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INFLATION AND TRADE OPENNESS REVISED: AN ANALYSIS USING PANEL DATA

Adolfo Sachsida[1]
Mário Jorge Cardoso de Mendonça[2]

1. Da Universidade Católica de Brasília. E-mail: <sachsida@pos.ucb.br>.
2. Do Instituto de Pesquisa Econômica Aplicada. E-mail: <mjorge@ipea.gov.br>.

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SUMÁRIO

SINOPSE

Neste artigo é estimada a relação entre inflação e abertura comercial [e.g., Romer (1993)] usando a metodologia de dados em painel. A vantagem desse método é a possibilidade de testar com maior grau de acuidade a hipótese sugerida por Terra (1998) de que a relação negativa entre abertura e inflação se deve à presença, na amostra, de países severamente endividados durante o período da crise da dívida externa. Os resultados econométricos dão suporte aos achados de Romer (1993), mostrando que a relação negativa entre abertura comercial e inflação não está restrita a um subconjunto de países e nem a um específico período de tempo.

ABSTRACT

In this article we estimate the relationship between inflation and trade openness [e.g., Romer (1993)] using modern panel data techniques. The advantage here is that we are able to explicit test the hypothesis proposed by Terra (1998) that the negative relationship between openness and inflation is due to severely indebted countries in the debt crisis period. The econometric results give support to Romer (1993) showing that the negative relationship between inflation and openness are neither restrict to a subset of countries or a time period.

1 INTRODUCTION

The main point raised by Romer (1993) is that upon verifying the correlation between inflation and openness the theory of temporal consistency is also being verified. That is, in countries where independent central banks operate or have credibility, there shouldn't be any relationship between inflation and openness. However, in countries which do not have independent monetary authorities, the openness would act to "brake" the incentive of the government in generating inflation. Thus, in these countries, a negative relationship between inflation and trade openness would be expected.

It is interesting to note that the majority of works that deal with this subject are cross-section analyses, and adopt the average of the variables under study in diverse countries to verify the relationship between inflation and openness. In this way, more sophisticated statistical techniques for data grouping are left aside. For example, the methodology of panel data seems to be much more appropriate for dealing with this problem. It allows the verification of the occurrence of changes in variable relationships over a period of time. Moreover, such methodology also permits the verification of the existence of effects which are characteristic of certain countries. In this sense, this procedure is perfect to test the hypothesys proposed by Terra (1998), that is, the negative correlation between openness and inflation is characteristic of severely indebted countries during the debt crisis period, but can not be extended to other set of countries or time periods.

It is important to note that this literature has been receiving new contributions and new explanations for the negative correlation between openness and inflation are being proposed. For Lane (1997) the conventional explanation of the influence of openness on inflation—that a more open country has less to earn with the generation of a "surprise" inflationary condition due to the deterioration of the exchange terms—is limited, because it only applies to countries big enough to affect the international structure of relative prices. Thus, the author considers another transmission link to explain the relationship between inflation and openness. Such explanation suggest the existence of imperfect competition and the presence of rigid nominal prices in the nontradable sector.

Adopting a game theory approach, Cavallari (2001) inserts the relationship between trade openness and inflation within a model characterized by monopolistic production, in the domestic sector of the economy, and a market of unionized work. The result of the theoretical model is that trade openness can affect inflation in a positive or negative manner. The final result depends on the level of concentration of wage bargaining in the country. The author estimated cross-section regressions (for period 1973-1988) as well as panel data (for years 1980, 1990 and 1994) for 19 countries of the OCDE. The econometrical results indicated that in the countries where wage bargaining is concentrated there is no relationship between the trade openness and inflation. However, in countries where the wage bargaining is decentralized there is a negative relationship between openness and inflation.

Estimating a panel for 146 countries in the period 1973-1998, Alfaro (2001) includes both a fixed effect of a country and as a time effect in the regression between openness and inflation. The results indicate that, in the short run, there is no

influence of trade openness on the inflation level. On the other hand, it is shown that, in the short run, a fixed exchange rate is an important factor to reduce inflation. In relation to the long run period, the author concludes that a negative and statistically significant relationship exists between trade openness and inflation.

