

CAUSALITY INFLATION-RELATIVE PRICES: COMPARATIVE EVIDENCE FROM LATIN-AMERICA

Carlos Dabús*

Liliana Cerioni**

Abstract

In this paper we study the causality in the relation between inflation and relative price variability for six Latin-American countries with inflationary history: Argentina, Brazil, Peru, Mexico, Uruguay and Venezuela. The study is carried out in the framework of four inflationary regimes: moderate, high, very high and hyperinflation. There is a positive relation in most cases, with a systematic increase of price variability at higher inflation. Inflation volatility and the dummies that represent the regime of inflation are the best explanatory variables of relative price variability, while the causality analysis shows two main results: instantaneous causality and a Granger causality relation from inflation to price variability. In all cases the effect of inflation on relative prices is more significant in extreme inflation, so that the non-neutrality of inflation seems to be increasing with the level of inflation.

Resumo

Neste artigo nós estudamos a causalidade na relação entre a inflação e a variabilidade de preços relativos para seis países latinoamericanos com história inflacionária: Argentina, Brasil, Peru, México, Uruguai e Venezuela. O estudo se efetua em quatro regimes inflacionários: o de inflação moderada, alta, muito alta e hiperinflação. Há uma relação positiva na maior parte dos casos, com um aumento sistemático da variabilidade de preços em uma inflação mais alta. A volatilidade da inflação e das variáveis "dummy", que representam o regime da inflação, são os melhores fatores explicativos da variabilidade de preços relativos, enquanto a análise de causalidade mostra dois resultados principais: a causalidade instantânea e uma relação de causalidade tipo Granger da inflação até variabilidade de preços. Em todos os casos, o efeito da inflação nos preços relativos é mais significativa na inflação extrema, a fim de que a não-neutralidade da inflação pareça crescente com o plano da inflação.

* CONICET – Departamento de Economía – Universidad Nacional del Sur

** Departamento de Economía – Universidad Nacional del Sur, 12 de Octubre y San Juan - (8000) Bahía Blanca, Argentina, Tel: 54-291-4595138, Fax 4595139, e-mail: cdabus@criba.edu.ar

Key Words: Causality, Inflation, Relative Prices .

JEL Code: E0-E3 .

1. Introduction.

Latin American economy has had serious problems because of long periods of high inflation. Several economies have had poor performances during the high inflation episodes that took place from the seventies on. High inflation affected the price system thus disturbing the normal evolution of markets. The relation between inflation and relative price variability (RPV) is widely documented in the literature. From the seminal papers of Glesjer (1965) and Parks (1978), a lot of empirical evidence shows that RPV across different goods increases with the inflation rate. Rogent and Wang (1993) found, in an aggregated measure of relative prices, given by the ratio between wholesale price index and consumer price index (WPI/CPI), that the most important sources of relative price movements are disturbances of fundamentals, like output and monetary shocks. At a more disaggregated level, Domberger (1987) studied RPV within markets for U.K.; his intragood analysis referred to different goods within one activity heading. Van Hoomisen (1988) developed an intragood analysis for Israel, considering prices of the same good across different stores. Llach and Tsiddon (1992) analysed the effects of inflation on the dispersion of prices, using disaggregated data on prices of food-stuffs in Israel. Dabús (1994) studied RPV for Argentina for different inflation levels, finding that price variability is systematically higher at higher inflation levels. Debelle and Lamont (1997) tested the correlation of inflation and intermarket RPV in a cross-section of U.S. cities. They also found a positive relation between inflation and price variability.

However, some aspects have not been thoroughly explored. In

particular, it would be interesting to scrutinise the evidence of the “inflation-relative price variability” relation (from now on IN-RPV relation) on different high inflation countries. The results of this sort of analysis could be useful to test the persistence of the relation in a cross-country context. In fact, it could help to know if it really applies to any sort of country, independently of its inflationary history. Up to now, most of the literature has concentrated in looking for a positive and significant IN-RPV relation, without a previous analysis of the underlying causal direction, which would inform on the proper regressions to run, and would point out which hypothesis of inflation fits better: the one founded on the monetarist approach or the one based on the structuralist view. The first is more compatible with a causal direction from inflation to RPV, because it assumes the monetary origin of inflation, while the structuralism stands a causal direction from RPV to inflation, because monetary rigidities would provoke upward adjustments of prices, and so inflation. Moreover, the study of episodes of extreme inflation (very high and hyperinflation) can give interesting evidence about relative price behaviour in these situations.

To shed some light on those subjects, we analyse the IN-RPV relation for six Latin-American countries with inflationary history: Argentina, Brazil, Mexico, Peru, Uruguay and Venezuela. All these countries constitute illustrative cases and provide a rich experience, with several inflationary episodes over the history of the recent decades. In agreement with the previous consensus in the literature, a positive IN-RPV relation can be found in most cases, with a systematic increase of RPV at higher inflation. But this relation is specially clear, and the effects of inflation on RPV are more significant, in countries with episodes of extreme inflation. In spite of the persistence of a positive IN-RPV relation can be observed in all cases, it seems to be particularly relevant in more unstable experi-

ences, meaning that non-neutrality of inflation would be increasing with the level of inflation. Therefore, we distinguish between two kinds of countries. A first group includes those countries which have experienced several periods of extreme inflation (Argentina, Brazil and Peru, from now on higher inflation countries, or HIC). A second group includes countries which show an inflation rate oscillating between moderate and high inflation, but that haven't experienced extreme inflation episodes (Mexico, Uruguay and Venezuela, from now on lower inflation countries, or LIC).

The analysis is carried out in the framework of four inflationary regimes: moderate, high, very high inflation and hyperinflation. Following Leijonhufvud (1990) criterion we consider an economy to be in a moderate inflation regime when its monthly inflation rate (MIR) is lower than 2%; in a high inflation when the MIR belongs to the range 2%–10%, in a very high inflation regime when it belongs to the 10%–50% range. When the MIR exceeds 50% we consider the economy to be suffering an hyperinflation episode. Usually these inflation levels are related to certain features of economic behaviour. Unexpected inflation and the variability of both relative prices and inflation, systematically increases at higher inflation rates, especially when the economy enters hyperinflation.

