i_t + \sigma_t\right) D_t$ out of (17).

[56] See Kaplan and Rodrik (2002) for empirical evidence on capital controls in Malaysia. Damill, Frenkel, and Rapetti (2005) report capital controls in Argentina.

[57] For (21), differentiate (17) w.r.t. u_t and σ_t imposing $d\dot{A}_t = d\dot{D}_t$.

identified through which devaluation gives rise to income- and balance sheet-effects depressing aggregate demand and supply in the short run[58]. On the other hand, devaluation may have positive effects on FOREX supply in the long-run. Provided that real exchange rate devaluation increases profitability and competitiveness of tradable sectors, the allocation of investment resources to these sectors bolsters exports growth and accelerates import substitution[59].

However, the short-run contractive effects of devaluation make developing countries reluctant to accept wide exchange rate fluctuations. As the literature puts it, there is *fear of floating*, and all kind of official interventions on FOREX markets are attempted in order to stabilize nominal exchange rates[60]. In this context, when a liquidity crisis happens and financing needs must be adjusted, a government does not devalue willingly with a purpose of reducing imports and FOREX demand. On the contrary, the government is forced to devalue because capital outflows exert pressure on FOREX markets that cannot be resisted.

The first generation of currency crisis models has emphasized the point made above. The story tells that a country running current account deficits recurrently is able to sustain a fixed-exchange rate regime to the extent that it has a *stock* of FOREX reserves. When this stock runs out, or even before if rational speculation is introduced into the picture, the fixed-parity cannot be maintained by the government[61]. This story was appropriate for the seventies, when developing countries were far from financial openness, their FOREX flows were mainly associated with exports and imports, and official lending assisted them on the verge of BOP crises. But financial liberalization in the nineties has changed many of these features. In particular, private capital inflows play a central role supplying financing and FOREX, and official lending can hardly compensate for private capital outflows when they take place[62]. However, the main message of the story is still valid: a country running current account deficits (and now also engaging in capital flight) is able to sustain a fixed exchange rate

[58] See Krugman and Taylor (1978), Aghion, Bacchetta, and Banerjee (2001), and Agenor and Montiel (1999, ch.6 and 7).
[59] To attain a permanently high and stable real exchange rate level, a broad set of policies must be implemented, involving capital controls and financial regulations. For an analysis of these policies in developing countries, see Gala (2006).
[60] See Calvo and Reinhart (2002).
[61] See Krugman (1979). In Krugman's model, the analytical emphasis is placed on the monetization of a fiscal deficit; but there is a relation between current account deficits and changes in reserves (Krugman, 1979, p.318).
[62] See Losser (2004).

regime to the extent that it receives *flows* of FOREX associated with foreign indebtedness and capital repatriation; when these FOREX flows diminish (or, worse, when they change direction), the fixed-parity cannot be maintained. In this context, the abandonment of the fixed-exchange regime is not a policy choice, but a consequence of the liquidity crisis itself.

Return spread and incentives to default: a discussion on feedbacks

So far, the return spread σ_t has been treated as an exogenous variable representing expectations on the debtor country's ability to raise FOREX resources and willingness to service foreign liabilities. However, feedbacks between σ_t and other variables are conceivable since the country's ability and willingness to pay are influenced by σ_t itself. For instance, the comparative-static exercises have shown that an increase in σ_t has contractive effects on output, investment, and growth, and that a payment standstill and capital controls attenuate these effects. Thus, there are strong incentives to implement such policies when the increase in σ_t happens. An expectation that willingness to pay will be weak in a protracted recession is itself a justification for the rise in σ_t. Therefore, there is a feedback between σ_t and the endogenous variables u_t, κ_t, and ρ_t. An eventual extension of the model could formalize σ_t as a function of *expected* values of u_t, κ_t, and ρ_t, and specify an expectation-formation mechanism. Self-fulfilling outcomes are likely to arise in such extension.

Issues on liquidity shortage, fixed-exchange rate crises, and balance-sheet effects suggest a feedback between σ_t and expectations on devaluation. In the model, the real exchange rate E_t^R and its rate of change ε_t have been treated as exogenous variables. But an increase in σ_t creates pressures on FOREX markets that can force the abandonment of a fixed-parity. In this context, expectations on devaluation are likely to arise, influencing EDS assessments and portfolio decisions. On the other hand, as devaluation increases the debt burden for debtors with foreign-denominated

liabilities, balance-sheet effects give a strong incentive to default. Naturally, this incentive justifies the rise in σ_t [63].

[63] For empirical evidence on links between default risk and devaluation risk, see Reinhart (2002), and Powell and Sturzenegger (2000). Blanchard (2004, p.10) develops a simple model to relate default probability and exchange rate level using a debt dynamics.

III. The Argentine crisis

In this section, the Argentine crisis is analyzed. Stylized facts are presented describing the macroeconomic performance in 1991-2001, when the country adopted a fixed-exchange rate regime, deepened its trade and financial openness, and undertook a wide structural reform program. The section summarizes the three main arguments in the literature explaining the crisis: fiscal unsustainability, current account unsustainability, and multiple equilibria. Applying analytical tools introduced in sections 1 and 2, the current account unsustainability argument is supported. By interpreting stylized facts and analytical results, an explanation for the Argentine crisis is developed.

III.1 Facts on capital inflows and financing needs

Table 2 shows variables introduced in the debt dynamics analysis of section 1:

TABLE 2: BOP Accounts and Net External Debt

USD billions Stocks measured at end of period	Variables in model	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Acumul. 1992-2000
Capital Account minus Intl. Reserve Variation		2.8	5.7	8.2	11.1	5.2	6.8	12.2	14.5	12.0	8.9	3.3	84.6
Capital Inflows	dD_t/dt	11.9	9.9	20.5	17.8	19.3	21.4	29.2	24.0	19.9	12.2	-3.7	174.2
Portfolio Investment and Others		na	6.2	13.7	12.2	9.2	14.7	22.1	14.7	7.0	6.6	-16.7	106.4
FDI		na	4.4	2.8	3.6	5.6	7.0	9.2	7.2	13.0	5.4	2.2	58.2
IFIs and Official Creditors		na	-0.8	3.9	2.0	4.5	-0.3	-2.1	2.2	-0.1	0.2	10.8	9.6
Capital Outflows (w. Intl.Res., w. E&O)	dA_t/dt	9.1	4.3	12.3	6.7	14.1	14.6	17.0	9.6	8.1	3.3	-6.9	90.0
Capital Outflows (w/o. Intl.Res., w. E&O)		6.9	1.0	8.1	6.0	14.2	10.7	13.8	6.1	6.9	3.8	5.2	70.5
International Reserve Variation		2.2	3.3	4.3	0.7	-0.1	3.9	3.3	3.4	1.2	-0.4	-12.1	19.5
Current Account		-2.8	-5.7	-8.2	-11.1	-5.2	-6.8	-12.2	-14.5	-12.0	-8.9	-3.3	-84.6
Exports	X_t	14.1	15.4	16.3	19.4	25.0	28.4	30.9	31.1	27.9	31.1	31.2	225.5
Imports	M_t	11.3	19.3	22.0	27.3	26.0	30.1	37.4	38.7	32.8	32.9	27.6	266.6
Factor Income - Payments	$r_t D_t$	6.0	4.8	5.6	7.2	9.0	9.9	11.7	13.5	13.5	14.9	13.1	90.2
Factor Income - Receipts (w. Transfers)	$i_t A_t$	1.7	3.1	3.1	3.9	4.9	4.9	5.9	6.5	6.5	7.8	6.2	46.7
Net External Debt	$D_t - A_t$	8.5	10.1	15.8	30.4	37.7	42.6	55.2	66.5	68.8	69.0	82.4	60.5 **
External Debt	D_t	75.3	82.3	102.3	119.6	140.0	159.6	188.3	206.8	219.1	221.9	215.2	146.6 **
Portfolio Investment and Others		46.4	49.4	63.3	74.6	85.0	99.2	121.5	132.1	130.2	127.2	108.3	80.8 **
FDI		11.5	16.3	18.5	22.4	28.0	33.6	42.1	47.9	62.1	67.8	69.2	56.2 **
IFIs and Official Creditors		17.4	16.6	20.5	22.5	27.0	26.8	24.7	26.8	26.8	26.9	37.8	9.6 **
External Assets (w. Intl.Res.)	A_t	66.8	72.1	86.5	89.1	102.3	117.0	133.1	140.4	150.2	152.9	132.8	86.1 **
External Assets (w/o. Intl.Res.)		58.9	61.1	71.0	73.1	86.3	97.3	110.3	114.1	122.9	126.0	117.9	67.1 **
International Reserves		7.9	11.0	15.5	16.0	16.0	19.7	22.8	26.2	27.3	26.9	14.9	19.0 **
MEMO I: Gross Domestic Product		167.5	212.5	236.6	257.5	258.0	272.2	292.9	299.0	283.6	284.2	268.7	
MEMO II: Errors and Omissions (E&O)		-1.1	-0.3	-1.2	-0.9	-2.2	-1.7	-1.3	-0.4	-0.5	-0.1	-3.4	

