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DUAL RESOURCE TRANSFERS AND THE SECONDARY MARKET PRICE OF DEVELOPING COUNTRIES' EXTERNAL DEBT

AFONSO S. BEVILAQUA
(e-mail asb@econ.puc-rio.br)

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Afonso S. Bevilaqua*

Departamento de Economia

PUC - Rio

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ABSTRACT

Secondary market prices usually are considered to reflect countries' external debt repayment prospects and a number of studies have tried to establish their econometric determinants by concentrating on the external resource transfer that has to be implemented when a country repays its external debt. However, external debt service requires a dual resource transfer. Trade surpluses have to be generated in order to make foreign exchange revenues available for debt repayment. In addition, with developing countries' external debt being largely a public liability, debt service requires that resources can be effectively transferred from the private to the public sector. In this paper a switching regression model with endogenous switching and unknown sample separation is used for analyzing the empirical importance of external and internal constraints on the determination of secondary market prices of developing countries' external debt. The econometric results obtained with the application of the model to a sample of middle-income developing countries strongly support the hypothesis that both resource constraints explain the observed movements in secondary market prices.

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1. Introduction

In recent years, loans for many developing countries have been traded in a secondary market at prices substantially below par. These secondary market prices often are considered to reflect countries' external debt repayment prospects and several studies have tried to establish their econometric determinants.

In general, these econometric studies concentrate only on the external resource transfer that has to be implemented when a country repays its debt. However, developing countries' external debt is largely a public liability, while foreign exchange revenues are predominantly generated by the private sector. Therefore, a country's repayment prospects depend on its ability to make a dual resource transfer. In addition to the external transfer, from the country to its creditors, there is a need for an internal resource transfer, from the private to the public sector.

Thus, the econometric analysis of secondary market price determination requires statistical models that incorporate both the external and the internal (or fiscal) resource constraints of a country, thereby allowing for two different regimes, since the inability to implement any of the two resource transfers should be reflected on a country's secondary market price.

If the underlying mechanism generating repayment problems has in fact two separate regimes, models that take this fact into consideration correct the bias in the estimated coefficients. Moreover, in the case of explanatory

variables that affect both constraints, models with two regimes estimate coefficients that simply do not exist in models with a single regime.

Also, from a policy viewpoint, econometric models with two regimes are likely to be more useful, since they allow for the identification of the particular constraint causing repayment problems in a given country. Models with a single regime will estimate coefficients that capture only the net effect of variables that affect both constraints. With two regimes it is possible to separate the effect of specific variables in each of the two constraints. The identification of these separate effects can be particularly important since adjustment policies designed to make a country succeed in transferring resources abroad can make it more difficult to transfer resources domestically.

In this paper a switching regression model with endogenous switching and unknown sample separation is used for analyzing the empirical importance of fiscal and external constraints on the determination of secondary market prices. The econometric results obtained with the application of the model to a sample of middle-income developing countries in the period of 1986 to 1991, a period in which most developing countries had virtually no access to international capital markets, strongly support the hypothesis that both resource constraints explain the observed movements in secondary market prices.

In addition, the results obtained in this paper show that when a model with two regimes is used, some of the determinants of secondary market prices may have opposite effects in the two constraints. The estimation of the

switching regression model shows that an overvalued real exchange rate has a positive impact on secondary market prices because of its effects on a country's ability to make an internal transfer, but has a negative impact on secondary market prices because of its effects on a country's ability to make an external transfer. In contrast, when a single regression model is used, the real exchange rate does not appear to have any significant impact in terms of predicting secondary market price variations.

The next section briefly discusses the nature of the secondary market for developing countries' external debt and how prices quoted in this market can be used for analyzing the debt repayment prospects of a country when there is a dual resource transfer. Section 3 presents the econometric methodology for dealing with switching regressions when the separation of the sample according to the two regimes is not known a priori. The implementation of the model and the results from the econometric analysis are discussed in Section 4. Finally, Section 5 concludes.

