

Inflationary regimes and relative price variability: evidence from Argentina

Carlos Dabús*

*Departamento de Economía, Universidad Nacional del Sur, 12 de Octubre y San Juan,
(8000) Bahía Blanca, Argentina*

Abstract

This paper explores the relation between inflation and relative prices for Argentina over the 1960–1993 period. The study is carried out in the framework of four inflationary regimes: moderate, high, very high inflation and hyperinflation. The evidence favors the view of non-neutrality of inflation: relative price variability is increasing in inflation, but decreasing when inflation climbs smoothly and gradually. The inflation rate and its volatility are the main explanatory factors of price variability, while the effects of expected and unexpected inflation are ambiguous. In contrast to previous consensus, we found that fix price variability is always increasing in inflation, and particularly in extreme inflation. In addition, the relation between inflation and relative prices exhibits structural changes across different levels of inflation. © 2000 Elsevier Science B.V. All rights reserved.

JEL classification: E0-E3

Keywords: Inflationary regimes; Relative price variability

1. Introduction

The relation between inflation and relative price variability is a traditional theme in monetary economics. There exists a vast literature dealing with the

* Telefax: +54-291-4595138.

E-mail address: cdabus@criba.edu.ar (C. Dabús).

effects of inflation on the price system.¹ The non-neutrality of inflation can be explained because a higher inflation is more erratic and less predictable, which deteriorates the information related to price decisions. The purpose of this paper is to analyze the relation between inflation and relative price variability, by using disaggregated data for Argentina over the 1960–1993 period. We examine the relation in which price variability is explained by the inflation rate, its volatility and the components of expected and unexpected inflation. Besides, we test the structural stability of this relation. The study is carried out in the framework of four inflationary regimes: moderate, high, very high and hyperinflation.² The main conclusions are that relative price variability is positively related to the inflation. In particular, this variability systematically increases at higher inflation rates, and especially when the economy enters hyperinflation.

In a similar way as Palerm (1991) for Mexico, our study considers total and sectoral price variabilities, for flex and fix prices. Two interesting analogies arise in both cases: (1) the effects of inflation are greater on the variability of fix prices, and (2) flex prices are generally more volatile than fix ones. Nevertheless, we found some new results, which contrast with previous findings (e.g. Palerm, 1990). Expected and unanticipated inflation are not the main explanatory factors of price variability. Besides, during hyperinflations fix prices are more volatile than flex prices. The effects of inflation on relative prices may differ depending on the flexibility of monetary prices. Inflation should have a greater incidence on prices with lower flexibility and lesser frequency of adjustment.

The paper is organized into five sections. The Section 2 shows the evolution of the inflation rate and relative prices. In Section 3, we analyze the relation between price variability and the inflation rate, its volatility and the components of expected and unexpected inflation. The analysis will allow us to determine two main points: (1) if there exists a positive relation between relative price variability

¹ Going back to Glesjer (1965) and Parks (1978), there is much empirical evidence showing that real price variability across different goods increases with the inflation rate (for example, Palerm, 1990 for Mexico, Moura and Kadota, 1982 for Brazil, and Blejer, 1981, 1983 and Tommasi, 1993 for Argentina, Domberger, 1987 for UK, Van Hoomisen, 1988 for Israel, and Debelle and Lamont, 1997 in a cross-section test of US cities).

² Following a version of the criterion suggested by Leijonhufvud (1990), the economy is considered in a regime of moderate inflation when the monthly inflation rate is lower than 2%. High inflation corresponds to the 2–10% range, very high inflation to the 10–50% range, and hyperinflation to values beyond 50%. According to the criterion for the division of the data set into these regimes (which is explained in Dabús, 1993), each regime contains the following periods:

- moderate inflation: January 1960–April 1970 and March 1991–November 1993.
- high inflation: May 1970–January 1975, May 1976–June 1982, July 1985–June 1987, September 1988–March 1989, August 1989–November 1989 and April 1990–February 1991.
- very high inflation: April 1974–February 1975, July 1982–June 1985 and July 1987–August 1988.
- hyperinflation: April 1989–July 1989 and December 1989–March 1990.

and inflation, and (2) if this relation is different for the sectors of flex and fix prices, respectively. Section 4 presents a test of structural change in the relation between inflation and relative price variability at different inflationary regimes. Finally, Section 5 states the conclusions.