** indicates a change in stock between 1991 and 2000

Small differences in aggregates are due to rounding

Sources: Argentine Ministry of Economy and Central Bank

According to BOP accounts, between 1992 and 2000 capital inflows amounted to USD 174 bn. The magnitude of these inflows was significant: on average, they represented 7% of GDP, and made external debt grow 13% annually[64]. What

[64] In the period 1992-2000, the accumulated net capital flows (minus reserve variations) were USD 85 bn according to BOP, while the change in net foreign liabilities was USD 61 bn according to the

financing needs did domestic agents cover with funds borrowed from abroad? The answer is interesting. On one hand, they lent abroad around 50% of the funds by engaging in capital flight; notice that capital outflows reached USD 70 bn and the accumulation of international reserves USD 20 bn. On the other hand, capital inflows financed a current account deficit whose magnitude, USD 84 bn, represented 3.5% of GDP on average. Decomposing this deficit into trade balance deficit and net factor income payments yields a relevant observation for a discussion on adjustment policies: each component accounted for 50% of CAD.

According to IIP data, the external debt excluding FDI stock had reached USD 154 bn in 2000. This figure was a dangerous 54% of GDP, much higher than what an applied EDS model based on indebtedness ratios would consider safe. But there were external assets for an almost identical amount; notice that investments abroad amounted to USD 126 bn and international reserves were USD 27 bn. Thus, the net external debt was just USD 70 bn, a manageable 24% of GDP; moreover, it was fully backed by FDI stock. But if the Argentine net foreign liabilities were not excessively large, what was wrong with the exchange arrangement and the foreign indebtedness process that they collapsed one year later?

III. 2 The debate:

Different answers to the question of what happened in Argentina are found in the literature, but three main arguments capture the essence of the debate: the "fiscal unsustainability hypothesis" (FUH), the "current account unsustainability hypothesis" (CAUH), and the "multiple equilibria hypothesis" (MEH)[65]. These hypotheses are discussed below.

For the FUH, the Argentine crisis was caused by fiscal imbalances and lack of political will to conduct a budgetary adjustment[66]. It is argued that fiscal imbalances fed an unsustainable public indebtedness, including both external and domestic public debt. Nothing was intrinsically wrong with the fixed-exchange rate regime; in

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International Investment Position (IIP). The difference between these figures is due to valuation effects associated with movements in exchange rates and asset prices (see Argentine Ministry of Economy, 2005). FDI is included in the country's external debt because profits are sent abroad regularly and FOREX is needed to do so. In table 2, FDI flows are net of equity exchanges because these transactions do not provide new financing (see Argentine Ministry of Economy, 2003).

[65] These labels are used by Powell (2002).

[66] See Mussa (2002), Teijeiro (2001), and Perry and Servén (2003).

contrast, by restricting money creation it imposed a bit of fiscal discipline. At some stage, when investors realised that no more funds were available for the government and no fiscal adjustment was feasible, fears of default-cum-devaluation triggered runs against domestic assets. Facing currency run, bank run, and lack of financing, the government devalued at the beginning of 2002. Soon after, it defaulted on foreign-currency denominated liabilities to avoid the debt burden associated to a higher real exchange rate.

For the CAUH, the crisis was a consequence of external imbalances and constraints on adjustment policies imposed by financial liberalization and the foreign exchange regime[67]. It is argued that external imbalances fed an unsustainable foreign indebtedness, including both public and private external debt. The fixed-exchange rate regime was not appropriate; although it had been a successful stabilization device in 1991-1992, it led to real exchange overvaluation and competitiveness problems feeding external imbalances. Financial liberalization and the exchange arrangement restricted the monetary instruments to cope with a *sudden stop*; in addition, the fixed-parity implied that current account adjustments had to be done by output contraction and deflation. At some stage, investors realised that EDS was at risk and fiscal adjustment could do nothing to resume EDS. Thereafter, the end of the story is similar to the FUH's.

For the MEH, the crisis was due to a combination of fiscal and external imbalances, and political inability to adjust them[68]. It is argued that sustainability problems would have been worked out within the exchange arrangement if appropriate political decisions had been made. But messy politics led to wrong policy choices. In addition, economic problems that politics should have managed contributed themselves to policy mismanagement. Allowing for interactions between economic and political variables, multiple equilibria are introduced into the picture. Thus, the crisis is explained as a possible outcome associated with a particular set of shocks and actions, and it is stressed that other outcomes could have occurred. In this sense, for the MEH, the crisis was "avoidable", i.e. other ends of the story were possible and could have happened. For the FUH and CAUH, on the contrary, sustainability problems could deliver nothing but a crisis, i.e. there were no other alternative equilibria.

[67] See Damill, Frenkel, and Rapetti (2005), Fanelli (2003), and Perry and Servén (2003).
[68] See Powell (2002).

Papers supporting one hypothesis have criticized the others in order to reinforce their stance. Regarding current account imbalances, the FUH concedes that EDS problems appeared when capital inflows reversed in 1998. However, it asserts that capital inflows reversals would have been avoided if the government had undertaken a fiscal adjustment to ensure public debt sustainability (PDS) and regain investors' confidence[69]. On the other hand, the MEH argues that EDS problems cannot explain by themselves the Argentine crisis. It attributes *sudden stops* in capital inflows to external shocks, or alternatively to foreign investors' perceptions on PDS problems. But the MEH stresses that recession and deflation in 1999-2000 brought trade surpluses to the level required to attain EDS; thus, EDS problems were small and manageable[70].

