THE EXTERNAL CONSTRAINT TO THE ECONOMIC GROWTH: NEW EVIDENCE WITH NEW DATA.

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ABSTRACT:

In this paper we try to analyse the role played by the external trade balance on conditioning growth, testing the Thirwall´s law. We use time series procedures to test country to country the external constraint instead of cross section approach. The Thirwall´s hypothesis is tested in two alternative ways. First we estimate two dynamic disequilibrium models: an adjustment model via prices (neoclassical model) and other via income (Keynesian model). Second we use cointegration techniques to obtain the export and import functions used to calculate the growth rate compatible with the external balance and compare it with actual growth rates of the last thirty years.

Results are mixed, indicating that the external constraint plays an important role on growth process but not as important as Thirwall proposes due to the real rate (relative prices) adjustment.

Keywords: external constraint, growth, external trade, exchange rate.

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1. - INTRODUCTION

In the last years we have seen a renewal interest in the economic literature of growth. Two kind of problems have centred the attention of researchers, the productivity growth and the existence of permanent differences among growth rates. The neoclassical answer to the second question is widely studied in the convergence literature, and pay attention in differences in technical progress, factor endowments, institutional problems, etc.

In an open economy world, in which factors are free mobile[1] and trade solve the different endowment of raw materials, supply side constrains explanations are difficult to consider as the main reasons of differences in trend growth rates. If capital is mobile among countries, there is no reason for technological differences in the production functions and demand constrains seems to play an important role explaining those differences in growth rates.

The Keynesian tradition focus the attention in the demand to explain differences in growth process among countries. For Keynesians the differences in growth are explained for insufficient levels in the demand side of the economy. Initially, investment was the main exogenous component of the demand to explain growth, but since 60´s was the external sector of the economy which played that role, and particularly the exports.

Harrod(1933) proposed that exports, thorough the trade multiplier, are the main component in determination of output and employment. Later, Thirwall (1979), developed this idea in the well known Thirwall´s law, and generate a recent collection of theoretical and empirical papers on external constraint.

[1] For most countries capital is, in practice, free mobile. It can be argued that labour is not too much mobile because of cultural and linguistic problems, but , at least for developed countries inmigration barriers are the main reason to inmobility in labour.

In this paper, we try to test the external constraint using time series methodology with the most recent and homogenous data available. We have used the database of the I.M.F. choosing a series of countries from all the geographical areas and per capita income levels. The number of countries for some areas is limited by the readiness of the data. The selection of countries has been: Europe: France, Spain, Germany and the United Kingdom as the biggest EU countries; America: Mexico and Brazil; Asia: Japan, Korea, Thailand and India, Africa: Morocco. We have built all the variables in index numbers with base 1990.

2.- THE THIRWALL´S MODEL

In Harrod (1933) is found by first time the introduction of the external sector of the economy like the fundamental determinant of growth, but was Thirwall (1979) who wrote the most recent version of this theory.

The exports and imports functions are expressed in multiplicative form as usual in the following way:

$$X = A(Q)^{a_1} Y^{*e} \qquad (1)$$

$$M = B(Q)^{a_2} Y^{p} \qquad (2)$$

where X are exports, M imports, Q is the real exchange rate defined like Q=(EP*/P), where E is nominal exchange rate, P are domestic prices, Y is domestic output and the * refers to foreign (rest of the world) variables, A and B are constants, and ε and π are the exports and imports elasticities.

Taking logarithms in (1) and (2) and deriving respect to time we get the dynamic versions of both expressions:

$$\dot{x} = a_1 \dot{q} + e\, \dot{y}^{*} \qquad (3)$$

$$\dot{m} = a_2 \dot{q} + p\, \dot{y} \qquad (4)$$

with α_1, ε, π >0; α_2 <0.

For a continuous trade balance $\dot{x} = \dot{m}$, and substituting we get to the growth rate compatible with the external balance:

$$\dot{y}_{b3} = 1/p\,(_1 - a_2\,\dot{q} + \dot{x}) \qquad (5)$$

or, substituting (3) into (5),

$$\dot{y}_{b4} = 1/p\,((a_1 - a_2)\,\dot{q} + e\,\dot{y}^*) \qquad (6)$$

if PPP holds over long run, q=0, then equations (5) and (6) become the Thirwall´s law:

$$\dot{y}_{b1} = 1/p\;\dot{x} \qquad (7)$$

or,

$$\dot{y}_{b2} = e/p\;\dot{y}^* \qquad (8)$$

Equations (7) and (8) have been contrasted, among others, by Thirwall(1979), McGregor and Swales(1985, 1986, 1991), Bairam(1988), McCombie(1989 and 1992), with contradictory results.

