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THE FALL IN COLOMBIAN SAVINGS DURING THE 1990s THEORY AND EVIDENCE

Por:
Juan Carlos Echeverry G.

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Para comentarios favor dirigirse al autor:
Fax: 2865936 - Teléfono 3421111 Ext. 3996
e-mail : jechevga@banrep.gov.co

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THEORY AND EVIDENCE

Juan Carlos Echeverry G.*

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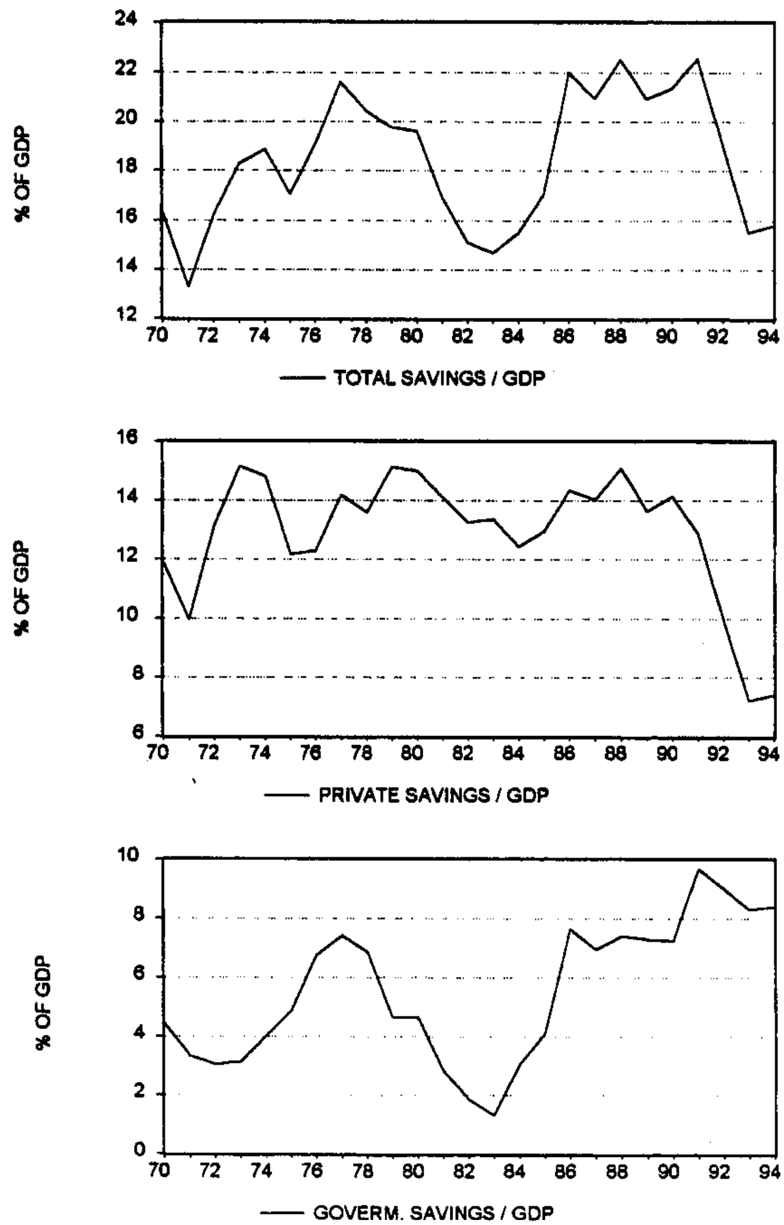
1. MOTIVATION

After 1991 Colombia witnessed a sharp fall in the national savings rate (see figure 1.1), and in particular that of the private sector. Two hypotheses have been advanced for explaining this behavior. The first one stresses consumption smoothing within the Permanent Income Hypothesis framework (PIH). The reasons for such smoothing can be related with three major phenomena that characterized this period; namely, **i.** Since 1990 the government pursued an "apertura" (opening), consisting of tariff reductions, which the agents may have deemed as non-credible (transitory); hence, they exploited the advantage of purchasing imported goods at current low prices, expecting future rises in tariffs.

ii. The agents believed in the apertura, but an overshooting of capital inflows led to an overvalued exchange rate, which, they expected, should be corrected at some point in the near future, with similar effects on current imports consumption. A similar effect on the real interest rate has been also claimed to have similar effects on total consumption (see Lopes et al , 1996). And **iii.** a predictable increase in income originated in fairly secure and substantial oil exports starting in 1997; this could lead oil exports revenues from $ 1.4 bn. yearly in 1991 (approximately 42% of total exports), to $ 4bn. after 1997. Such expected rise in income

Figure 1.1: Savings Rate in Colombia



would have caused the observed increase in consumption.