Regarding fiscal imbalances, the CAUH accepts that PDS problems may have undermined investors' confidence since 1998-1999. Nevertheless, it replies that fiscal imbalances were an endogenous outcome brought about by economic contraction and a high return spread[71]. Besides, the CAUH draws attention to the fact that the government made up for the negative effect on fiscal revenues of the economic contraction by rising tax rates and imposing new contributions. Hence, fiscal policy behaved pro-cyclically and may have aggravated the recession[72]. On the other hand, the MEH argues that PDS problems cannot explain by themselves the Argentine crisis. It stresses that primary fiscal surpluses were close to the level required to attain PDS; thus, PDS problems were small and manageable[73].

Along with PDS, EDS, and interactions between economics and politics, the debate includes vulnerability issues. Three vulnerability factors have been analyzed in the literature: (i) weaknesses in tax collection, aggravated by the loss of fiscal

[69] Perry and Servén (2003, p.40) support this interpretation with a twin deficits explanation.
[70] Powell (2002, p.34) argues that by 2000 trade surpluses had reached the level stabilizing the *gross* external debt-to-GDP ratio, i.e. the resource balance gap was around zero.
[71] Damill, Frenkel, and Rapetti (2005, p.10) report evidence on primary budget imbalances; since these imbalances were small, the authors argue that total budget deficits were explained by rising interest payments. Perry and Servén (2003, p.31) estimate cyclically-adjusted primary budget balances for the Federal government; as these balances were surpluses, the authors conclude that rising interest payments and declining economic activity were deteriorating the Federal government's overall balance.
[72] This point has been deemed a proof that the Argentine government did make efforts to continue servicing foreign liabilities in 1999-2001 despite large political costs, and that any fiscal adjustment attempted was not a substitute for the required external adjustment (see Damill, Frenkel, and Rapetti, 2005, p.16).
[73] Powell (2002, p.28) argues that in 2000 the primary fiscal surplus should have been increased around 4 percentage points to reach the level stabilizing the public debt-to-GDP ratio. But Perry and Servén (2003, p.36) deem such figure unlikely to attain given Argentine fiscal history and institutions.

revenues associated with the social security reform[74]; (ii) unhedged liability dollarization of the domestic financial system, i.e. the risk of balance-sheet effects associated with real exchange rate movements, coupled with a high exposure to sovereign risk[75]; and, (iii) pitfalls in financial and banking regulation[76]. As these factors were already in place when the main shocks occurred in 1998-1999, they are normally taken as predetermined conditions in the process leading to the crisis. Thus, they cannot explain the Argentine crisis by themselves[77].

III.3 An explanation for the Argentine crisis:

As the Argentine crisis is a complex phenomenon, it is difficult to validate a preferred hypothesis and to reject the other hypotheses. But it is always possible to provide additional support to the preferred one. In previous sections, this paper has set the stage for supporting the CAUH on the basis of an EDS assessment. The following explanation for the Argentine crisis is to be discussed. In the nineties, Argentina engaged in a foreign indebtedness process which financed current account deficits and capital flight, as has been shown above. Both the government and the private sector accumulated foreign liabilities, but their financing needs were very different. In particular, public external debt played a crucial role in the monetary side of the economy under Convertibility. The combination of international financing and fixed-exchange rate regime gave rise to a specific macroeconomic dynamics for variables determining EDS. In this regard, cyclical movements and trends are explained by such combination. The macroeconomic dynamics delivered outcomes inconsistent with EDS in both economic expansion and contraction; this is a crucial point for explaining the Argentine collapse. External shocks in 1998-1999 imposed a current account adjustment making investors aware of that inconsistency. In addition, the contractive effects of the adjustment posed policy dilemmas for the government. As the CAUH holds, investors realised that EDS was at risk and fiscal adjustment was ineffective. This triggered runs in 2001, and subsequently devaluation and default. In the

[74] See Damill, Frenkel, and Rapetti (2005), and Perry and Servén (2003).
[75] See Galiani, Levy Yeyati, and Shargorodsky (2003), and Perry and Servén (2003).
[76] See Fanelli and Pradelli (2002), and Levy Yeyati, de la Torre, and Schmukler (2003).
[77] Vulnerability factors amplified the effects of shocks, and motived coalition building to support or to resist policy decisions. Some attempts have been made to endogenize these factors (see Galiani, Tommasi, and Heymann, 2003, Tomassi, 2002, and Fanelli, 2003).

remaining part of this section, the building blocks of the explanation outlined are analyzed[78].

Public and private external debt:

Both the government and the private sector borrowed from abroad, but their financing needs were very different. Table 3 shows BOP and IPP data disaggregated by sectors[79]:

TABLE 3: BOP and IPP by Sectors

USD billions Stocks measured at end of period	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Acumul. 1992-2000
Government & Central Bank												
Capital Account minus Intl. Reserve Variation	6.9	-2.0	-0.2	3.8	7.9	6.2	4.3	5.4	8.6	9.3	19.4	43.2
Capital Inflows	9.1	2.2	7.5	3.7	7.8	10.0	7.4	9.2	11.1	6.8	6.8	65.8
Capital Outflows (w. Intl.Res)	2.2	4.3	7.8	-0.1	0.0	3.8	3.1	3.8	2.5	-2.5	-12.7	22.6
Capital Outflows (w/o. Intl.Res)	0.0	1.0	3.5	-0.8	0.1	-0.1	-0.2	0.4	1.3	-2.0	-0.6	3.1
International Reserve Variation	2.2	3.3	4.3	0.7	-0.1	3.9	3.3	3.4	1.2	-0.4	-12.1	19.5
Current Account	na	-2.4	-1.9	-2.2	-2.7	-3.3	-3.8	-4.2	-4.7	-4.9	-5.4	-30.1
Factor Income - Payments	na	2.8	2.7	3.2	3.9	4.5	5.2	5.8	6.4	6.9	7.1	41.3
Factor Income - Receipts	na	0.5	0.7	1.0	1.2	1.2	1.5	1.6	1.7	1.9	1.7	11.3
Net External Debt	40.9	34.6	30.3	37.5	42.6	46.1	44.4	50.3	49.8	52.7	68.5	11.8 **
External Debt	53.9	51.7	54.6	62.2	68.2	75.4	76.5	85.1	87.2	87.8	91.1	33.8 **
External Assets	13.0	17.0	24.2	24.7	25.6	29.3	32.1	34.8	37.4	35.1	22.6	22.0 **
Private Sector												
Capital Account	-4.1	7.7	8.4	7.3	-2.7	0.6	7.8	9.0	3.3	-0.5	-16.3	40.9
Capital Inflows	2.8	7.6	13.0	14.1	11.4	11.4	21.8	14.8	8.9	5.3	-10.5	108.3
Capital Outflows (w. E&O)	6.9	0.0	4.6	6.8	14.1	10.8	14.0	5.8	5.6	5.8	5.8	67.4
Current Account	na	-3.3	-6.3	-8.9	-2.4	-3.5	-8.4	-10.4	-7.3	-4.1	2.1	-54.5
Trade Balance	2.8	-4.0	-5.7	-7.9	-1.1	-1.8	-6.5	-7.5	-4.9	-1.8	3.5	-41.1
Factor Income - Payments	na	2.0	2.9	3.9	5.1	5.4	6.4	7.8	7.1	8.1	5.9	48.6
Factor Income - Receipts (w. Transfers)	na	2.6	2.3	2.9	3.7	3.7	4.5	4.9	4.7	5.8	4.5	35.2
Net External Debt	-32.4	-24.5	-14.5	-7.1	-5.0	-3.5	10.8	16.2	19.0	16.3	13.9	48.7 **
External Debt	21.3	30.6	47.7	57.3	71.7	84.1	111.8	121.7	131.9	134.1	124.1	112.8 **
External Assets	53.7	55.1	62.2	64.4	76.7	87.7	101.0	105.6	112.8	117.8	110.2	64.1 **