2. A Framework of Analysis

After 1982 many developing countries faced difficulties with maintaining external debt service and a secondary market emerged for bank loans to these countries. Initially, the majority of the operations in this market consisted of swaps among the lending banks, as they tried to adjust the country composition of their portfolios to reduce their exposure to countries where they

lacked expertise or the ability to manage their risk efficiently. More recently, with the emergence of debt conversion and debt reduction programs in many countries, loans have been traded at market determined prices. Trading has occurred among the original creditors and with investors interested in taking advantage of the existing secondary market discounts to acquire equity investment in the developing countries or simply to convert the original loans into other types of debt instruments, usually bonds.

From an estimated volume of only US$ 4 billion in 1985, trading in the secondary market has increased to about US$ 1,978 billion in 1993.[1] Most of this increase was observed after 1988, when debt conversion programs and Brady deals were introduced in the major debtor countries. While the market has experienced very rapid growth in recent years, it remains quite illiquid and most of the transactions are still concentrated on a small number of countries. It is estimated that about 70 percent of the trading in 1993 took place in claims of Argentina, Brazil, and Mexico.[2]

Secondary market prices have been considered to reflect the repayment prospects of debtor countries and have been viewed as indicators of the value of their outstanding debt. For that reason, they often have been used to evaluate costs and benefits of debt and debt service reduction operations.[3]

This interpretation of secondary market prices has motivated a large

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[1] World Bank (1994), vol. 1, p. 32.

[2] World Bank (1993), vol. 1, p. 18.

[3] See, for example, Bulow, Rogoff and Bevilaqua (1992).

number of econometric studies[4] that have tried to establish the degree to which price movements are indeed associated with changes in economic variables that are believed to reflect a country's external debt repayment prospects. The majority of the existing studies on secondary market price determination use econometric models with single equations. Since a debtor's repayment prospects depend on its ability to secure resources and transfer it to its external creditors, the use of single regime models implicitly assumes that the sector generating foreign exchange revenues in a given country is also the sector in charge of making external debt payments.

However, the repayment prospects of a country depend on its ability to make a dual resource transfer. An external resource transfer has to be implemented, since in the absence of external finance trade surpluses are needed to make foreign exchange available for debt repayment. But, in addition to this external transfer, an internal resource transfer also has to be accomplished. With developing countries' external debt being largely a public liability, while most of the export revenues usually are generated by the private sector, debt repayment depends on a resource transfer from the private to the public sector.[5]

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[4] Sachs and Huizinga (1987), Vatnick (1988), Anayiotos and de Piniés (1990), Claessens (1990), Cohen (1990), Ozler and Huizinga (1992), and Stone (1992) are some examples.

[5] The additional complications that arise for external debt service when most of the debt is held by the public sector have been analyzed by Cohen (1987), Fishlow (1988), Reisen and van Trotsenburg (1988), Easterly (1989), Reisen (1989), Rodrik (1990), van Wijnbergen et al. (1992), and Bevilaqua

Therefore, a country's repayment prospects will depend on its ability to make both an internal and an external resource transfers.[6] If it cannot implement any of these two transfers, this inability should be reflected on its secondary market price. For some countries, the ability to make an internal resource transfer can be the binding constraint for the evaluation of their repayment prospects. For others, the ability to make an external resource transfer can be the critical constraint.

As a starting point for an empirical analysis of secondary market prices that takes into consideration this dual character of the resource transfer, it can be assumed that there is an implicit secondary market valuation for the repayment prospects of a country associated with each resource constraint:

$$(1)\quad V_{1i}^{*} = x_{1i}'\beta_1 + u_{1i}$$

$$(2)\quad V_{2i}^{*} = x_{2i}'\beta_2 + u_{2i}$$

where V_{1i}^{*} and V_{2i}^{*} represent the implicit secondary market price valuations for the repayment prospects according to each resource constraint, x'_{1i} and x'_{2i} are $1xk_1$ and $1xk_2$ vectors of explanatory variables describing the ability to make

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(1993), among others.