Temple (2002) tries to establish a link between trade openness and the inclination of the Phillips'curve. The intuition that the inclination of the Phillips' curve is related to the opening is based on models of small economies opened in nominal rigidity. In such models, unanticipated monetary expansions typically lead to the real depreciation of the currency, which can cause two effects in trade-off between inflation and product. First, when inflation is measured in terms of prize indexes to the consumer, the effect of depreciation in the domestic prices of imported goods will be added to the inflationary costs of a monetary expansion. Second, if the wages are partially indexed to the IPC, or if the foreign goods are used as intermediate input in the domestic production, new costs must be computed to the responsibilities of the monetary expansion. Whith this in mind, it seems correct to assume that the product profit gained from a monetary expansion will be reduced. These two arguments imply that the Phillips' curve will be more inclined in open relatively economies. Still, Temple (2002) finds little evidence of the correlation between trade openness and the standard measures of trade-off between product and inflation.

Bowdler (2003) uses cross-section data for 20 countries, to test the hypothesis that short term inclination of the Phillips' curve varies positively with trade openness. The main conclusion of this study is that, if the cambial regimen is taken into consideration, the degree of trade openness in a country exerts a positive and robust effect (on?) in the inclination of the Phillips' curve. Bowdler proposes two explanations for the fact that his conclusion is the opposited Temple's (2002): *a*) a new measure of the inclination of the Phillips' curve is used; and *b*) the interaction between trade openness and the cambial regimen adopted by the country is explicitely considered. In an interesting manner, Bowdler (2003) rejects the explanation of Romer (1993) for the negative relationship between openness and inflation. The results of Bowdler give some support to the explanation proposed by Taylor (2000). That is, the negative relationship between openness and inflation is due to a moderate degree of pass-through of the exchange rate to the inflation.

According to Bleaney (1999) the negative correlation between inflation and openness found in some cross-section studies was a characteristic phenomenon of the 1970's and 1980's. However, such a correlation disappeared in the decade of 1990.

As can be seen in the previous paragraphs, we can infer that the correlation between openness and inflation has both country and time specific effects. In this way, the use of panel data methodology sounds like the best way to drive inferences about the relation of these two variables.

This article's main objective is the reestimation of the model proposed by Romer (1993), making use of modern panel data techniques. With new evidence propitiated by this approach we are able to confirm the predictions of Romer, showing that the negative correlation between inflation and trade openness is not

restricted to a subset of countries nor a time period. In the next section we describe the dataset and the econometric results. Section 3 concludes the article.

2 ECONOMETRIC RESULTS

The data used in this study were obtained from Summers and Heston (1988), and consist of a total of 152 countries in the period of 1950-1992.[1] Such as in Romer (1993), the following model was estimated:

$$\text{Log of inflation}_{it} = \alpha_\iota + \beta_\iota \text{ openness}_{it} \quad (1)$$

Where subscript i represents country i and t the time. Moreover α is the constant (subscript ι indicates that it can be different for each group of countries) and β is the inclination coefficient (again, it is allowed that this parameter be distinct for each group of countries). Log of the inflation is the natural logarithm of change in the implicit deflator of the GDP. The degree of openness is measured as the rate of the importations in relation to the GDP. The countries have been grouped in 7 distinct groups, in the following way: Group 1: Africa; Group 2: North and Central America; Group 3: South America; Group 4: Asia; Group 5: Europe; Group 6: Oceania; and Group 7: countries pertaining to the OCDE.[2]

In the present work, the estimate between trade openness and inflation by models of panel data are the great advantage in relation to estimates by cross-section or time series because it makes test hypothesis on specific groups of countries possible. Thus we can explicitly test the idea proposed by Terra (1998) stating that the negative relationship between inflation and openness can only be verified in the debt crisis period of 1982-1990 in severely indebted countries.

To verify the order of integration of the series, the tests of unitary root proposed by Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003) were carried out. Moreover, such tests were carried out for different numbers of lags and different deterministic components.[3] As a set, the results were shown to be robust in rejecting the null hypothesis of unity root in the series of logarithm of inflation (Linf) and trade openness. As one can observe in Table 1, the tests of Levin, Lin and Chu (LLC) and Im, Pesaran and Smith (IPS) always reject the null hypothesis of unity root to a level of at least 10% of statistical significance. We may then conclude that both variables are integrated of order zero (I(0)).

1. They can be accessed on the Internet at the address <http://pwt.econ.upenn.edu>.

2. The countries belonging to OCDE were taken from their group of geographical location. Thus, for example, the United States belongs to Group 7 (OCDE) and not to Group 2 (North and Central America).