** indicates a change in stock between 1991 and 2000

Small differences in aggregates are due to rounding

Sources: Argentine Ministry of Economy and Central Bank

In 1992-2000, the public sector borrowed USD 66 bn, and the private sector USD 108 bn, including USD 58 bn FDI flows. The government's financing needs were basically net interest payments, USD 30 bn; the remaining funds were devoted to reserve accumulation, USD 20 bn, FOREX transfers to the private sector, USD 13 bn, and accumulation of other assets abroad, USD 3 bn. Using USD 108 bn borrowed from abroad and USD 13 bn transferred by the government, the private sector financed a huge capital flight, USD 67 bn, a significant trade balance deficit, USD 41 bn, and net factor income payments, USD 13 bn. These figures put forward that foreign indebtedness was driven mainly by the private sector, which accounted for

[78] This paper does not attempt to review events because it has been done by most of the cited papers.
[79] In table 3, trade balance and FDI flows are attributed to the private sector.

60% of gross capital inflows. Thus, it is a myth that the process was a consequence of a public sector running fiscal deficits uncontrollably and tapping into external financing.

In fact, the public external indebtedness was beneficial for the monetary side of the economy. In a currency board, creation of monetary base and credit can proceed to the extent that capital inflows feed the reserve accumulation at the central bank. Thus, the government contributed to creating domestic monetary resources by raising more FOREX resources than those needed to service its own foreign liabilities; specifically, the USD 20 bn mentioned above. The monetary mechanism was simple: the government issued debt instruments abroad and sold FOREX to the Central Bank, who printed domestic currency meeting the Convertibility law. Since fiscal expenditure was paid mostly in domestic currency, reserves remained in stock[80].

However, the public external indebtedness ended up contributing to the private sector's accumulation of assets abroad. By 2000, USD 13 bn FOREX resources had been transferred somehow to that sector. A part of these transfers corresponded to debt services of foreign currency-denominated public liabilities in domestic investors' portfolios[81]. In the events of 2001, the private sector got USD 14 bn by buying reserves and receiving transfers; these FOREX resources financed private capital flight and payment of maturing foreign liabilities.

[80] See Damill (2000).
[81] FOREX sold by the government to the Central Bank could be sold subsequently to the private sector.

External debt-output cycles and macroeconomic dynamics:

Table 4 shows variables analyzed in the *ad hoc* model of section 2 [82]:

Table 4: Macroeconomic Variables

	Variables in model	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
USD billions												
Foreign Savings FS_t (Cap. Inflows)	$g_D D_t$	11.9	9.9	20.5	17.8	19.3	21.4	29.2	24.0	19.9	12.2	-3.7
Domestic Savings DS_t	$s\, u_t\, \gamma\, Kr_t / Er_t$	21.8	29.5	36.4	39.7	40.5	41.9	43.9	44.6	38.7	36.7	33.9
Capital Flight KF_t (Cap. Outflows)	$(1 - h_K) * (FS_t + DS_t)$	9.1	4.3	12.3	6.7	14.1	14.6	17.0	9.6	8.1	3.3	-6.9
Domestic Investment DI_t	$h_K * (FS_t + DS_t)$	24.5	35.5	45.1	51.3	46.3	49.2	56.7	59.6	51.1	46.0	38.1
Current Account Deficit	$TBD_t - NFIP_t$	1.5	5.7	8.2	11.1	5.2	6.8	12.2	14.5	12.0	8.9	3.3
Trade Balance Deficit (TBD_t)	$M_t - X_t$	-2.8	4.0	5.7	7.9	1.1	1.8	6.5	7.5	4.9	1.8	-3.5
Net Factor Income Payments ($NFIP_t$)	$r_t D_t - i_t A_t$	4.3	1.7	2.5	3.2	4.1	5.1	5.8	7.0	7.1	7.1	6.8
Debt Burden (Return Spread - Average)	$\sigma_t A_t$	na	1.2	1.8	2.1	1.8	2.4	2.6	3.0	2.7	2.4	2.8
F.I. Payments on Net Ext. Debt	$r_t (D_t - A_t)$	na	0.5	0.7	1.1	2.3	2.7	3.1	4.0	4.4	4.7	4.1
Pure Numbers												
Return Spread - Marginal	σ_t	0.130	0.066	0.065	0.046	0.110	0.084	0.050	0.054	0.084	0.078	0.106
Marg.Propensity to Import - Output	θ_Y	0.048	0.067	0.067	0.071	0.070	0.076	0.085	0.087	0.083	0.087	0.084
Marg.Propensity to Import - Investment	θ_K	0.064	0.113	0.137	0.173	0.157	0.181	0.216	0.228	0.214	0.212	0.182
Real Exchange Rate - index 1993=1	Er_t	1.220	1.053	1.000	0.975	0.947	0.946	0.949	0.970	0.992	0.981	0.991
Output Gap - index	u_t	0.942	0.997	1.000	1.000	0.951	0.972	0.997	0.992	0.920	0.879	0.866
Physical Capital - log. growth rate	κ_t	-0.010	-0.001	0.010	0.015	0.021	0.010	0.015	0.024	0.025	0.014	0.008
Output, actual - log. growth rate	ρ_t	0.100	0.098	0.061	0.057	-0.029	0.054	0.078	0.038	-0.034	-0.008	-0.045

Small differences in aggregates are due to rounding

Sources: Author' s estimates based on Argentine Ministry of Economy and Central Bank

In table 4, periods of low return spread σ_t and abundant capital inflows $\dot{D}_t$, say 1992-1994 and 1996-1998, are associated with high growth ρ_t and actual output close to potential (u_t close to 1); while periods of high σ_t and scarce $\dot{D}_t$, say 1995 and 1999-2001, had low values for ρ_t and u_t [83]. On the basis of these observations, it has been suggested that during the nineties Argentina went through external debt-output cycles (ED-OCs, hereafter)[84]. Keeping pace with external financing variables, the real economy showed an expansion phase in 1992-1994 and 1996-1998, a small contraction in 1995, and a deep recession from 1999 onwards.

ED-OCs are closely related to a well established fact in emerging economies: capital inflows are pro-cyclical. To explain this fact, the *ad hoc* model has postulated that causality runs from external financing variables (σ_t and $\dot{D}_t$) to domestic real variables (u_t and ρ_t). The argument rationalizing such causality is that capital inflows are a source of FOREX to pay output- and investment-related imports and

[82] Average return spread is computed using data reported in table 2 on rates *r* and *i*. Marginal return spread is J.P. Morgan's EMBI+ Spread for Argentina; it measures the excess return implicit in prices of quoted Argentine bonds. In the *ad hoc* model, an increase in σ_t formalizes bad news regarding EDS that have depressed bonds' prices; therefore, the EMBI+ Spread is a reasonable proxy for σ_t.

[83] Notice that the comparative-static exercise in (18) is consistent with these observations.