[6] In addition to its ability to make payments, a country's repayment prospects will also depend on its willingness to meet its external debt payments. That, however, is essentially an unmeasurable variable and its omission in the empirical analysis can account for some of the variation in secondary market prices that cannot be explained by the other variables that can be objectively measured.

each resource transfer, and u_{1i} and u_{2i} are error terms.

Neither V_{1i}^* or V_{2i}^* are observed. Instead, we observe a variable P_i, the quoted secondary market price of the external debt, given by

(3) $P_i = \min (V_{1i}^* , V_{2i}^*)$

Therefore, this formulation assumes that there is no prior knowledge of whether the observed secondary market price reflects the valuation implied by the internal or by the external constraint, i.e., whether for an specific country P_i is in fact a V_{1i}^* or a V_{2i}^*. All that is assumed to be known is that the observed price is reflecting the valuation associated with the resource transfer that is impairing a country's repayment prospect. If for a particular country internal (or fiscal) constraints are more severe than external constraints, the observed price P_i will be reflecting V_{1i}^*. Conversely, if external constraints outweigh internal constraints, P_i will be reflecting the repayment prospects indicated by V_{2i}^*.

In the next section an econometric methodology is discussed which allows for the estimation of the coefficients in the model described by equations (1) to (3) under the above discussed assumptions. Subsequently, the implementation of this methodology to the determination of the secondary market prices for developing countries' external debt will permit to assess the empirical importance of the dual resource transfer problem.

3. A Switching Regression Model with Endogenous Switching

A fundamental aspect of the model in the last section is that different constraints can be binding at different times and it is not known a priori which situation is prevailing when a given value for the dependent variable is observed. Therefore, the parameters of equations (1) and (2) have to be estimated through an econometric methodology that takes this fact into consideration.

The estimation of the model described by equations (1), (2), and (3) is analogous to the estimation of a disequilibrium model with unknown sample separation, also referred to in the literature as a switching regression model with endogenous switching.[7] The appropriate maximum-likelihood formulation for this type of model was first derived by Maddala and Nelson (1974). The discussion in this section draws on the presentations in Maddala (1983) and Quandt (1988).

Let f (u_{1i} , u_{2i}) denote the joint density of u_{1i} *and* u_{2i} , and g (V_{1i}^{*} , V_{2i}^{*}) the joint density of V_{1i}^{*} and V_{2i}^{*} derived from it. Then, the probability density function of P_i can be expressed formally as

$$(4)\quad h(P_i) = h(P_i \mid V_{1i}^{*} < V_{2i}^{*}) \cdot Prob(V_{1i}^{*} < V_{2i}^{*}) + h(P_i \mid V_{1i}^{*} \geq V_{2i}^{*}) \cdot Prob(V_{1i}^{*} \geq V_{2i}^{*})$$

[7] See Maddala (1986).

The conditional density h ($P_i \mid V_{1i}^* < V_{2i}^*$) can be written as

$$(5)\ h\ (P_i \mid V_{1i}^* < V_{2i}^*\ ) = \int_{P_i}^{\infty} g\ (P_i\ , V_{2i}^* \mid V_{1i}^* < V_{2i}^*\ )\ dV_{2i}^*$$

$$= \int_{P_i}^{\infty} g\ (P_i\ , V_{2i}^*\ )\ dV_{2i}^* \quad / \quad Prob\ (V_{1i}^* < V_{2i}^*\ )$$

Similarly,

$$(6)\ h\ (P_i \mid V_{1i}^* \geq V_{2i}^*\ ) = \int_{P_i}^{\infty} g\ (P_i\ , V_{1i}^* \mid V_{1i}^* \geq V_{2i}^*\ )\ dV_{1i}^*$$

$$= \int_{P_i}^{\infty} g\ (P_i\ , V_{1i}^*\ )\ dV_{1i}^* \quad / \quad Prob\ (V_{1i}^* \geq V_{2i}^*\ )$$

Substituting (5) and (6) in (4) yields the unconditional density of the dependent variable P_i

$$(7)\ h\ (P_i) = \int_{P_i}^{\infty} g\ (P_i\ , V_{2i}^*\ )\ dV_{2i}^* + \int_{P_i}^{\infty} g\ (P_i\ , V_{1i}^*\ )\ dV_{1i}^*$$