All these regimes can be observed in Argentina, that belongs to the HIC group, Brazil only shows moderate, high and very high inflation and Peru high and very high inflation. Referring to the LIC group, we can see that Venezuela, Uruguay and Mexico exhibit only regimes of moderate and high inflation (table 1 in section 2 shows for these countries the time periods covered by each regime).

References to price data and the variables to be used for each country, as well as to the evolution of the inflation rate and RPV, can be found in the next section. Before considering the regressions analysis, in section 3 we analyse causality in the IN-RPV relationship,

and, based on the results of this analysis, we conclude that there is predominance of instantaneous causality and causal direction from inflation to RPV in most cases. From these results, in section 4 we run the regressions assuming RPV as the dependent variable, and inflation rate, its volatility and the components of expected and unexpected inflation as explanatory variables. Finally, in section 5 we discuss the main results and present the conclusions.

2. Data Description and RPV Measures.

Price data availability determined the level of aggregation of the analysis, for instance, more disaggregated individual prices are used for Argentina, Brasil, Peru and Venezuela, but as we have obtained the weights of these prices only for Argentina and Peru, for Brazil and Venezuela we use a non weighted RPV.

The argentine price series used to calculate the RPV measures have been extracted from the statistical bulletins of the Instituto Nacional de Estadísticas y Censos (INDEC), from January 1960 to November 1993. The individual price data, of monthly frequency, correspond to WPI items. Price data were quoted from the maximal level of disaggregation available, WPI groups, which are equivalent to three digits of the International Standard Industrial Classification. Since the classification of WPI in Argentina changed in July 1984, two different classifications are used. The first corresponds to the interval January 1960-June 1984, and includes 87 price indexes. The second classification contains the period July 1984-November 1993, and includes 64 price indexes.

For Peru we use 168 individual prices of the consumer price index (CPI) for the period January 1980-April 1994, extracted from the Instituto Nacional de Estadísticas (INEI). Price data are of monthly frequency, and they include changes of price weights in 1985, 1988 and 1989. For Brazil we use 52 individual prices of the WPI, for

the period February 1974- August 1996, which were obtained from the Getulio Vargas Foundation. In the case of WPI of Venezuela 60 annual individual prices were extracted for the period 1960-1989, from the Banco Central de Venezuela. From the CPI we extracted 39 annual individual prices for the period 1962-1989. For Uruguay we use 17 prices for the December 1982-December 1991 period, and 29 prices during the May 1992-November 1995 period, extracted from the Direccin General de Estadísticas y Censos. Finally, for Mexico we use 10 monthly individual prices of the CPI for the period January 1970-September 1995 (at level of subsectors of CPI) obtained from the Banco de Mejico.

In short, we use monthly frequency for all cases except for Venezuela, where we use annual frequency. The variables are the inflation rate (IN), a measure of inflation variability (DESVIN), which we define as the difference, in absolute value, between the inflation rate and a centred moving average of six periods (months) of inflation¹, as follows:

$$\text{DESVIN} = |\text{IN}_t - (1/7) * \sum_i (i = -3..3) [\text{IN}_{t-i}]|.$$

Expected inflation (INE) is the inflation rate forecasted by the agents for the current period and results from an AR(1) model of inflation rate, (a technique developed in Parks (1978)), calculated "by regime of inflation". We assume that agents make their inflationary expectations with their information set using an AR (1) forecasting

¹Except in Venezuela, where given the lack of observations we only include one (annual) lag, so that here

$$\text{DESVIN} = |\text{IN}_t - (1/3) * \sum_i [(i = -1..1) [\text{IN}_{t-i}]].$$

model of inflation. Then, such information is the monthly inflation rate of the previous period (technique developed in Parks (1978)), calculated “by regime of inflation”². Unexpected inflation (INO) is the forecasting error of inflation rate; it results from the difference between actual and expected inflation (see Table 1), and its absolute value (ABINO) reflects the magnitude of that forecasting error.

Finally, RPV is a measure of the *non-uniformity* of the percentage variation of individual prices relative to the average inflation rate (as originally pointed out in Theil (1967, cap. 5)). The total relative price variability (RPV) is obtained in quadratic terms, using the weighted sum of monthly inflation rate of individual prices, as follows

$$RPV_t = \frac{\sum_i W_i^* (IN_{it} - IN_t)^2}{(1 + IN_t)^2}$$

where w_i is the weight of price “ i ” in the price index, IN_{it} is the inflation rate of price “ i ” in t and IN_t is inflation rate in t .

2.1 Inflation and RPV Evolution.

In most countries the evolution of RPV is closely and positively associated with inflation (see figures 1 to 8). This fact appears to be particularly clear in the highest peaks of inflation of the more unstable economies. In Argentina RPV increases substantially in the inflationary accelerations of 1962, 1975-76, 1985 and 1991, and particularly in both hyperinflations of 1989-1990; in Peru in both hyperinflationary peaks of 1988 and 1990, and in Brazil in the jumps

²Besides, the AR(1) model adjusts better to forecast the current inflation than models with more lags. For an extended discussion on the advantages and limitations of these measures see Dabús (1993).

of inflation rate of 1985, 1987 and 1989-90. Besides, lower inflation periods also show the same association; for example RPV increases with the inflation jumps of 1980-81 and 1989. However, a closer positive relation between inflation and RPV can be found in HIC, and RPV reaches its highest values in the months of highest inflation, like in both hyperinflations of Argentina and Peru.