In general, to test equations (7) and (8), following McGregor and Swales (1985 and 1986), we estimate first the trade functions to get the elasticities, and the growth rate compatible with the external constraint, and after we do the following regression:

$$\dot{y} = a + b\,\dot{y}_b + e \qquad (9)$$

where y is the actual growth rate, y_b the growth rate compatible with the external constraint and e is the error term.

In the next part we use a continous time unbalanced model with price and income adjustment and in the fourth part we estimate the trade functions using cointegration procedure. In both cases we calculate the growth rate compatible with the external constraint and the equation (9). In the last section we show the conclusions.

3. - A CONTINUOUS TIME UNBALANCE MODEL

Alonso and Garcimartín (1998) introduce some critics to the traditional pattern of Thirwall. The most interesting, to be adjusted to the economic reality is the one that says: ` it doesn't seem justified the hypothesis defended by Thirwall that the prices don't play any relevant role in the evolution of the commercial flows or in the determination of the income balance` (p.9). These authors intend to estimate the pattern without a priori assumptions on the role played by prices.

Therefore we estimate two different models on the adjustment of the current account, making a bigger stress in the income, assuming some nominal rigidities, following the keynesian hypothesis, or a prevalence of the adjustment in the prices following the neoclassical hypothesis. If in the country in question the adjustment that prevails is via income or prices, it will have different influence of the current account on the income and, therefore on his growth rate.

Supposing that the adjustment is carried out via income, the pattern can be written in the following way:

$$py = (a_1 - a_2)(e + p^* - p) + ey^* \qquad (10)$$

or if the adjustment is carried out via prices:

$$(a_1 - a_2)(e + p^* - p) = py - ey^* \qquad (11)$$

Obviously, the behavior of the exports and imports are not independent of income and prices. For that we outline a model of simultaneous equations for each one of the variables.

Following Alonso and Garcimartín[2]´s formulation, we would write the keynesian model by the following system of equations:

$$\dot{y} = a_1(x - m - q) \quad (12)$$

$$\dot{x} = a_2((a + a_1 q + ey^*) - x] \quad (13)$$

$$\dot{m} = a_3[(b + a_2 q + py) - m] \quad (14)$$

As neoclassical model, the following equations:

$$\dot{q} = a_1(x - q) \quad (15)$$

$$\dot{x} = a_2[(a + a_1 q + ey^*) - x] \quad (16)$$

$$\dot{m} = a_3[(b + a_2 q + ply) - m] \quad (17)$$

We have estimated both models for the group of countries mentioned previously by the procedure SURE and the results of the estimate are presented in tables 1 and 2. The results of the estimation indicate us that in 7 of the 12 countries the best adjustment provides from the keynesian pattern. In the case of Spain, Italy, France, Brazil, Mexico and Korea, the parameters present the expected sign and they are significant at the standard levels.

The neoclassical pattern would be the elect for the cases of Japan, Thailand and India, whose parameters have the expected sign and are significant. In the case of Germany and the United Kingdom, still when the signs are consistent with the neoclassical pattern, neither the significance levels or the R-squares allow to choose one or another model.

[2] To know how to arrive to that system of equations, see Alonso and Garcimartín(1998)

Our results differ of those obtained by Alonso and Garcimartín(1998) in the adjustment speed of the variable to their equilibrium value, especially in the imports equation. On the other hand in our work the number of significant parameters is quite smaller. Even in this way the parameters of the income elasticity[3] in the export and import equations are significant what allows us to calculate the Thirwall`s growth rate:

$$\dot{y}_b = 1/p\,(a_1 - a_2)\,\dot{q} + e/p\;\dot{y}^* \qquad (18)$$

For those countries we have checked if the law of Thirwall is fulfilled. For that, we carry out the following test:

$$1/p\,(a_1 - a_2) = 0 \quad \text{and} \quad \frac{e}{p} = 1$$

In appendix 2 we show the equations country by country, where y_{DM} is the estimated external balance growth rate. Looking at the results, in most of countries the regression presents the expected signs of the parameters, and is significant. For the European countries is better than for the others.