The second hypothesis is based on the relaxation of liquidity constraints (LCH), as a result of the capital inflows. Urrutia and Lopez (1994) argue that the increase in consumption was due to a relaxation in the liquidity constraints binding on an important share of the population (75% according to them). The inflow of capital experienced in the first years of the 1990s, and the monetary policy of that period would have allowed an increase in outstanding loans directed to consumption purposes. Cárdenas (1996) and Sánchez (1996) also present evidence in support of this hypothesis.

This paper presents a model of a small open economy along the lines of the PIH, which leads to an Euler equation test for the country. A representative consumer demands two goods, one that is imported and one that is non-tradeable, and maximizes expected utility intertemporally. The model predicts that expected changes in the real exchange rate will cause a boom in current consumption. Its testable implications allow us to confront the PIH vis-a-vis the LCH with Colombian data for the years before and after the sharp shift in the savings ratio. The test nests the three possible explanations mentioned: expected price changes, relaxation of liquidity constraints, and foreseeable increase in income. The evidence provides support to the transitory appreciation of the real exchange rate, and fails to idnetify the effect of the fall in the real interest rate.

The next section discusses some facts of the Colombian economy that give support to the contending hypotheses. Section 3 presents the theoretical framework. Section 4 pursues the empirical test and section 5 concludes.

2. Some Facts behind the Hypotheses

This section provides two sets of facts that lie at the core of the hypotheses presented in the motivation. The first set has to do with the substantial capital inflows that accrued to the economy. Table 2.1 shows that capital inflows experienced a dramatic increase during this period. These inflows were composed of an increase in private sector foreign debt (from \$ 46 m. in 1990 to \$ 2,428 m. in 1994), and direct investment (from \$112 m. in 1990 to \$ 1,117 m. in 1994). This phenomenon was accompanied by a fall in the nominal domestic loans interest rate, from 47.6% (annual effective) in May 1991 to a level between 33% and 37% between 1992 and 1994. Hence, a substantial amount of external resources was channeled through the financial sector at lower costs; for some authors this is responsible for an observed jump in outstanding loans, especially for consumption, and the fall in the savings rate.

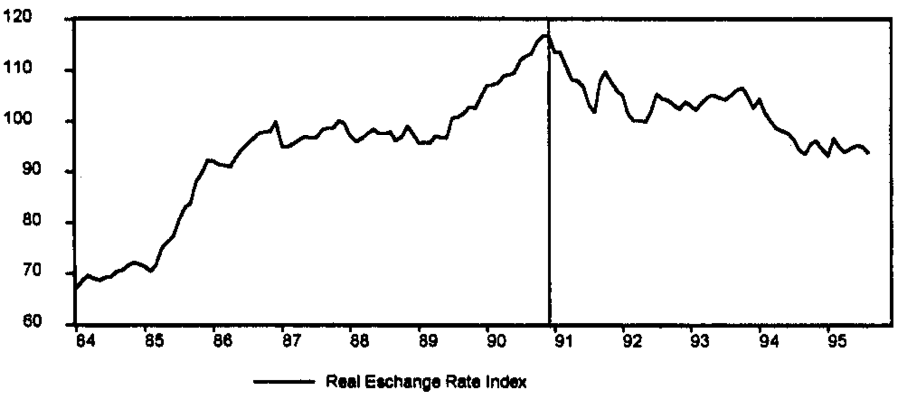
The second set, though, points in another direction. Indeed, the inflow of resources already documented created an excess supply of foreign currency. As Figure 2.1 shows, the consequence on the real exchange rate index (computed by the Central Bank) was visible since the end of 1990: it appreciated nearly 24% during the following three years.