On the other hand, in some HIC, like Argentina and Brazil, we have two cases in which the prices seem to evolve in accordance with the general level of prices. One happens when inflation rate climbs gradually. Here we can see a decrease of RPV along time (for example in the 1981-85 period in Argentina, and in the 1991-94 period in Brazil). A "smooth" positive inflation trend allowed decreasing price variability. This could point out the close association between sharp fluctuations in the inflation rate and increases in RPV. The other case occurs in sustained states of price stability: in the moderate long term inflation of Argentina during the sixties and the nineties, from August 1994 on in Brazil, and, in Peru, from the 1990 stabilisation on, RPV is clearly lower than in any other part of the period. The evolution of RPV seems to point out that RPV is particularly related to inflation volatility in the HIC group, in which abrupt changes of inflation rate occur simultaneously with the highest price dispersion.

RPV increases with inflation, and the evolution of inflation rate seems to indicate that higher inflation states are associated with a more volatile and less predictable rate of inflation. This is more evident in terms of inflationary regimes (see tables in 1 to 3). In terms of average evolution by regime, inflation variability (DESVIN), the absolute value of unexpected inflation (ABINO) and RPV increase

systematically with the level of inflation in every countries, and particularly in the HIC. Therefore, higher inflation is also more volatile and less predictable, and this is associated to a higher RPV. This fact can be explained by more volatile agent's expectations, or by more erratic expenditures or price decisions made at higher inflation. The data suggest that price variability is associated with a significant component of "noise" in the economy at highest inflation. This seems to be reflected in large movements of relative prices taking place in hyperinflation. This is very clear in the highest peaks of inflation, and we find the highest values of these variables in the highest peaks of inflation and hyperinflation. For example, in the hyperinflationary peak of July 1989 in Argentina, and in August 1990 in Peru (see the last column of each table)³.

³(3) Moreover, the temporal aggregation of data implies an underestimation of the "true" price variability in high inflation, and fundamentally in hyperinflation. Therefore, the values obtained in these cases possibly underestimate the variability that really occurred. The other underestimation of RPV arises from more aggregated individual prices, so that the RPV of Uruguay and Mexico hide a higher RPV (for example Palerm (1990), for the Mexican case, verifies empirically that more temporal aggregated data and more aggregated prices produce a lower RPV).