3. This procedure is important, because just as in the tests of unitary root for temporary series, the choice of the number of lags and of the deterministic components can alter the result of the test.

TABLE 1
TESTS OF UNITY ROOT[a]

Test	Lags	With constant (without constant)	
		Linf	Openness
LL	0	Reject to 1% (reject to 1%)	Reject to 1% (reject to 10%)
	1	Reject to 1% (reject to 1%)	Reject to 1% (reject to 10%)
	2	Reject to1% (reject to 1%)	Reject to 1% (reject to 10%)
	3	Reject to1% (reject to1%)	reJect to 1% (reject to 10%)
	4	Reject to1% (reject to 1%)	Reject to 1% (reject to 10%)
	5	Reject to 1% (reject to 1%)	Reject to 1% (reject to 10%)
IPS	0	Reject to 1%	Reject to 1%
	1	Reject to 5%	Reject to 1%
	2	Reject to 5%	Reject to 1%
	3	Reject to 5%	Reject to 1%
	4	Reject to 10%	Reject to 1%
	5	Reject to 5%	Reject to 1%

[a] Reject the null hypothesis implies the rejection of the occurrence of a unity root in the series.

Once the question of the order of the integration of the series is decided, the next step is the choice between the model of fixed effects or random effects. In this study, this choice is made on the basis of the test proposed by Wu-Hausman. In this way, the Wu-Hausman test was carried out for 4 distinct specifications. In the first, the test was applied directly to equation (1), in the second equation (1) was added with 7 regional dummies, in the third equation (1) was added with logarithm of the real GDP per capita, and in the fourth both regional dummies and the logarithms of the per capita real GNP, had been added to equation (1). In all the four specifications the null hypothesis was rejected to a level of 1% of significance. This suggests that perhaps the estimator of fixed effect is more appropriated to this estimation that the estimator of random effect. However, had the computational easiness, this article will go in such a way to present the results estimated for both models.[4]

Several equations had been estimated making use of different estimators.[5] The idea of this procedure is to verify the robustness of the econometric results. As it can be seem in Table 2, the results are extremely robust, and in practically all cases, we find a negative and statistically significant relation between inflation and trade openness, supporting the results of Romer (1993).[6]

4. For reasons of space economy the tests of Wu-Hausman are not reported in the article. However, they can be obtained directly with the authors.

5. A good description of the advantages and restriction to the uses of each estimator used in this article can be obtained in Baltagi (1995) and Greene (2002).

6. The result of the Breusch-Pagan test indicated the rejection of the null hypothesis that the simple pooling specification is corrected. In this way, pooled OLS is biased and inconsistent. This result indicates that we should use panel data estimators and not the OLS estimator [Wooldridge (2003, p. 439-441) and Baltagi (1995, p. 60-62)]. The result of the Breusch-Pagan test can be obtained from the authors upon request.

TABLE 2
BASIC RESULTS[a]

	Fixed effects within	Random GLS	Effects between	ML	GEE	AR(1)
Constant	4.2115	4.1819	4.0152	4.1829	4.1799	4.2855
	(0.0152)	(0.0355)	(0.0576)	(0.0365)	(0.0351)	(0.0366)
Openness	–0.0018	–0.0015	0.0013[b]	–0.0015	–0.0015	–0.0032
	(0.0002)	(0.0002)	(0.0008)	(0.0002)	(0.0002)	(0.0002)
	Fixed effects within AR(1)	Random HH	Effects GLS sa	AR(1) th	Arelano Bond	Arelano Bond ro
Constant	4.3253	4.2151	4.1809	4.2817	0.0009	0.0009[b]
	(0.0029)	(0.0607)	(0.0346)	(0.0361)	(0.0004)	(0.0006)
Openness	–0.0039	–0.0047	–0.0015	–0.0031	–0.0028	–0.0028
	(0.0003)	(0.0014)	(0.0002)	(0.0002)	(0.0003)	(0.0008)

[a] The values between parentheses are standard-deviations of the variables: ML is the estimator of maximum likelihood; GEE is the population-averaged estimator; AR(1) is the GLS estimator with a structure of autoregressive errors of the first order calculated by the procedure of Durbin-Watson; Within AR(1) is the estimator Within with a structure of autoregressive errors of the first order calculated by the procedure of Durbin-Watson; HH is the estimator of Hildreth-Houck; GLS sa is the GLS estimator corrected for small samples; AR(1) th is the same as AR(1) by used the procedure of Theil instead of Durbin-Watson; Arelano-Bond is the estimator of Arelano-Bond (note that in this case the dependent variable is the first difference of the openness); and Arelano-Bond ro estimates a matrix of robust variance-covariance of the parameters. Moreover, a series of other procedures were estimated which included the verification of heterocedastics residues, two-step procedures for the calculation of the estimators etc. However, all these procedures showed similar results to those described in Table 2. Therefore they had not been reported. However, such results can be directly acquired from the authors.