Table 2.1 Foreign Exchange Inflows to Colombia

	Total Inflows	Goods & Services		**Capital**	
	$ millions	$ millions	% GDP	$ millions	**% GDP**
1990	8430	6962	17.3	1468	**3.6**
1991	11175	8922	21.0	2253	**5.3**
1992	11910	8609	17.5	3301	**6.7**
1993	13084	8097	14.5	4987	**8.9**
1994	16206	9226	13.4	6980	**10.2**

Although it was not entirely clear what the equilibrium real exchange rate was, beliefs about an eventual real depreciation may have triggered an increase in consumption of imported goods. In fact, as Fig. 2.2 shows, the ratio of imports to domestic consumption visibly rose after 1990. The additional imports of con-

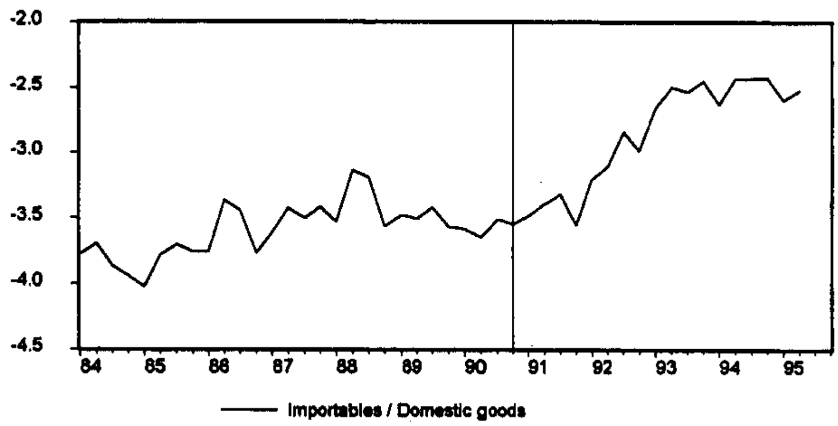
Figure 2.1: The Real Exchange Rate Appreciation of the 1990s



sumption goods (over the level of Dec. 1991), accumulated as of the end of 1994, add up to more than $ 3.5 billions. This represents 42% of the absolute fall in savings during these three years ($ 8.4 bn.[1]). This figures justify our preoccupation for price effects as another cause behind the fall in the savings rate.

[1]To compute this figure we substracted the actual savings of the private sector for each year, from those that would have occurred at 1991's savings rate (12.9%).

Figure 2.2: The Rise of Imports over Domestic Consumption



3. THE MODEL

We use the standard set-up of a representative agent whose objective is to maximize the present value of lifetime utility (β being his subjective rate of discount):

$$E_0 \sum_{t=0}^{\infty} \beta^t \ u\left(C_t\right)$$

where E is the expectation operator; C_t is total household consumption, and

$u\ (C_t)$ is the instantaneous utility associated with consumption C_t. The agent consumes two goods, one imported (c_{mt}) and one produced domestically, which is non-tradeable (c_{nt}); total consumption is then given by a Constant Elasticity of Substitution (CES) index, σ being the intra-temporal elasticity of substitution between imported and domestic goods; so as to make[2]

$$C_t = \left(c_{nt}^{(\sigma-1)/\sigma} + c_{mt}^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)} \tag{3.1}$$

The budget constraint of this individual evolves following:

$$A_{t+1} = A_t R + Y_t - P_{nt} c_{nt} - c_{mt} \tag{3.2}$$

where A_t is the value of non-human wealth at the beginning of period t; Y_t is real income ; R is the fixed real interest rate. The numeraire for each period is the import commodity (i.e. $P_{mt} = 1$); and P_{nt} is the price of non-tradeables in terms of importables (i.e. the inverse of the real exchange rate).

We can now split our consumer's lifetime utility maximization into a static

[2] Ogaki et al. (1995) report that the CES representation of preferences is not rejected by the data of the countries included in their sample, among which is Colombia. A similar set up is followed by Gavin, 1990; and Calvo and Végh (1990a, 1990b, 1993, 1994a)

problem, governed by the intra-temporal elasticity of substitution, and a dynamic one, geared by the inter-temporal elasticity between current and future consumption.