Figure 1. Inflation and RPV, Argentina, WPI, 1960–1993

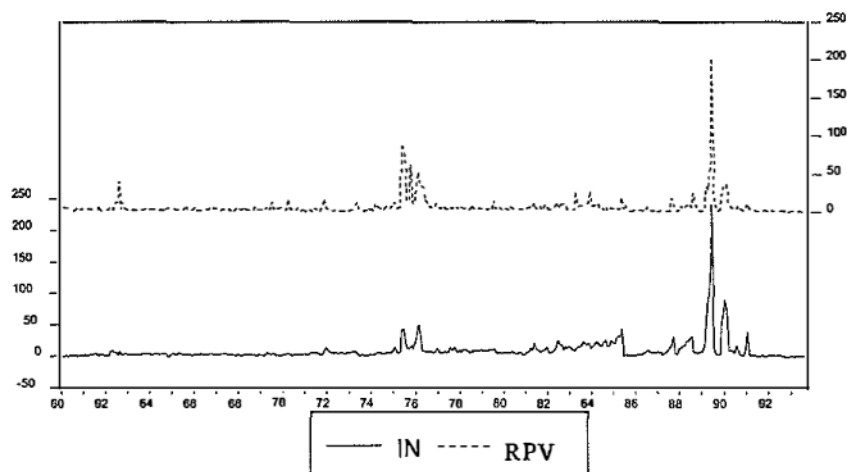


Figure 2. Inflation and RPV, Brazil, WPI, 1974–1996

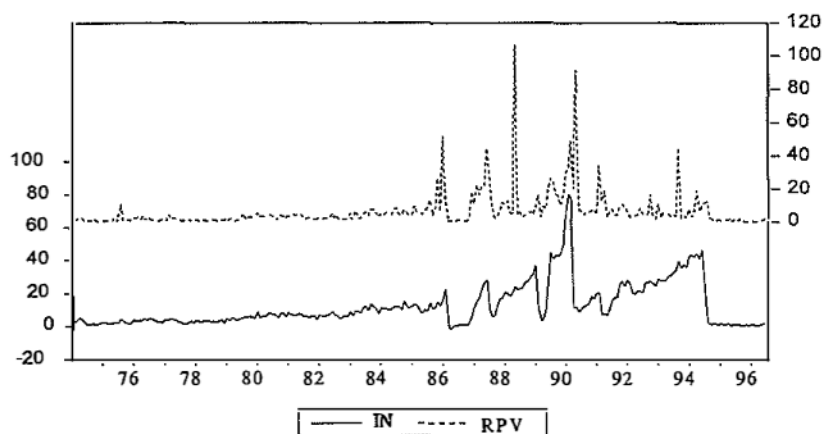


Figure 3. Inflation and RPV, Peru, CPI, 1980–1994

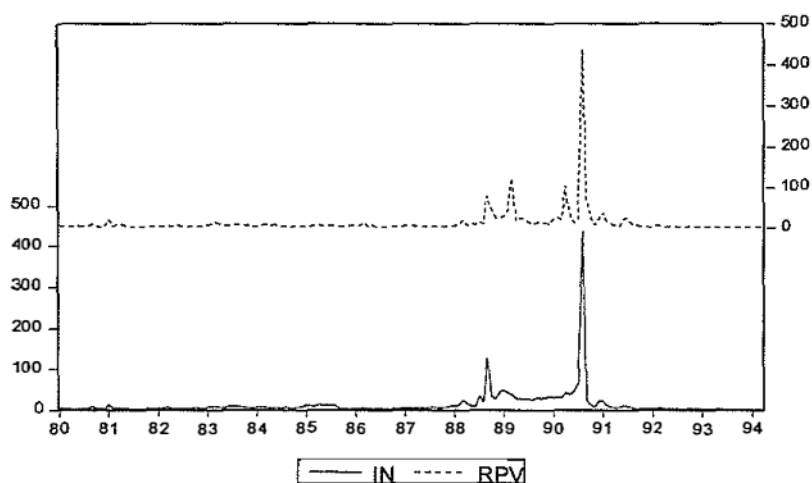


Figure 4. Inflation and RPV, Uruguay, WPI, 1983–1995

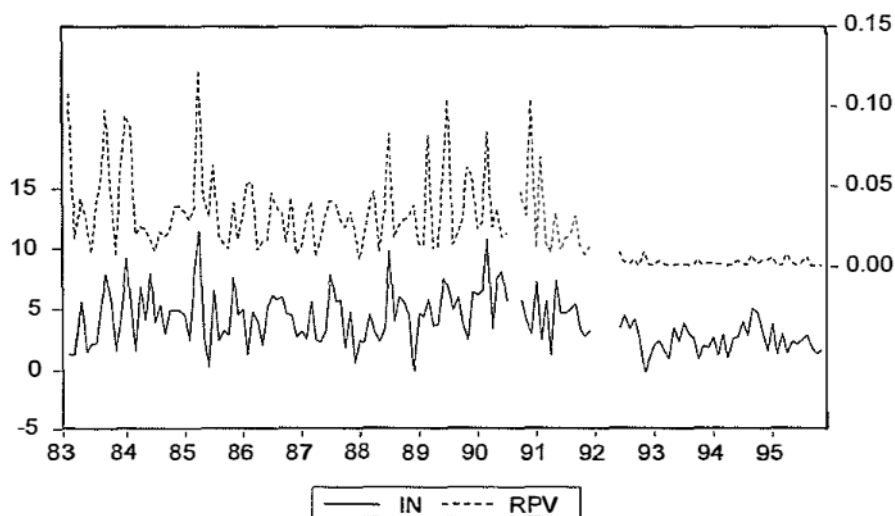
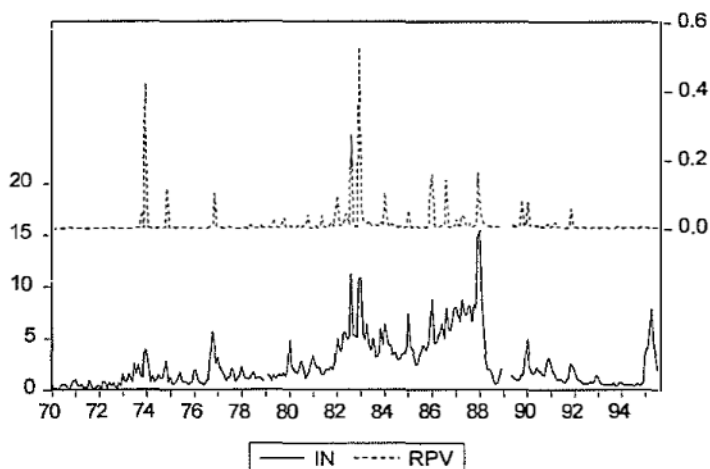
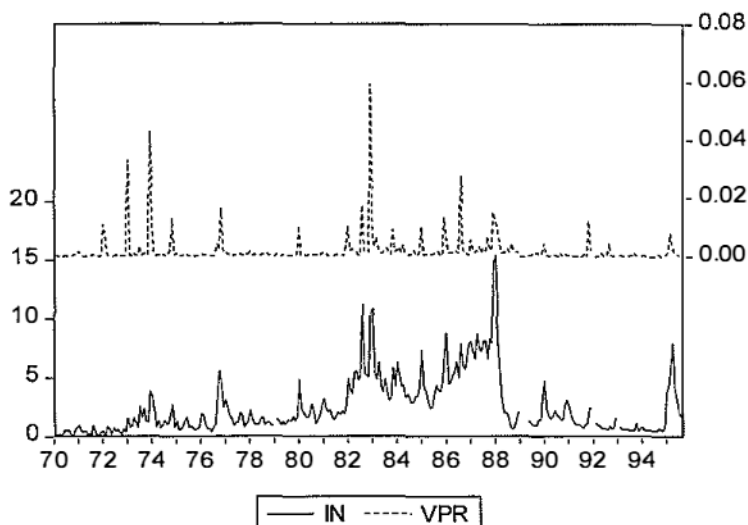


Figure 5. Inflation and RPV, Mexico, CPI, 1970–1995(*)



(*)The price data considered correspond to the consumer prices of goods grouped by their sector of production (agriculture, manufacture of foods and drinks, etc.).

Figure 6. Inflation and RPV, Mexico, CPI, 1970–1995(*)



(*)The price data considered correspond to the consumer prices of goods grouped by the type of expenditure (food and drink, garments, etc.).