[84] See Damill and Frenkel (2003), Fanelli and Pradelli (2002), and Fanelli (2003).

purchase assets abroad. Although domestic savings were the main source of finance for asset accumulation in Argentina, the country needed external savings to access internationally liquid resources[85].

The macroeconomic dynamics under ED-OCs involved the main determinants of EDS discussed in section 1, i.e. gross debt flows and financing needs. Three observations on the influence of ED-OCs on the country's financing needs deserve attention. First, capital flight showed a pattern shaped by external financing variables. Accumulation of assets abroad was significant in the ED-OCs' expansion phase since international liquidity was abundant and cheap. But it was also significant in 1995, when the Convertibility regime was challenged by the Tequila effect, interest rates increased, and international institutions provided official financing. In 2000-2001, in a context of high return spread, scarce capital inflows, and protracted recession, domestic investors behaved differently compared with 1995. Since capital flight actually decreased, and it did it more than capital inflows, it can be argued that agents preferred to use external assets to pay maturing foreign liabilities rather than to rollover debt at high interest rates[86].

Second, the trade balance deficit showed a cyclical pattern imitating ED-OCs. This is so because there were co-movements between output, investment, and imports, as the *ad hoc* model has emphasized. Real exchange overvaluation also influenced the trade balance deficit since it deteriorated competitiveness of import-competing and export sectors[87]. A significant real appreciation had occurred before the parity was fixed; in fact, at the outset of the hard peg, the real exchange rate level was low for historical standards[88]. Subsequently, the aggregate demand expansion during the first ED-OC increased domestic prices, worsening the real exchange rate misalignment[89].

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[85] Table 4 shows that domestic savings were two-thirds of total financing in 1992-2000, i.e. the Horioka-Feldstein puzzle holds for Argentina.

[86] For instance, in 2001 debt flows were negative, and assets abroad were liquidated to pay capital amortizations.

[87] A domestic production-substitution process took place and marginal propensities to import θ_Y and θ_K increased. On this, see Frenkel and González Rozada (1998).

[88] A real exchange rate index adjusted by international inflation shows an average level around 2.34 for 1975-1990, and 1.81 for 1975-2001. When the Convertibility regime was launched, the index was 1.17, and when it was abandoned, the index had fallen to 0.98. In 1991, fixing the nominal parity when its real value was so low was a policy decision, indeed. Many years ago, Keynes criticized a similar policy decision made by the UK government: the Gold Standard was re-established at the pre-war parity, and the overvalued real exchange rate might have brought about the subsequent recession (Keynes, 1923).

[89] According to Perry and Servén (2003, p.19), the real exchange appreciation at the beginning of the nineties was justified for efficiency-enhancing reforms had had positive effects on the productivity differentials between Argentina and her trading partners. However, the authors stress that the real

Third, the net factor income payments showed an upward trend as stocks of foreign liabilities and external assets increased along ED-OCs. In 1992-1996, these payments were 1.4% of GDP; the figure jumped to 2.4% in 1997-2000. According to (3), net factor income payments can be decomposed into the debt burden $\sigma_t A_t$, and interest payments on net foreign liabilities $r_t (D_t - A_t)$. Table 4 shows $\sigma_t A_t$ was far from negligible in the Argentine case: in 1992-2000, the accumulated debt burden reached USD 20 bn, accounting for almost 25% of the current account deficit[90].

EDS under ED-OCs:

ED-OCs are crucial to understand EDS in Argentina since these cycles influenced variables determining the net debt dynamics. Table 5 assesses EDS[91]:

Table 5: EDS Assessment

		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Initial conditions (USD bn)	Y_0	167.9	212.5	236.6	257.5	258.0	272.2	292.9	299.0	283.6	284.2
	X_0	14.3	15.4	16.3	19.4	25.0	28.4	30.9	31.1	27.9	31.1
	M_0	11.5	19.3	22.0	27.3	26.0	30.1	37.4	38.7	32.8	32.9
	D_0	75.3	82.3	102.3	119.6	140.0	159.6	188.3	206.8	219.1	221.9
	A_0	66.8	72.1	86.5	89.1	102.3	117.0	133.1	140.4	150.2	152.9
Growth rates (%) (*)	y	22.4	10.7	8.5	0.2	5.3	7.3	2.1	-5.3	0.2	-5.6
	x	7.2	6.0	17.1	25.4	12.8	8.6	0.7	-11.1	11.0	0.2
	m	51.8	13.0	21.5	-4.7	14.7	21.6	3.3	-16.6	0.5	-17.5
	d	8.9	21.8	15.6	15.8	13.1	16.6	9.4	5.7	1.3	-3.1
	a	7.7	18.2	3.0	13.8	13.4	12.9	5.3	6.8	1.8	-14.1
Return rates (%) (**)	r	10.8	9.5	8.3	16.3	13.6	10.0	10.4	13.0	13.3	15.2
	i	4.1	3.1	3.6	5.3	5.1	5.1	5.0	4.6	5.4	4.7
	σ	6.6	6.5	4.6	11.0	8.4	5.0	5.4	8.4	7.8	10.6
Dynamics Rt	Value t such that (9a) holds	-0.13	-6.37	NaN	3.81	-39.44	-2.24	-11.08	NaN	7.36	16.08
	Value (9b) for t	3E-02	8E-03	NaN	-4E-02	2E-05	1E-02	4E-03	NaN	-2E-02	-2E-02
	Rt when t goes to infinite	inf +	inf +	inf +	inf -	inf +	inf +	inf +	inf +	inf -	inf -
	Value Rt* (%)				31.8					65.3	133.2
	Value R_0 (%)	5.1	4.8	6.7	11.8	14.6	15.6	18.9	22.2	24.3	24.3
RBG (% GDP) (***)	X_t - M_t	-4.0	-5.7	-7.9	-1.1	-1.8	-6.5	-7.5	-4.9	-1.8	3.5
	(X - M) | T* = 0	6.0	5.4	4.8	8.2	8.7	6.8	5.6	5.3	8.2	9.0
	Difference	-9.9	-11.1	-12.7	-9.3	-10.5	-13.3	-13.1	-10.2	-10.0	-5.5

* indicates a rate of change computed on logarithm values
** indicates a marginal return rate
*** estimates using average return rate
Note: for 1996, (9a) also holds for -49.1; for 2000, (9a) also holds for -58.9

exchange rate was over-valued at the end of the decade from a current account sustainability perspective.

[90] Estimates using marginal return spread imply higher figures: the debt burden would have reached 3% of GDP even for a small net external debt.

[91] In table 5, initial conditions are lagged values of variables reported in table 2. Growth rates are computed on the logarithm of the initial conditions. Marginal *i* is the 3-year UST-bond yield. Marginal return spread is the EMBI+ Spread. If T^* exists, its value is highlighted; NaN is reported if there is no solution for (9a).

In table 5, T^* exists in 1995, 2000, and 2001, and it does not in 1992-1994 and 1996-1999. Thus, calculations suggest that the ED-OCs' expansion phase generated an explosive net debt dynamics, while the contraction phase gave rise to a non-explosive one. Table 5 shows that in periods of expansion, say 1993 and 1997, the time path of R_t was explosive as a consequence of high growth rates of debt and imports (*d* and *m*). On the contrary, in periods of contraction, say 2000 and 2001, the R_t dynamics became non-explosive due to low growth rates for these variables[92]. Regardless of the ED-OCs' phases, the growth rate of exports (*x*) was never large enough to prevent R_t from growing unboundedly[93].