Given a sample of n observations P_i, the likelihood function can then be written as

$$(8)\ L = \prod_{i=1}^{n} h\ (P_i)$$

If u_{1i} and u_{2i} are independently distributed (with mean zero, and variances σ_1^2 and σ_2^2) so that g (V_{1i}^* , V_{2i}^*) can be written as g_1 (V_{1i}^*) and g_2 (V_{2i}^*), and

if it is furthermore assumed that their distribution is normal, the likelihood function (8) becomes

$$(9)\ L = \prod_{i=1}^{n} \{\frac{1}{\sigma_1}\ \phi_1\ (\frac{P_i - x_1'\beta_1}{\sigma_1})\ [\ 1\ -\ \Phi_2\ (\frac{P_i - x_2'\beta_2}{\sigma_2})\ ]$$

$$+\ \frac{1}{\sigma_2}\ \phi_2\ (\frac{P_i - x_2'\beta_2}{\sigma_2})\ [\ 1\ -\ \Phi_1\ (\frac{P_i - x_1'\beta_1}{\sigma_1})\ ]\ \}$$

where ϕ (.) and Φ (.) denote, respectively, the density function and the cumulative distribution function of the standard normal distribution.

Differentiating (9) with respect to β_1 and β_2, setting the resulting first-order conditions to zero and solving them for β_1 and β_2 yields the maximum likelihood estimates of the parameters in the model described by equations (1), (2) and (3).

The maximum likelihood estimates of β_1 and β_2 can be used to calculate the probabilities that each observation is associated with the equation describing the internal constraint or with the equation describing the external constraint. That can be done by computing the following conditional probability for the more general formulation of the model

$$(10)\ Prob\ (V_{1i}^* < V_{2i}^*\ |\ P_i) = \frac{Prob\ (V_{1i}^* < V_{2i}^*\ ,P_i\ )}{Prob\ (P_i)}$$

$$= \frac{Prob\ (P_i |\ V_{1i}^* < V_{2i}^*\ )\ .\ Prob\ (V_{1i}^* < V_{2i}^*\ )}{Prob\ (P_i)}$$

$$= \int_{P_i}^{\infty} g\ (P_i\ , V_{2i}^*\ )\ dV_{2i}^*\ \ /\ \ h\ (P_i)$$

and classifying an observation as belonging to the equation describing the internal constraint if the calculated probability is > 0.5 and belonging to the equation describing the external constraint if it is < 0.5.[8]

The next section discusses the application of the switching regression model to the dual resource transfer problem and presents the results from the econometric analysis.

4. Model Implementation and Estimation Results

The switching regression model described above was estimated using a pooling of cross-section and time series data. Quarterly data was used for 1986 to 1991, a period during which developing countries were kept virtually with no access to international credit markets and, for that reason, external debt service was implemented primarily out of domestic sources of finance. The sample was formed by 20 middle-income developing countries that had their debts consistently traded in the secondary market in most of the six year period under analysis and for which data on the main explanatory variables was available. After deleting all the observations with missing values, the data set ended up with 406 observations. The means of the explanatory variables for the two resource constraints are shown in Table 1. The sources and definitions of all explanatory variables are presented in the data appendix.

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[8] The classification of the observations according to this conditional probability was suggested by Gersovitz (1980) and Kiefer (1980).

Table 1

Means of the Explanatory Variables, 1986-1991[1].