Figure 7. Inflation and RPV, Venezuela, CPI, 1961–1989

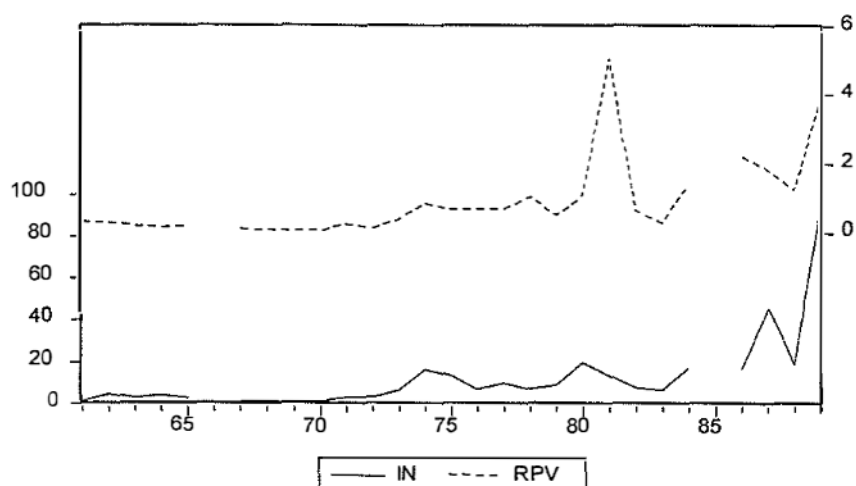


Figure 8. Inflation and RPV, Venezuela, CPI, 1963–1989

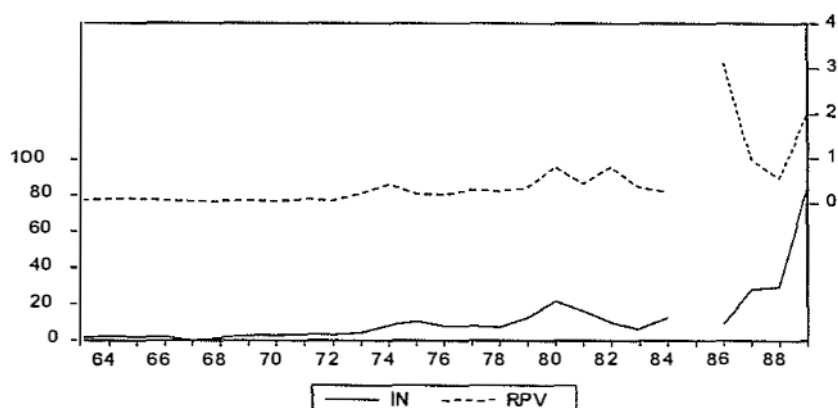


Table 1: Periods and Regimes of Inflation

Regimes/	Moderate	High Inflation	Very High	Hyperinflation
Country	Inflation	Inflation		
Argentina	1960.01-1970.04	1970.05-1975.01	1975.02-1976.04	1989.04-1989.07
	1991.04-1993.11	1976.05-1982.06	1982.07-1985.06	1989.12-1990.03
		1985.07-1987.06	1987.07-1988.08	
		1988.09-1989.03		
		1989.08-1989.11		
		1990.04-1991.03		
Brazil	1986.03-1986.11	1974.02-1982.12	1983.01-1986.02	
	1994.08-1996.08		1986.12-1994.07	
Peru		1980.01-1988.02	1988.03-1991.01	
		1991.02-1994.04		
Mexico(1)	1970.01-1980.12	1981.01-1988.04		
	1988.05-1995.09			
Mexico(2)	1970.01-1980.12	1981.01-1988.04		
	1988.05-1995.09			
Uruguay	1992.11-1995.11	1983.02-1992.10		
Venezuela	1963-1986	1987-1989		
CPI				
Venezuela	1961-1986	1987-1989		
WPI	1961-1986	1987-1989		

(*) This table shows the periods covered by each inflationary regime for all the countries considered.

(1) The price data considered correspond to the consumer prices of goods grouped by their sector of production (agriculture, manufacture of foods and drinks, etc).

(2) The price data considered correspond to the consumer prices of goods grouped by the type of expenditure (food and drink, garments, etc).

Table 2: HIC. Average Evolution of Inflation and RPV by Inflationary Regimes

Regimes	Total	Moderate	High	Very High	Hyper-	Peaks of
	Period	Inflation	Inflation	Inflation	Inflation	hyperinflation
Variables						
Argentina					July	
					1989	
(WPI)						
1960-1993						
IN	7.6	1.3	5.5	18.3	96.8	209.1
DESVIN	3.9	1.0	4.1	5.9	43.2	135.2
ABINO	2.6	1.1	2.4	5.9	10.1	16.7
RPV(*)	6.6	3.0	5.0	12.4	64.1	257.0
Brazil(WPI)						February 1990
1974-1996						
IN	11.8	0.7	4.1	21.0		80.4
DESVIN	12.0	2.4	4.1	10.5		49.1
ABINO	2.2	0.4	0.9	3.9		20.5
RPV	6.5	1.4	2.1	11.4		33.9
Peru(CPI)						August 1990
IN	13.3		5.4	44.0		438.2
DESVIN	82.0		34.3	260.8		192.2
ABINO	6.9		1.3	29.1		393.2
RPV	12.0		4.6	40.8		439.8

(*)RPV was multiplied by a factor of ten in Argentina.

Table 3: LIC. Average Evolution of Inflation and RPV by Inflationary Regimes

Regimes/ Countries	Total Period	Moderate Inflation	High Inflation	Peaks of High Inflation
Mexico(CPI) (1)				December 1982
1970-1995				
IN	2.5	1.4	5.2	10.7
DESVIN	0.6	0.4	1.1	3.9
ABINO	0.7	0.5	1.3	5.6
RPV(*)	0.2	0.1	0.4	5.9
Mexico(CPI) (2)				
1970-1995				
IN	2.5	1.4	5.2	10.7
DESVIN	0.6	0.4	1.1	3.9
ABINO	0.7	0.5	1.3	5.6
RPV(*)	1.3	0.7	2.8	52.8
Uruguay(WPI)				
1983-1995				
IN	4.0	2.4	4.6	
DESVIN	1.4	0.8	1.7	
ABINO	1.4	0.8	1.7	
RPV(*)	2.5	0.2	3.3	
Venezuela(WPI)				
1961-1989(**)				
IN	1.1	0.6	4.5	8.1
DESVIN	8.7	3.6	44.4	78.2
RPV(*)	89.6	71.7	232.3	398.7
Venezuela(CPI)				
1963-1989(**)				
IN	0.9	0.5	3.9	7.0
DESVIN	5.4	2.6	25.3	55.0
RPV(*)	45.1	35.7	117.0	198.8

(*)RPV was multiplied by a factor of a hundred in Uruguay, Venezuela and Mexico.

(**)We could not estimate ABINO for Venezuela because of the lack of observations in the high inflation period.