The results of the Wald test are shown in table 3. Those results indicate that you can accept both hypotheses in the cases of Spain and Brazil. In the cases of France, Italy and Thailand is accepted the hypothesis of $\frac{e}{p} = 1$, and to Germany[4], is accepted the other.

We can conclude that the external constraint plays an important role in determining the growth rate but the Thirwall´s hypothesis is not demonstrate.

[3] We didn't seize the price elasticities that are only significant to 3 countries in the function of exports and to one the imports one.

[4] ` We must pay attention on the fact that this conclusion is compatible with the significance of the prices in the trade functions and its presence in the specification of the current account´ Alonso and Garcimartín(1998) p.13.

4. - COINTEGRATION MODEL

Since the results obtained with the pattern of simultaneous equations are not conclusive, we estimate the export and import functions using cointegration techniques. For that, we have followed the traditional procedure of studying the cointegration relationships among this variables, and to estimate the equations of error correction, if this variables are cointegrated. The elected procedure is Johansen´s methodology to see cointegration and, if they are cointegrated, estimate the corresponding Vector Error Correction.

To carry out the cointegration test, first we should check the order of stationarity of variables. For it, we do the test of unit roots of the variables. The results of this test indicate us that in practically all the cases the output, exports and imports, has an unit root and the result is not conclusive for the real exchange rate. In this case we can not have balanced regressions, therefore the VAR could give spurious results (Marmol(2000)). This problem disappears if the variables are cointegrated.

We have carried out the cointegration test, and in all the cases the variables seem to be cointegrated using Johansen`s methodology, with at least one cointegration vector. We have estimated the Vectors of Error Correction, and we get the export and import functions for each country. In appendix 1 we show the cointegration equations.

In the countries where real exchange rate is not significant or has the incorrect sign, we run again the procedure excluding the real exchange rate. This is not too strong if we assume that real exchange rate is constant over the long run[5].

With the export and import elasticities we build again the external balance growth rate, and make the regression as indicated above. In appendix 2 we show the results county by country, where the estimated growth rate appear as y_{VEC}. Taking a look over the equations, we can see that the results do not differ too much from the

[5] We are assuming that in long run PPP holds at least in the weak versión.

dynamic model, showing that the external constraint plays an important role but not as Thirwall propose.

To finish, we made the regression on actual growth rate over the estimated rate using panel data procedure with both estimated growth rates. In appendix 2 we show the results. First we estimate the panel including all the countries from the sample except Japan, and the results confirm the previous ones.

After, we run the regressions for developed an undeveloped countries separately to found any diference in the behavior, assuming the hypothesis that as greater is the trade volume as important is the external constraint. This result is confirmed by the data, the estimated parameter is bigger for developed countries no matter wich estimated growth rate is used[6].

3. - CONCLUSIONS

The target of this work was to contrast the denominated external restriction to the growth in the economic literature. The main results from this work could be summarized as it follows:

1) It confirms that most of the adjustment of the external unbalances is carried out by income and not by prices confirming that demand constraints are important in the determination of the rate of growth in the economies.

2) The simplest version of the Thirwall´s law is only confirmed to Spain and Brazil, and only to the estimated growth rate using the dynamic model. To the rest the external constraint plays an important role but in a minor quantity that Thirwall proposes.

[6] The panel data was estimated with random effects.

3) The results are conditioned by the period taken to estimate, specially after 1973 where the desinflationary policies made another demand constraints to growth being more difficult to test correctly the external constraint.

4) The results are conditioned, probably by the number of countries, but otherwise if we expand the sample we were conditioned by the fiability of the data. We need more countries to use panel tecnichs as a powerfull alternative to time series tecnich.