Country	PUBLIC	INF	RGDPGR	GDS	EXRATE	DEBTEXP	ARREARS
Argentina	0.61	1610.22	0.97	14.82	83.55	5.95	0.08
Bolivia	1.00	182.83	2.10	6.48	25.85	6.97	0.03
Brazil	0.26	1088.05	1.70	25.34	101.23	3.44	0.04
Chile	0.69	19.83	6.00	22.16	76.57	2.73	0.00
Colombia	0.37	25.94	4.25	24.68	62.93	2.51	0.00
Costa Rica	0.74	18.98	4.03	22.88	78.18	3.10	0.05
Cote d'Ivoire	1.04	2.82	-0.93	16.30	129.01	4.22	0.04
Dominican Rep.	0.62	39.07	1.55	13.88	82.19	4.70	0.08
Ecuador	0.98	47.45	2.12	19.87	57.37	4.12	0.10
Hungary	0.62	14.98	-1.00	26.48	87.00	1.68	0.00
Mexico	0.48	68.02	1.78	22.90	81.53	4.28	0.00
Morocco	0.96	5.31	4.07	18.20	90.36	6.14	0.01
Nigeria	0.97	24.42	4.07	20.40	23.79	3.56	0.02
Peru	0.50	2051.15	-0.28	21.58	136.89	4.63	0.20
Philippines	0.61	9.73	3.87	17.73	73.25	3.69	0.00
Poland	0.53	204.52	-1.57	33.63	61.85	2.72	0.17
Turkey	0.43	56.26	5.38	21.72	76.99	3.12	0.00
Uruguay	0.44	83.02	3.22	17.74	93.88	2.41	0.00
Venezuela	0.55	38.32	3.10	24.20	62.09	2.66	0.00
Zaire	1.04	336.57	0.82	11.12	84.63	5.31	0.03
All Countries	0.62	233.88	3.08	21.96	78.72	3.39	0.03

1. See the appendix for sources and definitions.

The explanatory variables in the equation describing the internal constraint are proxies for the public sector's ability to collect revenues and were chosen with basis on the theoretical literature on public sector financing. The secondary market of developing countries' external debt was assumed to be a function of: the public or publicly guaranteed debt to GNP ratio (PUBLIC), the inflation rate (INF), the rate of growth of real GDP (RGDPGR), the share of gross domestic savings in GDP (GDS), and the real exchange rate (EXRATE). The budget deficit of the consolidated public sector, potentially an important determinant of the ability to implement an internal resource transfer, was not included as an explanatory variable because of lack of comprehensive data for most of the countries in the sample during recent years.

A higher public external debt to GNP ratio increases the need for collecting resources domestically for external debt service and, therefore, should reduce the secondary market price of a country's debt. The same should happen with the inflation rate, since in countries with high inflation rates it will be more difficult for the public sector to obtain resources through money creation. A high real GDP growth rate and a large share of savings in GDP facilitate the collection of domestic revenues by the public sector. Therefore, both should increase the secondary market price. Finally, an overvalued real exchange rate decreases the domestic cost of external debt service. Therefore, given the way the exchange rate index was constructed, the expected sign of this variable in the internal constraint should be positive; an overvaluation of the real exchange rate should increase secondary market prices.

In the equation describing the external constraint, the secondary market price of developing countries' external debt was assumed to be a function of the following variables: the debt to exports ratio (DEBTEXP), the real exchange rate (EXRATE), the London Interbank Offer Rate (LIBOR), and the percent of long-term external debt in arrears (ARREARS).

A higher debt to exports ratio implies that, all else equal, larger trade surpluses have to be generated in order to maintain external debt service. An overvalued real exchange rate, in turn, will make it more difficult for a country to generate the required trade surpluses for debt service. Therefore, both variables are expected to have a negative effect on the secondary market price, since increases in any of them will make interruptions in external debt service more likely. Increases in the LIBOR should also have a negative effect on the secondary market price of a country's external debt, given that it will raise interest payments. Finally, an increase in the percent of debt in arrears reflects difficulties with maintaining external debt service and should also have a negative effect on the secondary market price.

Table 2 displays the maximum likelihood estimates of the coefficients in the switching regression model. The results for the baseline switching regression model are shown in the first column. All the estimated coefficients in the two equations describing the resource constraints have their expected signs. Also, most of the coefficients are statistically different from zero at very high confidence levels. The only exception is the coefficient on the inflation rate, which has the correct sign but is not estimated with precision.

Table 2

Maximum Likelihood Estimates of the Coefficients in the Switching Regression Model , 1980-1990.