(1)The price data considered correspond to the consumer prices of goods grouped by their sector of production (agriculture, manufacture of foods and drinks, etc).

(2)The price data considered correspond to the consumer prices of goods grouped by the type of expenditure (food and drink, garments, etc).

Nevertheless, these results contrast with previous findings (Van Hoomisen (1988), Palerm (1990) and Tommasi (1993)). We find a non-concave relation between RPV and inflation, and no evidence that hyperinflations tend to unify price revisions. Unlike the evidence cited in the literature, we do not find the presence of some unifying forces in pricing at highest inflation.

In short, RPV increases at higher inflation, and reaches its highest values in periods of extreme inflation, particularly in the HIC group. Hence, inflation seem to be no neutral, and the “noise” associated to high inflation (reflected in higher inflation variability and unexpected inflation) seems to provoke more dispersion in relative prices, more intensively in HIC. However, despite the analysis of the evolution of inflation and RPV shows that they are positively associated, it does not allow us to see the causal direction underlying, which we analyse in the next section.

3. Causality.

In this section we try to establish the underlying causality of the IN-RPV relation by means the Granger's test (Granger (1969)). Table 4 shows that in most cases we found the predominance of a significant instantaneous causality. It seems interesting to point out that though these results show that RVP Granger causes IN and IN Granger causes RVP, this last relation is statistically more significant in most cases. When the feedback effect is not verified, the direction of causality goes from inflation to RPV. Besides, another interesting result is that there is significant feedback (FF) only in the HIC group, more precisely in the two highest inflation countries, Argentina and Brazil, during the very high inflation periods. Besides,

in these countries we also found that the effect of inflation on RPV increases as inflation levels increase. These results would indicate a different IN-RPV relation among countries of higher and lower inflation, the most intensive feedback effect being more common in the HIC group.

The predominance of instantaneous causality would indicate that inflation affects RPV and viceversa, in a period of time of at most a month (except Venezuela, because the frequency of price data is annual). In fact, we find instantaneous causality almost in all cases, which means that such causality does not depend of the level of inflation.

On the other hand, these causality results are not absolutely compatible with the monetarist or the structuralist explanation of inflation. However, the more significant effect of inflation on RPV at higher inflation could have two implications. One is more obvious, and implies that monetary rigidities are irrelevant in high inflation, showing that the monetary view is the more plausible one. The other implication is that factors associated to economic instability, like inflation variability or unexpected inflation, would become relevant to explain RPV in episodes of high and very high inflation.

Table 4: Inflation-Relative Price Variability Causality

Countries/ Regimes	Moderate Inflation	High Inflation	Very High Inflation	Hyper- Inflation
Argentina	LF and IC (1)	IC(2)	FF and IC(2)	IC(2)
Brazil	IN to RPV and IC(1)	IN to RPV and IC(2)	FF and IC (1)	
Peru	FF and IC (2)	FL and IC (2)		
Mexico	IC(2)	IC(2)		
Mexico	IC(2)	IC(2)		
Uruguay	IN to RPV for 3 or more lags	IC(2)		
Venezuela	IC(5)			
Venezuela	IC(1)			

FF: feedback statistically significant for values more than twice larger than the critical ones for a confidence level of 1%.

LF: feedback statistically significant for values for 5% or 1% of confidence level.

IC: instantaneous causality, for which (5), (1) means that it was verified for confidence levels of 1% and 5%, respectively, and (2) for values more than twice larger than the critical ones, for a confidence level of 1%.

IN to RPV: inflation causes RPV.

4. Explaining RPV.

In previous sections we stated that RPV increases with higher levels of inflation, particularly in regimes of extreme inflation; moreover, a causal direction from inflation to RPV as well as instantaneous causality could be verified in most countries. High inflation

is associated with a more volatile and less predictable inflation rate in Latin-America unstable countries. A highly inflationary environment degrades the informational contents of real prices (see for example Dabús (1996) who reports evidence in this sense for Argentina and Peru, and Tommasi (1993, 1994a) who does so for Argentina).

Based on those results, in this section we concentrate on regression analysis, assuming RPV as a function of inflation variability and the components of expected and unexpected inflation, in the way Parks (1978), Blejer (1983) and Palerm (1990) did. To capture the existence of structural change in this relation because of different inflation regimes we include dummy variables that represent each regime. As we have detected four regimes, we use three dummies: D1 stands for high inflation, D2 stands for very high inflation and D3 does so for hyperinflation (moderate inflation is considered the base category). Our work differs in two ways from the previous ones cited above. On one hand we test two alternative models to explain RPV: the first specification takes into account the hypothesis of neutrality of expected inflation (hypothesis verified in the empirical studies of Parks and Blejer), and therefore excludes INE; the second one omits the consideration of that hypothesis and includes this variable. On the other hand, we include the dummy variables in order to visualise the effect of the regime of inflation on RPV⁴.

Tables 1 and 2 in the Appendix present the regressions results⁵. Though the Durbin-Watson, Breusch-Godfrey and White tests show the existence of autocorrelation and/or heteroscedasticity problems in some regressions, the application of remedial measures did not

⁴The criterion for the division of the data set into these regimes is explained in Dabús (1993). The table with the periods that are included in each regime is shown in section 2.

⁵Before running the RPV regressions we analysed the stationarity of the series. To consider the robustness of the results we applied three tests of stationarity: the Durbin-Watson, the Dickey-Fuller and the Augmented Dickey-Fuller tests. In all cases we found that the series are stationary.

change fundamentally the overall results⁶.

The regressions results show that R^2 coefficients generally differ among countries, but in most cases they are above .30 and .40. Moreover, testing the overall significance of the regressions, the estimated statistics exceeded the critical value of 1% in almost all cases and the critical value of 5% in every regression, and cointegration tests on the regressions residuals showed absence of spurious correlation. In most cases inflation variability (DESVIN) is the best explanatory variable for RVP. It is less sensitive than the dummies to the introduction of expected inflation, INE (except for Peru). Furthermore, while the results of expected and unexpected inflation are ambiguous and different among the different countries, DESVIN is statistically significant in most cases. Hence, RVP seems to depend more on inflationary accelerations than on the components of expected and unexpected inflation.