[b] Insignificant variable to the level of 5% of statistical significance.

To facilitate the comparison of our study with Romer (1993), Table 3 includes the variable logarithms of the real GDP per capita (LGDPpc) and 7 regional dummies in equation (1). Thus, Tables 2 and 3 can be compared with Table 1 of Romer (1993). Again, practically all the estimators point to a negative relationship between inflation and trade openness. As the results are qualitatively similar, we will restrict ourselves to displaying only the results of the following estimators: Within, GLS, Between, ML and GEE. For the more curious reader, the remaining results can be directly obtained from the authors.

TABLE 3
ADDITIONAL RESULTS[a]

	Fixed effects within	Random GLS	Effects between	ML	GEE
Constant	3.7185	3.5450	2.3936	3.5738	3.5451
	(0.0943)	(0.0908)	(0.2259)	(0.0938)	(0.0948)
Openness	–0.0025	–0.0022	–0.0001[b]	–0.0023	–0.0022
	(0.0003)	(0.0002)	(0.0007)	(0.0003)	(0.0003)
LGDPpc	0.0691	0.0890	0.2187	0.0855	0.0890
	(0.0130)	(0.0120)	(0.0301)	(0.0122)	(0.0125)
Dummy	no	no	no	no	no
Constant	–	3.3592	2.1358	–	–
		(0.1590)	(0.3494)		
Openness	–	–0.0021	0.0004[b]	–0.0021	–0.0020
		(0.0003)	(0.0007)	(0.0003)	(0.0003)
LGDPpc	–	3.3592	0.2643	0.0795	0.0833
		(0.1590)	(0.0426)	(0.0127)	(0.0133)
Dummy	–	yes	yes	yes	yes

[a] The values between parentheses are the standard-deviations of the variable.

[b] Insignificant variable to the level of 5% of significant statistics.

To achieve a more similar sample period with Romer, our sample will be reduced and will begin in 1973 and go to 1992. Besides this, we will remove all the centrally-planned economies from the sample.[7] Thus, this new sample consists of 113 countries.[8] Table 4 presents the estimated results for this restricted sample. Once again, practically all the estimators indicate a negative and significant relationship between trade openness and inflation.

TABLE 4
ADDITIONAL RESULTS FOR THE RESTRICTED SAMPLE[a]

	Fixed effects within	Random GLS	Effects between	ML	GEE
Constant	4.4152	4.3362	3.9745	4.3527	4.3510
	(0.0304)	(0.0494)	(0.0748)	(0.0547)	(0.0539)
Openness	–0.0043	–0.0032	0.0018	–0.0034	–0.0034
	(0.0004)	(0.0003)	(0.0008)	(0.0004)	(0.0004)

[a] The values between parentheses are the standard-deviations of the variable.

Following the same previous procedure, we will now add the effect of the logarithm of real GIP per capita and some regional variable dummies to the above estimates. This result is reported in Table 5. The negative relationship between inflation and trade openness predominates once again.

TABLE 5
ADDITIONAL RESULTS FOR THE RESTRICTED SAMPLE[a]

	Fixed effects within	Random GLS	Effects between	ML	GEE
Constant	3.5690	2.6562	1.9281	2.7928	2.7900
	(0.2837)	(0.1884)	(0.2419)	(0.2136)	(0.2047)
Openness	–0.0048	–0.0035	0.0002[b]	–0.0039	–0.0039
	(0.0004)	(0.0003)	(0.0007)	(0.0004)	(0.0003)
LGDPpc	0.1100	0.2145	0.2717	0.2001	0.2004
	(0.0367)	(0.0240)	(0.0311)	(0.0269)	(0.0260)
Dummy	No	no	no	no	no
Constant	–	2.8086	1.4878	3.0546	3.0170
		(0.2707)	(0.4284)	(0.3001)	(0.2886)
Openness	–	–0.0032	0.0004[b]	–0.0036	–0.0036
		(0.0003)	(0.0007)	(0.0004)	(0.0004)
LGDPpc	–	0.2129	0.3310	0.1891	0.1928
		(0.0296)	(0.0481)	(0.0323)	(0.0313)
Dummy	–	yes	yes	yes	yes

[a] The values between parentheses are the standard-deviations of the variable.