Variable	1	2	3	4
- Internal Constraint -				
CONSTANT	3.654 (7.264)	2.252 (12.209)	4.009 (8.727)	2.528 (15.419)
PUBLIC	-1.660 (-4.217)	-0.484 (-3.909)	-1.666 (-5.185)	-0.512 (-4.900)
INF	-0.119 E-03 (-0.390)	-	-0.102 E-03 (-0.529)	-
RGDPGR	0.038 (2.172)	0.018 (2.408)	0.034 (2.606)	0.014 (2.161)
GDS	0.055 (3.800)	0.051 (8.800)	0.044 (3.616)	0.044 (9.555)
EXRATE	0.747 E-02 (3.088)	0.015 (9.829)	0.612 E-02 (2.868)	0.016 (12.290)
LA	-	-	-0.323 (-2.508)	-0.307 (-5.040)
- External Constraint -				
CONSTANT	5.822 (22.613)	6.615 (19.075)	6.001 (22.232)	6.722 (20.625)
DEBTEXP	-0.060 (-2.488)	-0.089 (-2.759)	-0.064 (-2.535)	-0.101 (-3.354)
EXRATE	-0.385 E-02 (-3.423)	-0.643 E-02 (-5.697)	-0.501 E-02 (-4.943)	-0.698 E-02 (-6.246)
LIBOR	-0.148 (-5.783)	-0.200 (-5.437)	-0.148 (-5.447)	-0.203 (-5.794)
ARREARS	-0.073 (-19.788)	-0.080 (-14.087)	-0.074 (-19.002)	-0.079 (-14.628)
σ_1	0.616 (11.451)	0.309 (9.701)	0.571 (14.251)	0.262 (11.329)
σ_2	0.363 (16.630)	0.500 (19.925)	0.352 (13.986)	0.507 (20.357)
Log likelihood	-195.121	-176.952	-190.790	-162.427
Number of observations	406	406	406	406

Asymptotic T-statistics in parentheses.

The second specification in Table 2 drops the inflation rate from the equation representing the internal constraint. The removal of this variable, however, does not have any substantial effect on the statistical significance of the other explanatory variables in the model.

In order to control for the possibility of region specific effects, a dummy variable for Latin-American countries (LA) was introduced as an additional explanatory variable in the internal constraint in Model 3. The coefficient for the dummy variable is highly significant and indicates that, on average, secondary market prices tend to be lower for Latin American countries. The results for the other explanatory variables are very similar to the ones obtained for Model 1.

The last specification in Table 2 adds the region dummy to the model that excludes the inflation rate. Again, there is no significant change in the estimated coefficients and their statistical significance. Similar results (not reported in the table) were obtained when the Latin-America dummy variable was included in the external constraint and when year dummies were added to the two constraints.

Likelihood ratio tests strongly reject the null hypothesis of all coefficients in the switching regression model, except a constant term, being equal to zero.

The results for the switching regression model confirm a central econometric hypothesis of this paper: the estimated coefficients for the real exchange rate have opposite signs in the equations describing the two constraints and are statistically different from zero at high confidence levels.

An overvalued real exchange rate increases the probability of interruptions in external debt service because of external constraints, since it makes it harder to generate trade surpluses. However, an overvalued real exchange rate reduces the probability of having interruptions in external debt service because of fiscal constraints, given that it decreases the cost of debt service in domestic currency. Therefore, a positive coefficient should be expected for the real exchange rate in the equation describing the internal constraint, since a reduction in the domestic cost of external debt service will tend to increase the secondary market price. At the same time, in the external constraint there should be a negative coefficient for the real exchange rate, since the secondary market price should be adversely affected when it becomes harder for a country to generate trade surpluses. Both results are obtained in all specifications of the switching regression model presented in Table 2.

Table 3 presents the results from the estimation of a single regression model using all the explanatory variables included in Model 1 in Table 2. When a model with a single regime is used to estimate the determinants of secondary market prices, the real exchange rate turns out to be not statistically different from zero at standard confidence levels. The statistical inference obtained in this case would indicate that the real exchange rate plays no role as a determinant of secondary market prices. Also, when a single regime model is used, the debt to exports ratio, highly significant in all four specifications in Table 2, has a coefficient with the wrong sign and is not statistically different from zero. On the other hand, when a single regime model is used, the

Table 3

Single Regime Model[1].