On the other hand, in HIC the only dummies that appear significant to explain RVP are the ones representing very high inflation and hyperinflation regimes. In LIC, the dummy representing high inflation is significant but it is sensible to the specification: when the hypothesis of inflation neutrality is not considered and the INE variable is included, it is no more significant. We used the dummies in

⁶Though the Breusch Godfrey test shows that there is first order autocorrelation in the Argentine regressions, and the White test shows heteroscedasticity, the regressions run with an AR(1) term and White's heteroscedasticity-consistent variances and standard errors show very similar results in relation to the original ones: D3 is still significant at 1% and so is DESVIN. In the case of Peru, where autocorrelation and heteroscedasticity problems could also be confirmed, the regressions run with an AR(2) term and the White's correction also show very similar results in relation to the original ones and furthermore D2 and INO become significant at 1%. The Breusch-Godfrey test could not be performed for the LIC, perhaps because of the way in which the explanatory variables are constructed, and even though in most cases the Durbin-Watson test does not show autocorrelation, regressions with AR(1) terms were run, but they showed no significant and the regressions result did not differ from the original ones. The same can be said about the White's correction.

order to capture the effect of the regimes of inflation, and we found that these results are compatible with our previous ones of the average increase of RPV in regimes of higher inflation. These regime effects seem to be more important in economies with very different states of inflation, and their relevance increase once the economy enters very high inflation (a monthly inflation rate higher than 10%, approximately). An interesting case is the Argentine hyperinflation, which shows a very high significance of the correspondent dummy. As stated before, in general dummies are more significant in those economies with more different inflationary regimes, which would imply that the effects of inflation on the price system are associated to more changing and less predictable levels of inflation.

In short, in most cases inflation variability and the dummies (i.e. the regime of inflation) are the best variables to explain RPV, while the results related to expected and unexpected inflation remain ambiguous. Then, this would mean that the distinction between the anticipated and non-anticipated component of inflation is not relevant to study the effects of the economic instability on the relative prices in high inflation countries.

5. Concluding Remarks.

In this paper we show some regularities about the IN-RPV relation in a comparative study of high inflation economies. In most cases a close positive association between RPV and the inflation rate is verified. In section 2 figures and tables of the average evolution of inflation and RPV show a close relation between price variability and inflationary shocks in all countries. Moreover, RPV is systematically higher at higher inflation levels, which is compatible with the hypothesis of non-neutrality of inflation.

On the other hand, when inflation increases gradually, as it did in the 1981-1985 period in Argentina and in the 1991-94 period in

Brazil, RPV diminishes with inflation. A “smoothly” increasing inflation trend allowed decreasing price variability. So, it can be concluded that large increases in RVP are mainly generated by sharp fluctuations in the inflation rate.

The causality analysis shows two main results: instantaneous causality on one hand and a Granger causality relation from inflation to RPV on the other. The main explanatory factors of relative prices behaviour are the regime of inflation and inflation variability. In this sense, we found sounder results in the HIC group, which suggests that inflation is no neutral in general, but extreme inflation seems to provoke a rupture of price system, and so a *non-concave* IN-RPV relation, as we can see in the months of highest inflation. The higher frequency of price changes, typical of very high inflation and hyperinflation, does not suggest the presence of unifying forces in pricing in these situations. So that the “noise” associated to extreme inflation episodes, like inflation variability or informational problems related to real prices, could be relevant to explain the effects of inflation on the price system.

In short, we found a positive IN-RPV relation in a comparative study of six countries, which is particularly clear in terms of inflationary regimes, and in the HIC group. However, some questions remain to be analysed. A sectoral study can shed light on the relevance of different price practices of flex and fix prices, to consider the IN-RPV relation in each of these sectors in high inflation economies. Another possibly extension consider the inclusion of stable countries in the sample in order to verify the robustness of the results found here. Furthermore, other factors affecting RPV may be considered in the analysis. A panel data model would be useful in this sense of avoiding specification bias. In fact this is one of the following steps in our research on this subject. Finally, following Tommasi’s theoretical conclusions about a negative effect of inflation on growth (Tommasi

(1994b)), the study of the positive IN-RVP relation can be extended to take account of its effects on growth. It can be postulated that inflation negatively affects economic growth because of its effects on relative price variability; this, in turn, has disruptive effects on the organization of markets, thus resulting in lower growth.

Submitted in March 1999. Revised in May 2001.

References

- Blejer M. 1983. "On the anatomy of inflation: The variability of relative commodity prices in Argentina". *Journal of Money, Credit and Banking*, 15:469–482.
- Boletines Estadísticos del Banco de Mexico.
- Boletines Estadísticos del Banco de Venezuela.
- Boletines Estadísticos de la Dirección General de Estadística y Censos, Uruguay.
- Boletines Estadísticos de la Fundación Getulio Vargas, Brazil.
- Boletines Estadísticos del Instituto Nacional de Estadísticas, Peru.
- Boletines Estadísticos del Institutos Nacional de Estadística y Censos, Argentina.
- Dabús, C. 1993. "Inflación y Precios Relativos: Estudio del Caso Argentino". Doctoral Dissertation. Universidad Nacional del Sur. 1993
- Dabús, C. 1994. "Inflación, Precios Relativos y Cambio Estructural: Argentina 1960-1990". *Estudios de Economía* (Universidad de Chile) 21:47–64.