Table nº1

Adjustment via income

	a_1	a_2	α_1	ε	a_3	α_2	π
Spain	0.034	-0.272	0.225	2.52	-0.063	-0.272	4.391
Porb	0.01	0.009	0.7	0	0.6	0.8	0.03
United K.	-0.005	-0.149	0.231	1.307	-0.199	0.014	1.465
	0	0.06	0.2	0	0.12	0.9	0
Italy	0.045	-0.862	0.138	1.856	-0.357	0.059	1.8
	0	0	0.01	0	0.02	0.7	0
Germany	-0.006	-0.286	0.194	1.649	-0.755	0.18	1.978
	0	0.02	0.11	0	0	0	0
France	0.0008	-0.437	0.196	1.865	-0.495	0.098	2.142
	0	0	0.01	0	0	0.14	0
Brasil	0.027345	-0.10029	-0.058858	0.792117	-0.22003	0.022428	1.326391
	0.0485	0.2554	0.2864	0.5463	0.0201	0.1711	0
Mexico	0.009114	-0.441962	0.033026	1.987544	-0.096685	0.093826	2.220505
	0.0002	0.0115	0.0149	0	0.0263	0.1723	0
Morocco	-0.016178	-0.128462	-0.513805	1.839885	-0.321054	-0.026772	0.914735
	0.3221	0.1412	0.3612	0.0008	0.0374	0.8927	0
Japan	-0.049687	-0.020527	6.401917	11.28849	-0.281775	0.124438	1.731517
	0	0.6552	0.655	0.5636	0.0038	0.1877	0
Korea	0.03991	-0.017069	10.17133	33.57145	0.115525	1.401509	1.777027
	0.1763	0.8355	0.839	0.8079	0.7448	0.7973	0.3439
Tailand	-0.023455	-0.082289	0.671442	1.891734	-0.304551	-0.347047	1.133762
	0.3807	0.1083	0.5443	0.0307	0.0145	0.3734	0
India	-0.00801	-0.065055	-2.491554	1.684039	-0.098009	-0.681819	3.707189
	0.0278	0.2864	0.3138	0.8039	0.1473	0.3557	0

Table nº2

Adjustment via prices

	a_1	a_2	α_1	ε	a_3	α_2	π
Spain	0.034	-0.272	0.225	2.52	-0.063	-0.272	4.391
Porb	0.01	0.009	0.7	0	0.6	0.8	0.03
United K.	-0.005	-0.149	0.231	1.307	-0.199	0.014	1.465
	0	0.06	0.2	0	0.12	0.9	0
Italy	0.045	-0.862	0.138	1.856	-0.357	0.059	1.8
	0	0	0.01	0	0.02	0.7	0
Germany	-0.006	-0.286	0.194	1.649	-0.755	0.18	1.978
	0	0.02	0.11	0	0	0	0
France	0.0008	-0.437	0.196	1.865	-0.495	0.098	2.142
	0	0	0.01	0	0	0.14	0
Brasil	0.027345	-0.10029	-0.058858	0.792117	-0.22003	0.022428	1.326391
	0.0485	0.2554	0.2864	0.5463	0.0201	0.1711	0
México	0.009114	-0.441962	0.033026	1.987544	-0.096685	0.093826	2.220505
	0.0002	0.0115	0.0149	0	0.0263	0.1723	0
Morocco	-0.016178	-0.128462	-0.513805	1.839885	-0.321054	-0.026772	0.914735
	0.3221	0.1412	0.3612	0.0008	0.0374	0.8927	0
Japan	-0.049687	-0.020527	6.401917	11.28849	-0.281775	0.124438	1.731517
	0	0.6552	0.655	0.5636	0.0038	0.1877	0
Korea	0.03991	-0.017069	10.17133	33.57145	0.115525	1.401509	1.777027
	0.1763	0.8355	0.839	0.8079	0.7448	0.7973	0.3439
Tailand	-0.023455	-0.082289	0.671442	1.891734	-0.304551	-0.347047	1.133762
	0.3807	0.1083	0.5443	0.0307	0.0145	0.3734	0
India	-0.00801	-0.065055	-2.491554	1.684039	-0.098009	-0.681819	3.707189
	0.0278	0.2864	0.3138	0.8039	0.1473	0.3557	0

Table 3

Results Thirwall's Law
y=a+by'+e

	Spain	German	France	Italy	UK	Brazil	Mexico	Korea	India	Japan	Thailand	Morocco
A	**0.02**	***0.008***	***0.005***	***0.001***	***0.001***	***0.003***	***0.01***	**0.007**	**0.06**	***0.003***	**0.04**	**0.04**
Prob t	0.03	0.3	0.3	0.8	0.8	0.8	0.4	0	0.001	0.7	0	0.04
B	***0.74***	***0.074***	***0.89***	***0.91***	***0.75***	2.4	***1.05***	0.01	1.05	***0.7***	0.41	0.03
Prob t	0.003	0.02	0	0.0004	0.0008	0.002	0.003	0.3	0.09	0.0002	0	0.2
Wald Test B=1	0.5	0.4	0.5	0.7	0.2	0.06	0.8	0	0.002	0.2	0.0002	0.0000013
R-Cuadr.	0.48	0.26	0.61	0.31	0.38	0.25	0.21	0.02	0.8	0.32	0.41	0.25
d-w	1.7	2.1	2.1	2.1	2	2.1	2	1.8	1.8	1.8	1.8	1.9