Variable	Ordinary Least Squares Estimate
CONSTANT	4.481 (21.638)
PUBLIC	-0.585 (-6.686)
INF	-0.509 E-04 (-2.857)
RGDPGR	0.013 (2.805)
GDS	0.043 (11.103)
EXRATE	0.862 E-03 (1.252)
DEBTEXP	0.867 (0.522)
LIBOR	-0.151 (-8.776)
ARREARS	-0.075 (-20.993)
Adj. R^2	0.74
Standard Error	0.37
Number of observations	406

1. Model with all explanatory variables from model 1 in Table 2.
T-statistics in parentheses.

coefficient on the inflation rate is estimated with more precision than it is in the switching regression model.

Tables 4 through 7 present the average probabilities of regime classification during the period 1986-1991 for each one of the specifications in Table 2. The estimated probabilities of regime classification are fairly stable across all model specifications. According to the results, for most countries in the sample secondary market price changes were more likely to be associated to external than to fiscal (or internal) constraints. For some countries in the sample, however, there is a higher probability that variations in the secondary market prices are associated with fiscal constraints. This is the case for Bolivia, Nigeria, and Zaire, that are classified as internally constrained in all four specifications in Table 2. For the specifications that do not include the inflation rate as an explanatory variable, there is an increase in the number of fiscally (or internally) constrained countries relative to the baseline model. Chile, Colombia, Philippines, Turkey, and Venezuela, all of them countries with inflation below the sample average, become internally constrained when the inflation rate is dropped from the model. On the other hand, Zaire, a country with inflation above the sample average, becomes externally constrained when the inflation rate is not used in the estimations.

The econometric results obtained with the estimation of the switching regression model in this paper give support to the hypothesis that both fiscal and external constraints play a role in the determination of developing countries' creditworthiness.

Table 4

Average Probabilities of Regime Classification, 1986-1991
for Model 1 in Table 2.

Country	Probability of Internal Constraints	Probability of External Constraints
Argentina	0.357	0.643
Bolivia	0.998	0.002
Brazil	0.028	0.972
Chile	0.295	0.705
Colombia	0.125	0.875
Costa Rica	0.350	0.650
Cote d'Ivoire	0.485	0.515
Dominican Republic	0.251	0.749
Ecuador	0.396	0.604
Hungary	0.149	0.851
Mexico	0.180	0.820
Morocco	0.376	0.624
Nigeria	0.854	0.146
Peru	0.001	0.999
Philippines	0.394	0.606
Poland	0.023	0.977
Turkey	0.149	0.851
Uruguay	0.207	0.793
Venezuela	0.320	0.680
Zaire	0.882	0.118

Table 5

Average Probabilities of Regime Classification, 1986-1991
for Model 2 in Table 2.

Country	Probability of Internal Constraints	Probability of External Constraints
Argentina	0.321	0.679
Bolivia	0.990	0.010
Brazil	0.088	0.912
Chile	0.566	0.434
Colombia	0.585	0.415
Costa Rica	0.140	0.860
Cote d'Ivoire	0.104	0.896
Dominican Republic	0.227	0.773
Ecuador	0.370	0.630
Hungary	0.418	0.582
Mexico	0.301	0.699
Morocco	0.453	0.547
Nigeria	0.943	0.057
Peru	0.000	1.000
Philippines	0.680	0.320
Poland	0.011	0.989
Turkey	0.602	0.398
Uruguay	0.450	0.550
Venezuela	0.542	0.458
Zaire	0.487	0.513

Table 6

Average Probabilities of Regime Classification, 1986-1991
for Model 3 in Table 2.