[b] Insignificant variable to the level of 5% of significant statistics.

7. As in Romer (1993) the following un-centrally planned economies were also removed from the sample: Afghanistan, Angola, Chad, Guinea, Iraq, Mali and Mozambique.

8. The study of Romer includes 114 countries. Our sample excludes the country of Burma which is present in Romer's (1993) study.

Since we have verified the negative relationship between inflation and trade openness, we will now test the hypothesis proposed by Terra (1998) which states that such a relationship is due to the severely indebted countries during the period of the debt crisis (1982-1990). To make our work more similar to Terra (1998) we will restrict our sample to the 1973-1990 period. Also, as in Terra (1998), the 113 countries will be divided into 4 groups according to their degree of external indebtedness (severe, moderate, little and others). The classification of each country in its respective group follows the classification proposed by Terra (1998).[9]

We use three different sample periods to estimate the paremeters for each set of countries. The sample refers to: *a*) the full period (1973-1990); *b*) only the pre-debt crisis period (1973-1981); and *c*) the debt crisis period (1982-1990). Table 6 show these results for the fixed effects (within) estimator. Table 7 reports the same set of results but for the random effects (GLS) estimator.[10]

TABLE 6
TEST OF THE TERRA HYPOTHESIS—FIXED EFFECTS (WITHIN)[a]

	All		Severely indebted			Moderately indebted			Low indebted		Other countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Open	–0.004	–0.004	0.0005	–0.011	–0.006	–0.001	–0.010	–0.003	–0.001	–0.001	–0.003	–0.0003	–0.003
	(–9.5)	(–4.7)	(0.48)	(–7.9)	(–6.2)	(–1.4)	(–8.8)	(–4.6)	(–2.2)	(–1.4)	(–5.9)	(–0.6)	(–3.5)
Cons	4.407	4.321	4.161	4.492	4.125	3.993	4.232	4.320	4.287	4.106	4.873	4.681	4.920
	(141)	(71.4)	(58.4)	(57.3)	(75.1)	(63.9)	(65.4)	(69.3)	(53.1)	(40.1)	(108)	(104)	(49.3)
N	1988	616	315	301	516	261	255	368	187	181	488	238	250

[a] N is the size of the sample. The value between parentheses is the t-test. Column 1 represents the estimate for all the countries during the whole period (1973-1990); columns 2, 5, 8 and 11 are estimates for groups of countries for all the period; columns 3, 6, 9 and 12 represent the estimates for groups of countries for the period previous to the crisis of the debt (1973-1981); and columns 4, 7, 10 and 13 are estimates for groups of countries for the period of the debt crisis (1982-1990).

TABLE 7
TEST OF TERRA HYPOTHESIS—RANDOM EFFECTS (GLS)[a]

	All		Severely indebted			Moderately indebted			Low indebted		Other countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Open	–0.002	–0.003	–0.0003	–0.005	–0.004	–0.0005	–0.008	–0.002	–0.001	–0.001	–0.001	–0.0003	–0.001
	(–7.5)	(–4.1)	(–0.3)	(–5.0)	(–4.9)	(–0.5)	(–7.0)	(–4.1)	(–1.5)	(–1.4)	(–5.1)	(–0.9)	(–3.1)
Cons	4.327	4.257	4.213	4.184	4.040	3.933	4.097	4.283	4.219	4.099	4.781	4.685	4.694
	(88.1)	(59.3)	(46.9)	(55.8)	(46.8)	(42.9)	(41.6)	(46.5)	(43.5)	(34.5)	(96.8)	(88.6)	(87.0)
N	1988	616	315	301	516	261	255	368	187	181	488	238	250

[a] N is the size of the sample. The value between parentheses is the t-test. Column 1 represents the estimate for all the countries during the whole period (1973-1990); columns 2, 5, 8 and 11 are estimates for groups of countries for all the period; columns 3, 6, 9 and 12 represent the estimates for groups of countries for the period previous to the debt (1973-1981); and columns 4, 7, 10 and 13 are estimates for groups of countries for the period of the debt crisis (1982-1990).