APPENDIX 1.- VECTOR ERROR CORRECTION ESTIMATES OF EXPORT AND IMPORT FUNCTIONS

DEVELOPED COUNTRIES

GERMANY

$$\dot{x}_t = -8.519 - \underset{(14.51)}{0.059}{}^* T + \underset{(25.34)}{3.405}{}^* \dot{y}^*_{t-1}$$

$$\dot{m}_t = 10.069 - \underset{(5.81)}{0.038}{}^* T + \underset{(13.43)}{3.539}{}^* \dot{y}_{t-1}$$

SPAIN

$$\dot{x}_t = -3.604 - \underset{(1.59)}{0.06}{}^* T + \underset{(1.63)}{2.315}{}^* \dot{y}^*_{t-1}$$

$$\dot{m}_t = -4.03 + \underset{(23.814)}{1.863}{}^* \dot{y}_{t-1}$$

FRANCE

$$\dot{x}_t = -5.04 - 0.029 * T + \underset{(11.70)}{0.124}{}^* q_{t-1} + \underset{(82.94)}{2.233}{}^* \dot{y}^*_{t-1}$$

$$\dot{y} = -1.799 - \underset{(1.972)}{0.41}{}^* q_{t-1} + \underset{(14.295)}{1.803}{}^* \dot{y}_{t-1}$$

ITALY

$$\dot{x}_t = -1.764 + \underset{(19.24)}{1.374}{}^* \dot{y}^*_{t-1}$$

$$\dot{m}_t = -32.28 + \underset{(17.684)}{8.422}{}^* \dot{y}_{t-1}$$

UNITED KINGDOM

$$\dot{x}_t = -3.918 + \underset{(4.62)}{1.893}{}^* \dot{y}^*_{t-1}$$

$$\dot{m}_t = -0.761 + \underset{(4.47)}{1.124}{}^* \dot{y}_{t-1}$$

UNDEVELOPED COUNTRIES

BRASIL

$$\dot{x}_t = 3.388 + \underset{(7.74)}{1.546}{}^{*}\, q_{t-1} + \underset{(17.78)}{2.023}{}^{*}\, \dot{y}^{*}_{t-1}$$

$$\dot{m}_t = -7.299 - \underset{(5.67)}{0.662}{}^{*}\, q_{t-1} + \underset{(18.92)}{2.386}{}^{*}\, \dot{y}_{t-1}$$

INDIA

$$\dot{x}_t = -41.77 + \underset{(2.85)}{10.40}{}^{*}\, \dot{y}^{*}_{t-1}$$

$$\dot{m}_t = -6.32 + \underset{(2.68)}{0.230}{}^{*}\, T + \underset{(1.64)}{0.263}{}^{*}\, \dot{y}_{t-1}$$

MEXICO

$$\dot{x}_t = -7.66 - \underset{(15.12)}{0.051}{}^{*}\, T + \underset{(28.91)}{3.149}{}^{*}\, \dot{y}^{*}_{t-1}$$

$$\dot{m}_t = -5.66 + \underset{(2.48)}{2.343}{}^{*}\, \dot{y}_{t-1}$$

MOROCCO

$$\dot{x}_t = -12.29 + \underset{(2.55)}{3.794}{}^{*}\, \dot{y}^{*}_{t-1}$$

$$\dot{m}_t = -12.26 + \underset{(8.69)}{3.817}{}^{*}\, \dot{y}_{t-1}$$

TAILAND

$$x_t = -16.78 + \underset{(28.91)}{4.717}{}^{*}\, y^{*}_{t-1}$$

$$m_t = -0.583 + \underset{(35.11)}{1.075}{}^{*}\, y_{t-1}$$

APPENDIX 2.- REGRESSIONS BETWEEN ACTUAL GROWTH AND EXTERNAL CONSTRAINED GROWTH. COUNTRY BY COUNTRY

DEVELOPED COUNTRIES

GERMANY

$$\dot{y} = \underset{(0.70)}{0.762} + \underset{(2.35)}{0.782} * \dot{y}_{DM} \quad R^2 = 0.21$$

$$\dot{y} = \underset{(0.48)}{0.762} + \underset{(2.38)}{0.677} * \dot{y}_{VEC} \quad R^2 = 0.25$$