The *static problem* is then:

$$\max\left(c_{nt}^{(\sigma-1)/\sigma} + c_{mt}^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}$$

$$s.t. \qquad e_t = P_{nt}c_{nt} + c_{mt}$$

where e_t is total consumption expenditures at period t. The first order conditions lead to:

$$\frac{c_{mt}}{c_{nt}} = P_{nt}^{\sigma} \tag{3.3}$$

Equation (3.3) states that the effect of relative price changes on theconsumption of home-goods and importables depends on the intra-temporal elasticity of substitution (σ). Indeed, σ measures the ease, in terms of utility, with which consumption of one good can be foregone in favor of another in a given period. Now it is possible to obtain the expression for imports and domestic goods consumption in terms of aggregate consumption; to that end the aggregate price index: $P_t = \left[1 + P_{nt}^{1-\sigma}\right]^{\frac{1}{1-\sigma}}$, and aggregate expenditure

$$e_t = P_t \, C_t \tag{3.4}$$

are replaced into equation (3.3), to obtain the following two expressions for disaggregate consumption:

$$c_{nt} = \left(\frac{P_{nt}}{P_t}\right)^{-\sigma} C_t \tag{3.5}$$

$$c_{mt} = \left(\frac{1}{P_t}\right)^{-\sigma} C_t \tag{3.6}$$

Equations (3.5) and (3.6) are the solution of the static problem faced by this consumer.

The *dynamic problem* faced by this agent consists of the inter-temporal maximization of the present value of its expected lifetime utility:

$$\begin{aligned} &\max\ E_0 \textstyle\sum_{t=0}^{\infty} \beta^t\, u\, (C_t) \\ &s.t. \qquad A_{t+1} = A_t R + Y_t - P_t C_t \end{aligned}$$

The first order conditions yield the following Euler equation:

$$\frac{1}{P_t}\, u^{'}\, (C_t) \;=\; \beta\, R \quad E_t \left\{ u^{'}\, (C_{t+1}) \quad \frac{1}{P_{t+1}} \right\} \tag{3.7}$$

We assume a Constant Relative Risk Aversion (CRRA) utility function:

$u(C_t) = \frac{C_t^{1-1/\rho}}{1-1/\rho}$, (where $\rho > 0$ is the elasticity of inter-temporal substitution); we also assume that: $\beta R = 1$. Hence (3.7) is transformed into:

$$1 = E_t \left\{ \left(\frac{C_{t+1}}{C_t} \right)^{-\rho} \left(\frac{P_t}{P_{t+1}} \right) \right\}$$

Taking logs the following expression follows:

$$\Delta \log C_{t+1} \cong \alpha - \frac{1}{\rho} E_t [\Delta \log P_{t+1}] + \varepsilon_t \qquad (3.8)$$

Equation (3.8) expresses that the change in total consumption is determined by the expected change in the aggregate price index. By definition (see P_t above), such index is governed by the movements on P_{nt}, the inverse of the real exchange rate. Hence, total consumption in this economy will move in the same direction as the expected real exchange rate (notice the negative sign in the RHS of equation 3.8). More explicitly, if agents consider that the current real exchange rate is overvalued, and that a real depreciation is likely, a decreasing path of total consumption will result. People will consume more today than in the future, and a current consumption boom should occur.

4. Testing the Model for Colombia

The analysis of this model is readily applicable to Non-Durables consumption (NDC), since, as Hall (1978) puts it, including durables would cast the suspicion that the findings are an artifact of the procedure of imputing a service flow to the stock of durables[3]. Hence, we focus on the evolution of non-durables consumption for Colombia. However, there is a necessary qualification for the data: domestic consumption data is of a poor quality. The quarterly figures are not observed but computed with econometric techniques, and the annual ones will not provide enough degrees of freedom for testing the predictions during the relevant period of study (four years at most). This fact hinders a direct test a-la-Hall. In contrast, imports consumption data are observed monthly, and are disaggregated between durables and non-durables.

4.1. Empirical Specification

The model has a straightforward implication for non-durable imports; indeed, taking logs and first differences in equation (3.6) makes:

[3] Our emphasis in non-durable consumption goods is also supported by evidence obtained by other studies on Colombia, as Lopez (1996) who argues that "consumption of durable goods after the trade reform cannot be blamed for the decline in the private savings rate." However, that study attributes the fall in the savings to a deterioration of disposable income during the 1990s due to tax increases. An explicit treatment of durables is pursued by Chah et al. (1995)

$$\Delta \log c_{mt+1} = \sigma \, \Delta \log P_{t+1} + \Delta \log C_{t+1}$$

Replacing this expression into (3.8), yields

$$\Delta \log c_{mt+1} = \alpha + \left(\sigma - \frac{1}{\rho}\right) E_t \left[\Delta \log P_{t+1}\right] + \varepsilon_t \qquad (4.1)$$