The discussion on EDS results presented at the end of section 1 is useful for interpreting the facts described in table 5. Consider a wide definition of EDS encompassing two conditions: a non-explosive net external debt-to-GDP ratio and a positive real output growth. Thus, when Argentina was growing, it could not attain EDS because its ability to raise FOREX resources from net exports did not grow as much as it should have in order to prevent net foreign liabilities from growing unboundedly. On the other hand, when the economy was declining, it could ensure a non-explosive time path for the indebtedness ratio because debt and imports plummeted in a context of high interest rates and protracted recession, but since real output growth was negative, EDS was not attained either[94].

On the basis of this interpretation, it can be argued that the high return spread level observed in 2000-2001 reflected the investors' concerns on EDS problems in Argentina: trends in output, imports, exports, and debt had implied that the country was unable to raise FOREX from foreign trade in *good times*; in addition, the adjustment needed to stop such trends could make the country unwilling to pay its

[92] However, the value R_{T^*} that should be reached before starting a non-increasing time path is very high: 65% in 2000, and 133% in 2001.

[93] 1995 is an exception: a very high *x*, coupled with small *y* and *m*, helped to attain a non-explosive time path for R_t despite of a high *d*.

[94] In this regard, a criticism can be made to the argument used by MEH to disregard the CAUH, i.e. Powell's resource balance gap calculations (Powell, 2002). The reason why calculated gaps were small in 2000-2001 was that imports decrease in a context of contractionary adjustment; thus, the supposedly sustainable current account would cease to be sustainable as soon as growth were resumed. Besides, in table 5, gap calculations for 2000 show that Argentina needed a trade surplus around 2.7% of GDP to stabilise the *net* external debt-to-GDP ratio, but the country reached a trade deficit 0.6% of GDP. These figures differ from Powell's calculations because he excludes FDI from foreign liabilities stock, and does not include the debt burden term discussed in (10).

foreign liabilities in *bad times*. As the macroeconomic dynamics delivered outcomes inconsistent with EDS in both economic expansion and contraction, foreign investors had a strong incentive to reduce exposure to Argentine debt instruments. They did it abruptly in 2001.

External shocks and adjustment:

When did investors start concerning about EDS problems? It is likely that fears emerged in 1998-1999, when the Argentine economy suffered several external shocks: a reduction in terms of trade, the Russian default, the Brazilian devaluation, the appreciation of Euro against the US dollar. These shocks weakened the country's sources of FOREX, mainly capital inflows and exports, imposing an adjustment on financing needs and current account deficit. Under these circumstances, investors paid attention to the EDS problems[95].

By 1998, Argentina had capital inflows amounting 8% of GDP, capital outflows around 3%, and a current account deficit of 5% of GDP. When external financing variables deteriorated, the current account adjustment led to economic contraction and low growth. The burden of the adjustment fell on the trade balance deficit, which amounted to 2.5% of GDP in 1998; as usual, the trade balance adjusted by lowering imports. No payment standstill was declared, so net factor income payments remained unchanged at around 2.5% of GDP. In addition, no capital controls were imposed, so domestic investors could divert funds to purchase assets abroad without restrictions. By 2000, the scenario was very different from earlier times of economic success. Real output had fallen 4% and the output gap reached 12% of potential output. Capital inflows and outflows had halved, and imports contraction brought trade balance deficit to 0.7% of GDP. Nevertheless, the current account deficit remained at a high level, 3% of GDP. In this context, the government faced many policy dilemmas and chose to undertake a fiscal adjustment[96].

According to the CAUH, the fiscal adjustment in 2000 did not help to resume EDS nor PDS. On the contrary, it aggravated the recessionary adjustment and

[95] At that time, UBS Warbug (2000) and Deustche Bank (2000) analyzed EDS issues. The former argued that EDS was not a concern because Argentina had external assets, while the latter warned about competitiveness problems.

[96] A detailed analysis of policy dilemmas at that time is presented in Levy Yeyati, de la Torre, and Schmukler (2003), Galiani, Tommasi, and Heymann (2003), and Perry and Servén (2003).

sustainability problems. To support this argument, the comparative-static derivatives (18)-(19)-(20)-(21) introduced in section 2 are computed numerically. Since parameter values and initial conditions are involved in the computations, a benchmark scenario is calibrated using data for 1998-1999. Table 6 shows calibrated data:

TABLE 6: Benchmark Scenario

	Variables in model	Benchmark values
USD billions / Stock at beginning of period		
Foreign Savings FS_t (i.e. Cap. Inflows)	$g_D D_t$	20.0
Domestic Savings DS_t	$s\, u_t \gamma Kr_t / Er_t$	40.0
Capital Flight KF_t (i.e. Cap. Outflows)	$(1 - h_K) * (FS_t + DS_t)$	9.0
Domestic Investment DI_t	$h_K * (FS_t + DS_t)$	51.0
External Debt	D_t	200.0
External Assets	A_t	150.0
Exports	X_t	32.0
Imports	M_t	31.0
Factor Income - Payments	$r_t D_t$	16.0
Factor Income - Receipts	$i_t A_t$	4.0
GDP - Actual	Y_t	267.0
GDP - Potencial	Yp_t	267.0
Parameters and Variables		
Return Spread - Marginal	σ_t	0.06
Marg.Propensity to Import - Output	θ_Y	0.08
Marg.Propensity to Import - Investment	θ_K	0.20
Marg.Propensity to Save	s	0.15
Interest Payments Proportion	α	1.00
Real Exchange Rate	Er_t	1.00
GDP - Actual	$u_t \gamma Kr_t$	267.0
GDP - Potencial	γKr_t	267.0
Output Gap - index	u_t	1.00
Physical Capital - log. growth rate	κ_t	0.04
External Assets - log. growth rate	a_t	0.06
External Debt - log. growth rate (d_t)	g_D	0.10
Proportion Dom.Investment (excl.FDI)	h_K	0.85
Proportion Capital Flight	$(1 - h_K)$	0.15

Comparative-static derivatives are computed using the benchmark scenario and different values for partial derivatives of the functions $g^D_{(*)}$ and $h^K_{(*)}$. The results are reported in table 7:

TABLE 7: Comparative-static Derivatives

Expressions and Parameters	Derivatives in model	Benchmark values	High $\lvert g_{1(*)}\rvert$	Low $\lvert g_{1(*)}\rvert$	High $\lvert h_{1(*)}\rvert$	Low $\lvert h_{1(*)}\rvert$	High $h_{2(*)}$	Low $h_{2(*)}$
Ext.Debt growth rate - Derivative w.r.t. σ	$dg_D / d\sigma$	-0.50	-1.00	0.00	-0.50	-0.50	-0.50	-0.50
Prop.Dom.Invest. - Derivative w.r.t. σ	$dh_K / d\sigma$	-0.50	-0.50	-0.50	-1.00	0.00	-0.50	-0.50
Prop.Dom.Invest. - Derivative w.r.t. u	dh_K / du	0.25	0.25	0.25	0.25	0.25	1.00	0.00
(18)	$du_t / d\sigma_t$	-13.21	-16.29	-10.13	-14.30	-12.13	21.05	-8.56
(19)	$du_t / d\sigma_t$ **w.fiscal.adj.**	-34.77	-45.51	-24.04	-37.35	-32.20	12.16	-15.21
(20)	$du_t / d\sigma_t$ **w.paym.st.**	-4.16	-7.24	-1.09	-5.25	-3.08	6.63	-2.70
(21)	$du_t / d\sigma_t$ **w.cap.contr.**	-5.69	-5.15	-6.24	-5.50	-5.89	-4.42	-6.30

In table 7, the bottom line is the derivative (18) evaluated for benchmark values: a one percentage point increase in the return spread σ_t reduces the output gap

ratio u_t around 0.13. Therefore, an increase in the cost of foreign borrowing has a large contractive effect on actual output. A simple sensitivity analysis can be conducted by computing (18) for different values of partial derivatives of $g^D_{(*)}$ and $h^K_{(*)}$. Apart from an extreme value corresponding to a high h_2, the reduction in u_t ranges from 0.09 to 0.16; thus, the bottom line is representative.