SPAIN

$$\dot{y} = \underset{(2.207)}{2.324} + \underset{(1.60)}{0.737} * \dot{y}_{DM} \quad R^2 = 0.48$$

$$\dot{y} = \underset{(2.02)}{2.32} + \underset{(1.61)}{0.34} * \dot{y}_{VEC} \quad R^2 = 0.48$$

FRANCE

$$\dot{y} = \underset{(1.38)}{0.826} + \underset{(4.6)}{0.765} * \dot{y}_{DM} \quad R^2 = 0.60$$

$$\dot{y} = \underset{(4.96)}{2.53} + \underset{(2.17)}{0.153} * \dot{y}_{VEC} \quad R^2 = 0.35$$

ITALY

$$\dot{y} = \underset{(0.177)}{0.1583} + \underset{(3.92)}{0.902} * \dot{y}_{dm} \quad R^2 = 0.31$$

$$\dot{y} = \underset{(0.17)}{0.158} + \underset{(3.92)}{5.602} * \dot{y}_{VEC} \quad R^2 = 0.31$$

UNITED KINGDOM

$$\dot{y} = \underset{(0.133)}{0.106} + \underset{(3.21)}{0.718} * \dot{y}_{DM} \quad R^2 = 0.37$$

$$\dot{y} = \underset{(0.133)}{0.106} + \underset{(3.21)}{0.380} * \dot{y}_{VEC} \quad R^2 = 0.37$$

UNDEVELOPED COUNTRIES

BRASIL

$$\dot{y} = \underset{(-0.08)}{0.146} + \underset{(3.73)}{2.2836} * \dot{y}_{DM} \qquad R^2 = 0.31$$

$$\dot{y} = \underset{(4.78)}{4.680} + \underset{(0.20)}{0.0189} * \dot{y}_{VEC} \qquad R^2 = 0.08$$

INDIA

$$\dot{y} = \underset{(5.79)}{6.053} - \underset{(-1.71)}{1.055} * \dot{y}_{DM} \qquad R^2 = 0.08$$

$$\dot{y} = \underset{(4.94)}{5.88} - \underset{(-1.34)}{0.01} * \dot{y}_{VEC} \qquad R^2 = 0.06$$

MEXICO

$$\dot{y} = \underset{(1.03)}{1.512} + \underset{(0.29)}{1.009} * \dot{y}_{DM} \qquad R^2 = 0.29$$

$$\dot{y} = \underset{(1.03)}{1.512} + \underset{(2.48)}{0.674} * \dot{y}_{VEC} \qquad R^2 = 0.29$$

MOROCCO

$$\dot{y} = \underset{(2.17)}{2.87} + \underset{(0.92)}{0.180} * \dot{y}_{DM} \qquad R^2 = 0.19$$

$$\dot{y} = \underset{(2.17)}{2.876} + \underset{(0.92)}{0.365} * \dot{y}_{VEC} \qquad R^2 = 0.19$$

TAILAND

$$\dot{y} = \underset{(5.12)}{4.395} + \underset{(5.20)}{0.475} * \dot{y}_{DM} \qquad R^2 = 0.40$$

$$\dot{y} = \underset{(5.121)}{4.395} + \underset{(5.20)}{0.1809} * \dot{y}_{VEC} \qquad R^2 = 0.40$$

RESULTS FROM PANEL DATA

ALL COUNTRIES

$$\dot{y} = \underset{(4.48)}{2.575} + \underset{(3.73)}{0.451} * \dot{y}_{DM} \qquad R^2 = 0.20$$

$$\dot{y} = \underset{(7.98)}{3.45} + \underset{(2.96)}{0.116} * \dot{y}_{VEC} \qquad R^2 = 0.15$$

DEVELOPED COUNTRIES

$$\dot{y} = \underset{(1.65)}{0.651} + \underset{(7.86)}{0.856} * \dot{y}_{DM} \qquad R^2 = 0.27$$

$$\dot{y} = \underset{(6.38)}{2.214} + \underset{(3.93)}{0.248} * \dot{y}_{VEC} \qquad R^2 = 0.09$$

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$$\dot{y} = \underset{(4.208)}{3.517} + \underset{(3.61)}{0.604} * \dot{y}_{DM} \qquad R^2 = 0.16$$

$$\dot{y} = \underset{(7.641)}{4.925} + \underset{(2.217)}{0.109} * \dot{y}_{VEC} \qquad R^2 = 0.08$$

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