- Dabús, C., M. Fernandez, & C. Iglesias 1996. "Contenido Informativo de los Precios en Alta Inflación: Evidencia de Argentina y Peru". *Anales de la XXXI Reunión Anual de la Asociación Argentina de Economía Política* 2:377–385.
- Debelle, G. & O. Lamont 1997. "Relative Price Variability and Inflation: Evidence from U. S. cities". *Journal of Political Economy* 105:132–153.
- Domberger, S. 1987. "Relative Price Variability and Inflation: a Disaggregated Analysis". *Journal of Political Economy* 95:547–566.
- Glesjer, H. 1965. "Inflation, Productivity and Relative Prices: A Statistical Study". *Review of Economics and Statistics* 47:761–780.
- Granger, C. 1969. "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods". *Econometrica* 37:67–98.
- Leijonhufvud, A. 1990. "Extreme Monetary Instability: High Inflation". Lecture given at the University of Hoheneim, Germany.
- Llach, S. & D. Tsiddon 1992. "The Behavior of Prices and Inflation: An Empirical Analysis of Disaggregated Price Data". *Journal of Political Economy* 100:2,349–389.
- Palerm, A. 1990. "Prices Formation and Relative Price Variability in an Inflationary Environment". UCLA Ph.D. Thesis.
- Parks, A. 1978. "Inflation and Relative Price Variability". *Journal of Political Economy* 86:79–95.
- Roger, J. & P. Wang, 1993. "Sources of Fluctuations in Relative Prices: Evidence from High Inflation Countries". *The Review of Economic and Statistics* 75:2,589–605.

- Theil, H. 1967. *Economics and Information Theory*. Chicago: Rand McNally.
- Tommasi, M. 1993. "Inflation and Relative Prices: Evidence from Argentina". In Sheshinski, E. & Y. Weiss, eds., *Optimal Pricing, Inflation and Cost of Price Adjustment* (MIT Press, Cambridge) 487–513.
- Tommasi, M. 1994a. "Inflation and the Informativeness of Prices: Microeconomic Evidence from High Inflation", Preliminary Version. Department of Economics, UCLA.
- Tommasi, M. 1994b. "High Inflation: Resource Missallocations and Growth Effects", Working Paper. Department of Economics, UCLA.
- Van Hoomissen, T. 1988. "Search Information and Price Dispersion: Evidence from Israel". *Journal of Political Economy* 96:1303–1311.

Appendix: Regressions results.

Table 1: HIC. Argentina (WPI) 1960-1993,
Brazil (WPI) 1974-1996, Peru (CPI) 1980-1994(a)

Dependent Variable	Constant	Explanatory variables (b)					Adj. R ²	F	D-W	B-G	White
RPV	Term	D2	D3	DESVIN	INO	INE					
Argentina	0.14	0.51	0.58	0.10	0.02		0.58	143.7	1.33	48.43	268.3
1	(5)	(1)	(1)	(1)	(1)			(1)			
Argentina	-0.02	-0.59	-3.99	0.05	0.05	0.08	0.68	175.8	1.31	30.08	131.4
2	(ns)	(1)	(1)	(1)	(1)	(1)		(1)			
Brazil	0.99	6.69		0.94	0.18		0.31	40.8	1.95	0.35	10.06
1		(1)		(1)	(ns)			(1)			
Brazil	0.85	5.84		0.88	0.18	0.06	0.31	30.6	1.98	0.35	14.24
2		(1)		(1)	(ns)	(ns)		(1)			
Peru	4.38	29.98		0.23	0.79		0.88	423.7	1.78	11.37	27.76
1	(1)	(1)		(1)	(1)			(1)			
Peru	-6.58	-44.7		0.13	0.87	2.01	0.89	358.7	1.75	7.16	34.09
2	(5)	(5)		(ns)	(1)	(1)		(1)			

(a) All regression correspond to OLS estimations (5) Significant at 5% level (1) Significant at 1% level (the same is valid for the following table) (ns) Non significant

(b) Because of the bad performance of D1 in all cases, only the results of the regressions including D2 and D3 are reported.

Table 2: LIC. Mexico (CPI) (1) 1970-1995,
Uruguay 1983-1995, Venezuela 1960-1989

Dependent Variable	Constant Term	Explanatory variables				Adj. R^2	F	D-W	White
RPV		D1	DESVIN	INO	INE				
Mexico	0.00	0.011	0.015	0.014		0.36	54.03	2.18	49.56
(CPI)1(a)	(ns)	(5)	(1)	(1)			(1)		
Mexico	0.00	0.013	0.016	0.014	0.00	0.35	40.44	2.19	51.15
(CPI)2(a)	(ns)	(ns)	(1)	(1)	(ns)		(1)		
Mexico	0.00	0.001	0.0018	0.0015		0.32	43.58	2.08	52.07
(CPI)1(b)	(ns)	(ns)	(1)	(1)			(1)		
Mexico	0.00	0.00	0.001	0.0016	0.00	0.32	33.63	2.05	51.46
(CPI)2(b)	(ns)	(ns)	(1)	(1)	(ns)		(1)		
Uruguay	-0.003	0.02	0.006	0.004		0.55	53.53	1.83	13.06
1	(ns)	(1)	(1)	(1)			(1)		
Uruguay	-0.0022	0.007	0.006	0.004	0.008	0.58	44.66	1.80	19.57
2	(1)	(ns)	(1)	(1)	(1)		(1)		
Venezuela	0.34	-0.66	0.04			0.40	9.73	2.15	1.45
1(c)	(ns)	(ns)	(1)				(1)		
Venezuela	0.18	-0.28	0.02			0.31	5.17	0.84	0.38
2(d)	(ns)	(ns)	(5)				(5)		

(a) The price data considered correspond to the consumer prices of goods grouped by their sector of production (agriculture, manufacture of foods and drinks, etc.).

(b) The price data considered correspond to price the consumer prices of goods grouped by the type of expenditure (food and drink, garments, etc.)

(c) Considering annual data on WPI for the period 1961-1989.

(d) Considering annual data on CPI for the period 1963-1989.