The prediction of equation (4.1) is that *no other variable* different from the expected change in prices index (for our purposes, also the real exchange rate) should have predictive power over the changes of importables consumption[4]. This implication allows the design of a simple, yet powerful test of the three explanations proposed for the Colombian consumption boom. Indeed, the hypotheses can be tested with the significance of the coefficients of the following empirical

[4]The standard results of this family of models depend on the tension between the **inter-temporal** (ρ) and the **intra-temporal** (σ) elasticities of substitution (see Ostry, 1988; Gavin, 1990; and Calvo and Végh, 1990a, 1990b, 1993, 1994a). The evidence on these elasticities for Colombia is due to Gaviria (1993) and Ogaki et al. (1995); the former, using the methodology of Ostry and Reinhart (1992) obtains the following results for the elasticities of substitution: $.24 \leq \rho \leq .32$, and $.597 \leq \sigma \leq .713$. Ogaki et al. (1995) find values of (.588, .678) for the pair (ρ,σ).

equation:

$$\Delta \log c_{m,t+1} = \beta_0+\beta_1\Delta \log P_{t+1}+\beta_2 \{\Delta \log x_{t-j}\}+\beta_3 \{\xi_{84-91}\Delta \log x_{t-j}\}+\varepsilon_t \quad (4.2)$$

for $(j \geq 0)$; where ξ is a dummy variable that takes the value of one between 1984 and Dec.- 1991, and zero thereafter; and x are other regressors chosen to test the validity of the model. The three hypotheses mentioned correspond to the following propositions:

1. *Anticipated price changes* $(H_0 : \beta_1 = 0)$: under the null, changes in NDC imports do not depend on the expected changes of the real exchange rate.

2. *Liquidity constraints*: here we have to distinguish three cases: **2a.** $(H_0 : \beta_2 = 0, \quad \beta_3 \neq 0)$: under the null for the period previous to 1991, but not thereafter, some variables available in period t or before, different from the expected change in prices, help in predicting future consumption, $c_{m,t+1}$. This would indicate the relaxation of liquidity constraints from 1991 on. **2b.** $(H_0 : \beta_2 = 0, \quad \beta_3 = 0)$: under the null liquidity constraints were not binding neither before nor after 1991. And, **2c.** $(H_0 : \beta_2 \neq 0, \quad \beta_3 = 0)$: under the null liquidity constraints were present before and after Jan.-1991,

and were not relaxed after that date.

3. *Other unobservable factors (i.e. a foreseeable increase in income)* ($H_0 : \beta_1 = 0, \quad \beta_2 = 0, \quad \beta_3 = 0$): under the null the regressors will not have predictive power on changes in NDC imports, indicating that the error term embodies all relevant information. This alternative would be interpreted as evidence in favor of the expected increase in income, and of some other factors not observed by the econometrist.

4.2. Estimation Results

The model was estimated with Two-Stage Least Squares. For testing the presence of liquidity constraints three different sets of instruments (and regressors) were used, namely: **i.** exports, **ii.** a proxy for income(or economic activity) and **iii.** the dependent variable. Additional to the influence of the real exchange rate another price variable was tested: the real interest rate. The justification for testing this variable is twofold; on the one hand the model predicts that the consumption based interest rate is affected by the expected changes in prices. Taking the changes of the real interest rate as a proxy of the consumption based one justifies its consideration. On the other hand, It has been argued that such variable is a determinant for the evolution of the savings rate during that period (see lopez et al., 1996).

The most successful set of regressors and instruments was that related to exports, whose results appear in Table 1. They confirm the validity of PIH for the behavior of non-durables consumption for the country. First and foremost, the real exchange rate enters significantly, in agreement with the prediction of the model. Second, liquidity constraints do not appear to be binding neither before nor after 1991. And the result is robust to the inclusion of contemporaneous exports in the regressors.

Appendix 1 shows the tests performed with the other set of regressors and instruments. Using consumption of energy as a proxy for economic activity (see Table 2) leads to binding liquidity constraints, but this result is not robust to the exclusion of contemporaneous energy in the equation. Table 3 shows that using the dependent variable as regressor leads to the validity of liquidity constraints for the whole period, but not to their relaxation after 1990.12. This scenario would leave all the explanation to the error term, i.e. to the foreseeable oil shock. Finally, the test for using the real interest rate, instead of the real exchange rate as the price variable, summarized in Table 4, shows that this variable does not enter significantly in any of the regressions, no matter the set of regressors or instruments used. The fact that we are using imports consumption, rateher than domestic consumtion data may weaken the effect of this variable.