Country	Probability of Internal Constraints	Probability of External Constraints
Argentina	0.472	0.528
Bolivia	0.999	0.001
Brazil	0.075	0.925
Chile	0.444	0.556
Colombia	0.272	0.728
Costa Rica	0.611	0.389
Cote d'Ivoire	0.492	0.508
Dominican Republic	0.370	0.630
Ecuador	0.584	0.416
Hungary	0.182	0.818
Mexico	0.347	0.653
Morocco	0.413	0.587
Nigeria	0.914	0.086
Peru	0.004	0.996
Philippines	0.439	0.561
Poland	0.025	0.975
Turkey	0.170	0.830
Uruguay	0.351	0.649
Venezuela	0.577	0.423
Zaire	0.906	0.094

Table 7

Average Probabilities of Regime Classification, 1986-1991
for Model 4 in Table 2.

Country	Probability of Internal Constraints	Probability of External Constraints
Argentina	0.349	0.651
Bolivia	0.992	0.008
Brazil	0.122	0.878
Chile	0.698	0.302
Colombia	0.729	0.271
Costa Rica	0.160	0.840
Cote d'Ivoire	0.025	0.975
Dominican Republic	0.255	0.745
Ecuador	0.450	0.550
Hungary	0.311	0.689
Mexico	0.374	0.626
Morocco	0.273	0.727
Nigeria	0.937	0.063
Peru	0.000	1.000
Philippines	0.541	0.459
Poland	0.002	0.998
Turkey	0.553	0.447
Uruguay	0.536	0.464
Venezuela	0.689	0.311
Zaire	0.229	0.771

5. Conclusions

In this paper a switching regression model was used for testing the empirical importance of the dual resource transfer problem for the determination of variations in secondary market prices of developing countries' external debt. The results obtained in the econometric analysis suggest that both fiscal and external constraints are important determinants of secondary market prices. The use of the estimated coefficients for the calculation of probabilities of regime classification imply that for most countries secondary market prices were, on average, more likely to be determined by external than by fiscal constraints. However, for some countries in the sample, fiscal constraints seem to have been more important determinants of the variations in secondary market prices during the period under analysis.

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DATA APPENDIX

Sources and definitions of the data series used in the paper:

Dependent Variable: log of the secondary market price of developing countries' external debt. Quarterly averages of bid and offer prices, calculated by using the last available quotation for each month. Data for Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru, Philippines, and Venezuela from Latin Finance; Bolivia, Cote d'Ivoire, Dominican Republic, Morroco, Nigeria, Poland, Uruguay, and Zaire from Salomon Brother's Indicative Prices for Less- Developed Country Bank Loans; Bolivia after the third quarter of 1990, Dominican Republic after the second quarter of 1990, and Hungary and Turkey after the second quarter of 1989 from Euroweek; Uruguay after the fourth quarter of 1990 from LDC Debt Report.

Public or Publicly Guaranteed Debt to GNP Ratio (PUBLIC): ratio of year-end public and publicly guaranteed debt outstanding and disbursed, to Gross National Product. All Data from World Debt Tables 1992-93, Data on Diskette.

Inflation Rate (INF): yearly rate of change in the quarterly averages of the monthly Consumer Price Index. Data from IMF's International Financial Statistics on CD-ROM.

Rate of Growth of Real GDP (RGDPGR): yearly growth in real GDP. Data from World Bank (1992a).

Gross Domestic Savings (GDS): gross domestic savings as % of Gross Domestic Product. Data from World Bank (1992a).

Real Exchange Rate (EXRATE): multilateral effective real exchange rate, quarterly averages of index numbers. Data from IMF's International Financial Statistics on CD-ROM, except for Argentina, Brazil, Mexico, Peru, and Turkey, where the data comes from JP Morgan's World Financial Markets.

Debt to Exports Ratio (DEBTEXP): ratio of year-end long-term debt outstanding and disbursed to exports of goods and non-factor services in the same year. Debt figures are from World Debt Tables 1992-93, Data on Diskette. Exports from World Bank (1992a).

Percent of long-term external debt in arrears (ARREARS): year-end interest arrears as a percent of long-term external debt. Data from World Debt Tables 1992-93, Data on Diskette.

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