9. The classification was based on the World Bank Development Report (1993, p. 328-329) and used standard definitions of the degree of indebtedness of the countries in the three year average (1989-1991).

10. The other estimators of random effects (MLE and GEE) present qualitatively similar results to the GLS estimator. To economize space they will not be reported here. However, they can be obtained directly from the authors.

In relation to the 13 regressions which appear both in Table 6 and 7, we must remember that: *a*) column 1 represents the estimate for all the countries during all the period (1973-1990); *b*) columns 2, 5, 8 and 11 are estimates for groups of countries for all the period; *c*) columns 3, 6, 9 and 12 represent the estimates for groups of countries for the period previous to the debt crisis (1973-1981); and *d*) columns 4, 7, 10 and 13 are estimates for groups of countries for the period of the debt crisis (1982-1990). With this, the test of the hypothesis proposed by Terra (1998) can be carried out by a simple t-test over the coefficient of openness in columns 3, 4, 6, 7, 9, 10, 12 and 13. In accordance with Terra (1998) the negative relationship between openness and inflation occurs only in the severely indebted countries, during the period of the debt crisis. Thus, in agreement with Terra (1998) the coefficient of openness should be negative and statistically significant only in column 4, being statistically insignificant in columns 3, 6, 7, 9, 10, 12 and 13.

Observing Table 6, we notice that the coefficients of openness are insignificant, at 5% of statistical significance, for columns 3, 6, 10 and 12, being significant and negative for column 4. Thus, the Terra hypothesis fails in explaining the behavior present in columns 7, 9 and 13. In relation to Table 7, the openness coefficients are insignificant in columns 3, 6, 9, 10 and 12, and significant and negative in column 4. With this, the Terra hypothesis fails to explain the behavior in columns 7 and 13.

The test of Wu-Hausman for the choice the model of fixed effects or the model of random effects was carried out for the 13 estimates present in Tables 6 and 7. Adopting a critical level of 5% of statistical significance, the Wu-Hausman test suggests the adoption of random effects for the models: 3, 9, 10 and 12. For the remaining models, Wu-Hausman test suggests the adoption of fixed effects.[11] Thus, we have that the negative relationship between inflation and openness must be rejected for models 3, 6, 9, 10 and 12. This indicates that the negative relationship between inflation and openness only occurs during the period of the debt crisis (1982-1990) and for the following group of countries: severely indebted, moderately indebted, and for the other countries. Notice that such results refutes the Terra hypothesis (1998) because, for the author, the negative relationship between openness and inflation must only occur in the severely indebted countries during the debt crisis.

To verify the robustness of these regressions we will include the logarithm of the real GDP per capita in these estimates and verify if the inclusion of this control instrument affects the coefficients of trade openness. Table 8 (fixed effects) and Table 9 (random effects) report these results.

In relation to Table 8, we notice that the openness coefficients are insignificant, at 5% of statistical significance, only for columns 3 and 6, being significant and negative for columns 4, 7, 9, 10, 12 and 13. Thus, the Terra hypothesis fails in explaining the behavior present in columns 7, 9, 10, 12 and 13. In relation to Table 9, the openness coefficients are insignificant in columns 3 and 6, being significant and negative in columns 4, 7, 9, 10, 12 and 13. With this, the Terra hypothesis fails in explaining the behavior present in columns 7, 9, 10, 12 and 13.

11. To economize space, the results of the Wu-Hausman tests were not presented in this article. However they can be obtained directly from the authors.

TABLE 8

NEW RESULTS—FIXED EFFECTS (WITHIN)[a]

	All	Severely indebted			Moderately indebted			Low indebted		Other countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Open	–0.004	–0.005	0.0008	–0.011	–0.005	–0.002	–0.009	–0.003	–0.003	–0.003	–0.003	–0.001	–0.005
	(–9.7)	(–5.4)	(0.75)	(–8.2)	(–5.4)	(–1.8)	(–8.2)	(–4.7)	(–3.1)	(–3.2)	(–6.5)	(–3.3)	(–6.3)
Lgdp	0.081	0.373	–0.121	0.558	–0.414	0.152	–0.511	0.072	0.165	0.599	0.118	0.439	0.932
	(2.1)	(3.7)	(–1.1)	(3.04)	(–5.7)	(1.4)	(–3.9)	(1.2)	(2.3)	(5.5)	(2.6)	(5.4)	(10.3)
Cons	3.776	1.639	5.02	0.444	7.147	2.896	7.994	3.773	3.056	–0.586	3.825	0.795	–3.64
	(12.7)	(2.2)	(6.5)	(0.3)	(13.5)	(3.7)	(8.2)	(8.5)	(5.7)	(–0.6)	(9.5)	(1.1)	(–4.3)
N	1988	616	315	301	516	261	255	368	187	181	488	238	250