The results then privilege the transitory appreciation of the real exchange rate as the explanation for the consumption boom. Exports seem to be the appropriate regressor. The model has helped in proposing an explanation of the consumption boom, and in designing a test for the alternative hypotheses, which was not previously available.

Table 1. Test for Liquidity Constraints IV Estimation

Two-Stage Least Squares[5]; Dependent variable: $\Delta \log Non\ Durable\ c_m\ (t+1)$

variable	coeff.	t-stat.	coeff.	t-stat.
$\Delta \log RER\ (t+1)$	8.66	2.14	8.51	2.17
$\Delta \log Exports\ (t+1)$	.18	.46		
$\Delta \log Exports\ (t)$	.3	.63	.17	.45
$\Delta \log Exports\ (t-1)$	.14	.29	.07	.15
$\Delta \log Exports\ (t-2)$	.03	.06	-.01	-.02
$\Delta \log Exports\ (t-3)$	.04	.09	.03	.08
$\Delta \log Exports$ dummy$_{84-91}$ $(t+1)$	-.37	-.86		
$\Delta \log Exports$ dummy$_{84-91}$ (t)	-.18	-.37	.06	.15
$\Delta \log Exports$ dummy$_{84-91}$ $(t-1)$	.00	.00	.14	.27
$\Delta \log Exports$ dummy$_{84-91}$ $(t-2)$	.02	.05	.09	.18
$\Delta \log Exports$ dummy$_{84-91}$ $(t-3)$	-.26	-.58	-.24	-.54
Dummy$_{91-95}$ (t)	.11	1.89	.11	1.99
Constant	-.05	.04	-.06	-1.5
P(F-stat.) excl. regress. $\Delta \log Exports$	0.9744		0.9927	
P(F-stat.) excl. regress. $\Delta \log Exp.$ dummy$_{84-91}$	0.9259		0.9565	

[5]Sample: 1984:6 - 1995:8; included observations: 135. Instruments list: one lag of the dependent variable, four lags of the real exchange rate, four lags of $\Delta \log Exports$ and four lags of $\Delta \log Exports$ dummy$_{84-91}$. This last variable consists of $\Delta \log Exports$ multiplied by a dummy that takes the value of 1 before 1990.12, and zero thereafter.

5. CONCLUDING REMARKS

The paper tests the contending hypotheses for the dramatic fall in Colombia's savings rate after 1991. A theoretical model is developed to analyze the effect of expected price changes on non-durables consumption. The model allows the design of an empirical test of the three proposed explanations of the consumption boom; namely, expected price changes, liquidity constraints relaxation, and a foreseeable increase in income.

Interestingly, the results indicate that the explanation of this phenomenon relies on the transitory appreciation of the real exchange rate experienced during the first years of the 1990s, triggered by capital inflows. The hypothesis of a relaxation of liquidity constraint did not receive support from the data, neither did the the fall of the real interest rate during this period. In sum, the results confirm the validity of PIH for the behavior of non-durables consumption for the country.

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APPENDIX 1

Table 2.	**Test for Liquidity Constraints**		IV Estimation	
TSLS[6];	Dependent variable: $\Delta \log \textit{Non Durable } c_m \ (t+1)$			
variable	coeff.	t.stat.	coeff.	t-stat.
$\Delta \log RER\ (t+1)$	1.71	.09	5.57	1.55
$\Delta \log Energy\ (t+1)$	-13.5	-.4		
$\Delta \log Energy\ (t)$	-2.33	-.27	1.39	2.18
$\Delta \log Energy\ (t-1)$	-5.3	-.44	.23	.28
$\Delta \log Energy\ (t-2)$	-3.19	-.39	.41	.6
$\Delta \log Energy\ (t-3)$	-1.66	-.37	-.08	-.12
$\Delta \log Energy$ dummy$_{84-91}$ $(t+1)$	41.3	.58		
$\Delta \log Energy$ dummy$_{84-91}$ (t)	22.6	.57	-1.76	-1.98
$\Delta \log Energy$ dummy$_{84-91}$ $(t-1)$	22.9	.59	-.43	-.4
$\Delta \log Energy$ dummy$_{84-91}$ $(t-2)$	12.2	.55	-.88	-.87
$\Delta \log Energy$ dummy$_{84-91}$ $(t-3)$	4.33	.522	-.07	.08
Dummy$_{91-95}$ (t)	.53	.6	.07	1.35
Constant	-.32	-.63	-.03	-.83
Prob(F-stat.) excl. regress. *Ener.* of	0.994		0.2833	
Prob(F-stat.) excl. regress. *Ener.*	0.995		0.348518	

[6]Same features as the regressions of Table 1. Instruments list: one lag of the dependent variable, four lags of the real exchange rate, four lags of $\Delta \log Energy$ and four lags of $\Delta \log Exports$ dummy$_{84-91}$.