Derivative (19) supports the CAUH's argument on the ineffectiveness of fiscal adjustment. For the benchmark values, the reduction in u_t reaches 0.35 when higher domestic savings attempt to compensate for lower external savings. Although the sensitivity analysis shows differences in the figures, it is remarkable that the contraction in (19) is systematically larger than in (18) [97]. At some stage, investors should have realised that fiscal adjustment could do nothing to resume EDS and PDS. Thereafter, events lead to currency and debt crises, as the papers supporting CAUH have stressed.

A final argument: inconsistencies in the pattern of international integration

Concluding this section, the EDS assessment tool developed in section 1 is used to support an argument linking EDS problems in Argentina with international integration patterns in the globalization process. Specifically, conditions under which Argentina might have attained EDS are identified and related to external developments.

Below, table 8 show EDS assessments for a set of scenarios. Scenario I is the benchmark case since it uses the same parameters reported in table 1. Scenario II increases exports growth rate from 10% to 12%. Scenario III increases spread-output elasticity from -2.20 to -1.65, rises output-imports elasticity from 2.56 to 3.00[98], and reduces intercepts for ρ^* and μ^* reported in (11c) by 20%. Scenario IV reduces initial foreign liabilities from USD 222 bn to USD 190 bn[99]. All these changes are

[97] For a comparison purpose, derivatives (20) and (21) measure the effects of an interest payment standstill and capital controls, respectively. For the benchmark values, the reduction in u_t is around 0.04 when a default on interest is declared after the *sudden stop*, and it is 0.06 when capital controls are restricted to compensate for lower external savings.

[98] This is the average output-imports elasticity in 2004-2005.

[99] A debt reduction of USD 32 bn is similar to the haircut applied to foreign investors in the 2005 Argentine bond exchange.

considered simultaneously in scenario V. In the table, values for T^* are highlighted in grey provided R_t does not grow unboundedly, real output growth rate is positive, and $R_{T*} \leq 60\%$.

Table 8: EDS Assessment

	Scenario I			Scenario II			Scenario III			Scenario IV			Scenario V		
	Real Exports G.R. = 10% Spread-Elasticity of Output = -2.20 Output-Elasticity of Imports = 2.56 Debt = USD 222 bn			Real Exports G.R. = 12% Spread-Elasticity of Output = -2.20 Output-Elasticity of Imports = 2.56 Debt = USD 222 bn			Real Exports G.R. = 10% Spread-Elasticity of Output = -1.65 Output-Elasticity of Imports = 3.00 Debt = USD 222 bn			Real Exports G.R. = 10% Spread-Elasticity of Output = -2.20 Output-Elasticity of Imports = 2.56 Debt = USD 190 bn			Real Exports G.R. = 12% Spread-Elasticity of Output = -1.65 Output-Elasticity of Imports = 3.00 Debt = USD 190 bn		
Return Spread (%) (**)	Output Growth (%)	Value t such that (9a) holds	Value Rt* (%)	Output Growth (%)	Value t such that (9a) holds	Value Rt* (%)	Output Growth (%)	Value t such that (9a) holds	Value Rt* (%)	Output Growth (%)	Value t such that (9a) holds	Value Rt* (%)	Output Growth (%)	Value t such that (9a) holds	Value Rt* (%)
3.0	9.63	-1.00		9.63	-1.14		8.04	-2.13		9.63	-1.13		8.04	-2.82	
3.5	8.53	-1.64		8.53	-1.94		7.21	-3.74		8.53	-1.68		7.21	-5.34	
4.0	7.43	-2.60		7.43	-3.28		6.39	-7.47		7.43	-2.52		6.39	-17.24	
4.5	6.33	-4.30		6.33	-6.01		5.56	-46.67		6.33	-3.96		5.56	NaN	
5.0	5.23	-7.90		5.23	-14.30		4.74	103.50	1712	5.23	-6.90		4.74	12.16	44.86
5.5	4.13	-18.08		4.13	-37.87		3.91	13.49	69.32	4.13	-15.52		3.91	7.12	31.71
6.0	3.03	91.80	8905	3.03	18.04	120.05	3.08	8.56	53.51	3.03	81.65	4295	3.08	5.35	27.91
6.5	1.93	17.85	124.57	1.93	10.22	70.90	2.26	6.64	48.45	1.93	15.32	79.34	2.26	4.45	26.25
7.0	0.83	10.90	78.65	0.83	7.60	59.55	1.43	5.62	46.23	0.83	9.11	48.64	1.43	3.90	25.42
7.5	-0.27	8.23	66.11	-0.27	6.30	55.03	0.61	4.99	45.17	-0.27	6.80	39.93	0.61	3.53	25.00
8.0	-1.37	6.90	60.79	-1.37	5.52	52.93	-0.22	4.56	44.72	-1.37	5.59	36.07	-0.22	3.26	24.82
8.5	-2.47	6.03	58.19	-2.47	5.01	51.98	-1.04	4.25	44.61	-2.47	4.86	34.05	-1.04	3.06	24.79

** indicates a marginal return rate

Initial conditions (USD bn): $Y_0 = 284$; $X_0 = 31$; $M_0 = 33$; $A_0 = 153$

Exogenous variables: Intern.Int.Rate $i = 5\%$; Infl. for Y = 0%; Infl. for X and M = 0%;

According to scenario V, EDS might have been attained in a context of less dependence on capital inflows and imports, faster exports growth, and debt reduction. For a return spread of 5.5%, estimated output growth is around 4% and net foreign liabilities reach 32% of GDP. Scenarios II, III, and IV suggest that degree of dependence on external debt and exports growth are the main determinants of these results[100].

From the point of view of economic development, external debt and exports are intertwined variables: debt allows developing countries to grow, while exports allow them to pay the debt back. The *original sin* problem and the *external gap* play a role in this regard since FOREX resources are involved in lending, trading, and servicing foreign liabilities. Thus, for a country to attain EDS, exports should grow

[100] For any return spread level, large differences in T^* values are observed between the benchmark case and scenarios II and III.

pari passu with foreign indebtedness, i.e. access to international financial markets must be accompanied with access to international goods markets. Nevertheless, the current globalization process is asymmetric: developed countries are willing to lend to developing countries and exert pressures to make them open their capital accounts[101]; but developed countries are reluctant to relax their protectionist trade policies and buy developing countries' exports. EDS is hardly attainable under these circumstances[102].