[a] N is the size of the sample. The value between parentheses is the t-test. Column 1 represents the estimate for all the countries during the whole period (1973-1990); columns 2, 5, 8 and 11 are estimates for groups of countries for all the period; columns 3, 6, 9 and 12 represent the estimates for groups of countries for the period previous to the debt crisis (1973-1981); and columns 4, 7, 10 and 13 are estimates for groups of countries for the period of the debt crisis (1982-1990).

TABLE 9

NEW RESULTS—RANDOM EFFECTS (GLS)[a]

	All	Severely indebted			Moderately indebted			Low indebted		Other countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Open	–0.003	–0.003	–0.000	–0.005	–0.004	–0.0006	–0.007	–0.003	–0.002	–0.002	–0.001	–0.0007	–0.001
	(–8.5)	(–4.4)	(–0.0)	(–5.2)	(–4.3)	(–0.6)	(–6.7)	(–4.7)	(–2.8)	(–3.3)	(–5.2)	(–2.0)	(–3.0)
Lgdp	0.202	0.108	–0.096	0.098	–0.116	0.248	–0.060	0.134	0.174	0.424	0.103	0.321	0.655
	(8.2)	(1.86)	(–1.3)	(1.6)	(–2.0)	(3.9)	(–0.7)	(2.8)	(3.2)	(6.3)	(2.6)	(5.8)	(9.0)
Cons	2.741	3.486	4.900	3.485	4.864	2.108	4.532	3.246	2.920	0.783	3.805	1.760	–1.47
	(14.2)	(8.2)	(9.6)	(8.1)	(11.4)	(4.5)	(7.1)	(8.7)	(7.1)	(1.4)	(10.5)	(3.4)	(–2.1)
N	1988	616	315	301	516	261	255	368	187	181	488	238	250

[a] N is the size of the sample. The value between parentheses is the t-test. Column 1 represents the estimate for all the countries during the whole period (1973-1990); columns 2, 5, 8 and 11 are estimates for groups of countries for all the period; columns 3, 6, 9 and 12 represent the estimates for groups of countries for the period previous to the debt crisis (1973-1981); and columns 4, 7, 10 and 13 are estimates for groups of countries for the period of the debt crisis (1982-1990).

The test of Wu-Hausman for the choice between the model of fixed effects or the model of random effects was carried out for the 13 estimates present in Tables 8 and 9. Adopting a critical level of 5% of statistical significance, the Wu-Hausman test suggests the adoption of random effects for the models: 3, 9 and 10. For the remaining models, the test suggests the adoption of fixed effects.[12] Thus, we have that the negative relationship between inflation and openness must be rejected only for models 3 and 6. This indicates that the negative relationship between inflation and openness occurs in severely indebted countries and in the rest of the countries, during the period of the debt crisis and in the period previous to the debt crisis. Again, this result refutes the Terra hypothesis.

12. Seeking the space economy, the results of the tests of Wu-Hausman were not showed in this article. However they can be obtained directly with the authors.

3 CONCLUSION

The main objective of this article was to apply the panel data methodology to verify the hypothesis proposed by Romer (1993), which states a negative relationship between trade openness and inflation. The econometric results corroborates Romer's findings, showing great robustness to both different specifications and different time periods.

The hypothesis developed by Terra (1998), stating that the negative relationship between inflation and openness was due to severely indebted countries, during the debt crisis, was explicitly tested and rejected. It was shown that the negative relationship between inflation and openness occurs not just in the severely indebted countries, but in other groups of countries too, during the debt crisis period as well as in the period previous to the debt crisis.

In a summarized way, this study strengthens the results which Romer (1993 and 1998) presented, showing that a negative relationship between openness and inflation exists. Moreover, it was showed that such a relationship is not specific to any group of countries nor specific to a determined period of time. Thus, countries that experienced an increase of openness also observed a reduction in their levels of inflation.

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