Table 3. **Test for Liquidity Constraints** IV Estimation

TSLS[7]; Dep. var.: $\Delta \log$ *Non Durable* c_m $(t+1)$

variable	coefficient	t-stat.
$\Delta \log RER\ (t+1)$	-.3	-.08
$\Delta \log NDc_m\ (t)$	-.54	-3.17
$\Delta \log NDc_m\ (t-1)$	-.58	-3.55
$\Delta \log NDc_m\ (t-2)$	-.26	-1.57
$\Delta \log NDc_m\ (t-3)$	-.28	-1.78
$\Delta \log NDc_m$ dummy$_{84-91}$ (t)	-.28	-1.53
$\Delta \log NDc_m$ dummy$_{84-91}$ $(t-1)$	-.006	.028
$\Delta \log NDc_m$ dummy$_{84-91}$ $(t-2)$	-.21	-.98
$\Delta \log NDc_m$ dummy$_{84-91}$ $(t-3)$	.03	.18
Dummy$_{91-95}$ (t)	.07	1.53
Constant	.004	.15
Prob(F) excl. regress. $\Delta \log NDc$	0.0014	
Prob(F) excl. regress. $\Delta \log NDc_m$dum..	0.3518	

[7]Same features as the regressions of Table 1. Instruments list: one lag of the dependent variable, four lags of the real exchange rate, four lags of $\Delta \log NDc_m$, which is the dependent variable, and four lags of $\Delta \log NDc_m$ dummy$_{84-91}$.

Table 4. Test for Liquidity Constraints IV Estimation

Two-Stage Least Squares[8]; Dependent variable: $\Delta \log Non\ Durable\ c_m\ (t+1)$

Regressors	$\Delta \log Exports$		$\Delta \log Energy$		$\Delta \log Non\ Durable\ c_m$	
	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.
$\Delta RIR\ (t+1)$	-.25	-1.64	-.32	-1.5	.13	.88
$\Delta \log Exports\ (t+1)$	.71	.84	-5.04	-.99	-.98	-1.67
$\Delta \log Exports.\ (t)$	.16	.89	-.93	-.4	-.67	-2.26
$\Delta \log Exports\ (t-1)$	1.47	1.14	-4.11	-1.2	-.41	-1.26
$\Delta \log Exports\ (t-2)$	1.4	1.04	-3.3	-1.2	-.26	-1.5
$\Delta \log Exports\ (t-3)$	1.8	.147	-2.2	-.98	.11	.19
$\Delta \log Exp.$ dum.$_{84-91}$ $(t+1)$	-1.24	-1.18	12.9	.76		
$\Delta \log Exp.$ dum.$_{84-91}$ (t)	-.56	-.54	5.45	.46	.11	.19
$\Delta \log Exp.$ dum.$_{84-91}$ $(t-1)$	-1.8	-1.2	4.18	.37	.14	.37
$\Delta \log Exp.$ dum.$_{84-91}$ $(t-2)$	-1.9	-1.15	.91	.13	-.12	-.35
$\Delta \log Exp.$ dum.$_{84-91}$ $(t-3)$	-1.9	-1.28	-1.3	-.34	-.08	-.23
Dummy$_{91-95}$ (t)	.03	.41	.19	.84	.07	1.36
Constant	-.01	-.33	-.07	-.41	.02	.6
P(F) excl. regress. *Exp.*	0.8639		0.7833		0.1854	
P(F) excl. regress. $Exp - d.$	0.8249		0.8356		0.9518	

[8]Same features as the regressions of Table 1. Here the real interest rate replaces the real exchange rate as the *price* variable. Instruments list: one lag of the dependent variable, four lags of the *real interest rate*, and, depending of the regression, four lags of either $\Delta \log Exports$, or $\Delta \log Energy$ or the dependent variable and four lags of the respective dummy variables.