Another important point is that scenarios in table 8 assume long-run values to be constant over time. In scenario V, the return rate must stay permanently at a 5.5% level for output to grow at 4% (y), debt at 5.5% (d), and imports at 7.5% (m). Having historical figures as a reference, those values are not unrealistic at all: in 1992-2000, the average return spread was 7%, and average growth rates were 5.7% for output, 12% for debt, and 12% for imports. But there is a crucial difference between assumed long-run values and observed figures in practice: volatility. In this regard, it has been largely documented that the current globalization process increases international financing sources, but capital flows are volatile and spread instability on domestic macroeconomic variables[103]. Since investors rise return spreads to accommodate for developing countries' instability, interest rates remain at high levels for developed countries' standards. EDS is negatively affected by this fact. Overall, the exercise in table 8 suggests that more symmetric and less volatile international integration would have contributed to economic growth and EDS in Argentina.

[101] In addition, developed countries are delighted to receive developing countries' capital at low interest rates.
[102] To put it in simple terms: if a person is allowed to borrow, but she is not proportionately allowed to sell to her creditors ... how could she pay the money back?
[103] See Stiglitz (2004), and Prasad, Rogoff, Wei, and Kose (2003).

IV. Summary and conclusions

This paper dealt with EDS problems in developing countries, with especial attention to the Argentine crisis. In section 1, it has been shown that capital flight and return spread influence the net external debt dynamics, and thus have implications often neglected by standard EDS assessment tools. In particular, a debt burden arises and makes EDS more difficult to achieve in those countries. Besides, the influence on debt dynamics of basic relationships between macroeconomic variables was analyzed empirically. It has been shown that net foreign liabilities have a complex dynamic behaviour when return spread and growth rates are changed in a manner consistent with these relationships.

In section 2, an *ad hoc* model was developed to rationalize macroeconomic linkages and discuss features of a liquidity crisis at a theoretical level. On the basis of Structuralist gap notions, the model emphasized the role played by FOREX markets in developing countries. Comparative-static derivatives proved the contractive effects of the liquidity crisis and the relative effectiveness of alternative adjustment policies. The main result was that output contraction is caused by FOREX market disequilibrium associated with *sudden stop* in capital inflows and rising interest rates. It is mainly the *external gap*, rather than the *investment-savings gap,* that requires the economy to adjust by recession when external financial shocks happen. In this context, a fiscal adjustment is ineffective and policies addressing FOREX sources and uses directly allow to attenuate the output contraction.

The Argentine crisis was discussed in section 3. The main hypotheses explaining the crisis were reviewed, namely the "fiscal unsustainability hypothesis", the "current account unsustainability hypothesis", and the "multiple equilibria hypothesis". The paper provided additional support to the current account unsustainability hypothesis emphasizing EDS problems faced by the Argentine economy. The following points were discussed: (i) the private foreign indebtedness was significant, and the public external debt was crucial to monetize the economy under a fixed-exchange rate regime; (ii) the combination of foreign indebtedness and hard peg could generate cycles in the real side of the economy, whose dynamics has been outlined; (iii) EDS was not achieved in any phase of these cycles, and this

discouraged capital inflows sustaining the exchange arrangement; (iv) after suffering a sequence of external shocks, the country engaged in a huge adjustment to continue servicing foreign debt, and the adjustment itself was extremely costly in terms of output and growth looses; (v) the government could not defend the fixed-parity when capital outflows accelerated, and it would have been politically impossible to continue servicing foreign liabilities after devaluing the domestic currency.

Appendix

Solving the dynamic equation for the net external debt:

Consider expression (3) for a generic period *v*; multiply by $e^{\int_v^t r_s ds}$, integrate from 0 to *t*, and rearrange terms to get:

$$\text{(A1)} \quad \int_0^t \left(\dot{D}_v - i_v D_v\right) e^{\int_v^t r_s ds} dv - \int_0^t \left(\dot{A}_v - i_v A_v\right) e^{\int_v^t r_s ds} dv = \int_0^t \left(M_v + \sigma_v D_v - X_v\right) e^{\int_v^t r_s ds} dv$$

The LHS of (A1) can be solved by integrating by parts. From Leibniz's rule:

$$\text{(A2)} \quad \int_0^t \left(\dot{Z}_v - i_v Z_v\right) e^{\int_v^t r_s ds} dv = Z_t - Z_0 e^{\int_0^t r_s ds} + \int_0^t \left(r_v - i_v\right) Z_v e^{\int_v^t r_s ds} dv$$

Set $Z_v = D_v$ and $Z_v = A_v$, use $\sigma_v = r_v - i_v$, and plug (A2) into (A1); the expression (4) arises.

VAR Model – Expression (11)

Sample: 1993:1 2000:4 **Observations: 32**
t-statistics in ( )

	DEBT G.R. (t)	OUTPUT G.R. (t)	IMPORTS G.R. (t)
DEBT G.R. (t-1)	0.73711	0.20519	0.30182
	(3.02119)	(1.15194)	(0.44502)
DEBT G.R. (t-2)	0.44284	0.13737	1.02076
	(1.49705)	(0.63606)	(1.24138)
DEBT G.R. (t-3)	-0.22667	0.00115	-0.91209
	(-0.9289)	(0.00643)	(-1.34464)
OUTPUT G.R. (t-1)	-0.29734	0.40671	1.11802
	(-0.7953)	(1.49)	(1.07577)
OUTPUT G.R. (t-2)	-0.13175	-0.52495	-2.07869
	(-0.32473)	(-1.77222)	(-1.84312)
OUTPUT G.R. (t-3)	0.00735	-0.28060	0.84568
	(0.01994)	(-1.04327)	(0.8258)
IMPORTS G.R. (t-1)	0.14848	0.11423	0.75856
	(1.58685)	(1.67219)	(2.9164)
IMPORTS G.R. (t-2)	-0.04933	0.05005	-0.01586
	(-0.48517)	(0.6743)	(-0.05611)
IMPORTS G.R. (t-3)	0.08356	0.04114	-0.23984
	(1.04536)	(0.70492)	(-1.07947)
CONSTANT	0.00256	0.04031	0.11745
	(0.09227)	(1.99152)	(1.52394)
RETURN SPREAD (t)	0.31423	-0.99572	-1.63135
	(0.44033)	(-1.91109)	(-0.82235)
RETURN SPREAD (t-1)	0.62912	1.22567	2.06790
	(0.59183)	(1.57928)	(0.6998)
RETURN SPREAD (t-2)	-0.98660	-1.07275	-2.21041
	(-1.64904)	(-2.45591)	(-1.32908)
R-squared	0.92089	0.94145	0.91411
Adj. R-squared	0.87093	0.90447	0.85986
Sum sq. resids	0.00731	0.00390	0.05647
S.E. equation	0.01961	0.01432	0.05452
F-statistic	18.43124	25.45795	16.85068
Log likelihood	88.74649	98.81330	56.03049
Akaike AIC	-4.73416	-5.36333	-2.68941
Schwarz SC	-4.13870	-4.76788	-2.09395
Mean dependent	0.12235	0.02638	0.06701
S.D. dependent	0.05459	0.04633	0.14563
Determ.Res.Covar.		6.82E-11	
Log Likel. (d.f. adj.)		238.32740	
Akaike Info Criteria		-12.45796	
Schwarz Criteria		-10.67160	

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