2. Behavior of relative price variability: flex and fix prices³

Relative price variability is a measure of the *non-uniformity* of the percentage variation of individual prices relative to the average inflation rate (as originally was pointed out in Theil, 1967).⁴ In Argentina, this variability is increasing in inflation. Besides, flex and fix prices should react in different ways to inflationary shocks, because flex prices have higher frequency of adjustment than fix price.

Figs. 1–3 show the evolution of the inflation rate and relative price variability. Inflation remained at moderate levels during the 1960s. In the middle of the 1970s, the economy entered levels of high and very high inflation, and from 1975 to 1990, the inflation rate oscillated very erratically between high inflation and hyperinflation states. In turn, total and intrasectoral price variability evolved irregularly. In the moderate inflation of the 1960s, it was relatively low and stable, with large increases associated with big jumps of the inflation rate since the middle off the 1970s, and particularly in the hyperinflations of 1989 and 1990. In turn, total price variability decreased gradually from 1981 to 1985, while the

³ Flex prices are assumed to be determined as on a commodity exchange, while fix prices are set by producers (Heymann and Leijonhufvud, 1995). Flex-price goods include agrarian products; they are non-durable and homogeneous goods, which are exchanged in organized markets through an auctionary mechanism and with high frequency of adjustment. Fix-price goods are differentiated and durable goods; their prices are determined by means of “price-setting” mechanism and the frequency of adjustment is low.

⁴ The total relative price variability (TRPV) was obtained in quadratic terms; using the weighted sum of the individual prices monthly inflation rate, as follows:

$$\text{TRPV}_t = \frac{\sum_i w_i (\text{IN}_{it} - \text{IN}_t)}{(1 + \text{IN}_t)^2} \quad (1)$$

where w_i is the weight of price i in the price index, IN_{it} is the inflation rate of the price i in t and IN_t is inflation rate in t . In turn, the intrasectoral price variabilities were calculated by considering real price variations *within* each sector. This implies that we use Eq. (1), but in this case we calculate the divergence between the variation rate of each individual price of a sector and the corresponding sectoral inflation.

On the other hand, the price data used to calculate the relative price variability have been extracted from the statistical bulletins of the Instituto Nacional de Estadística y Censos (INDEC), from January 1960 to November 1993. The individual price data are of monthly frequency, and corresponding to the items of the national wholesale price index (WPI, 1960 = 100). Price data were quoted at level of WPI groups. Since the classification of WPI changed in July 1984, we use 87 price indexes over the 1960–1984 period, and 64 over the 1984–1993 period.

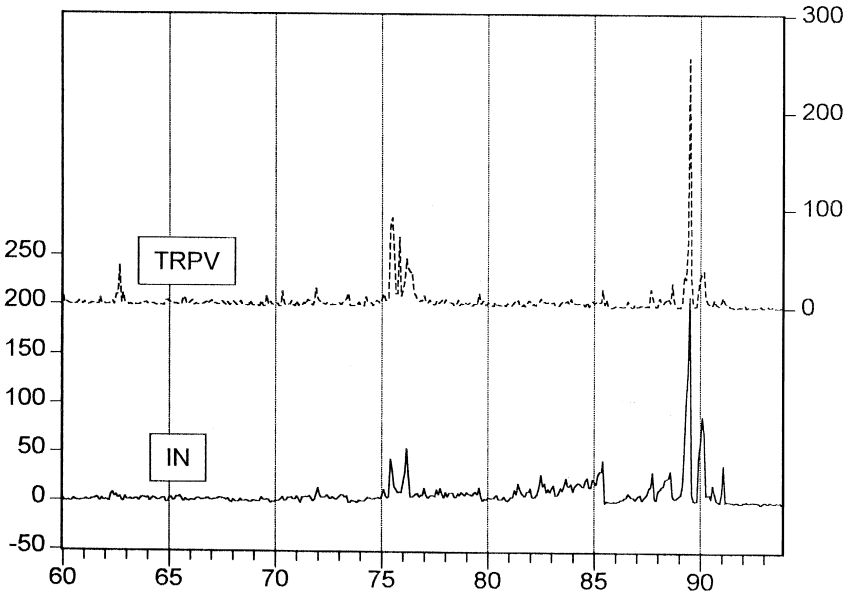


Fig. 1.

inflation rate increased gradually. A “smoothly” positive inflation trend allowed decreasing price variability. This seems to indicate that it is mainly sharp

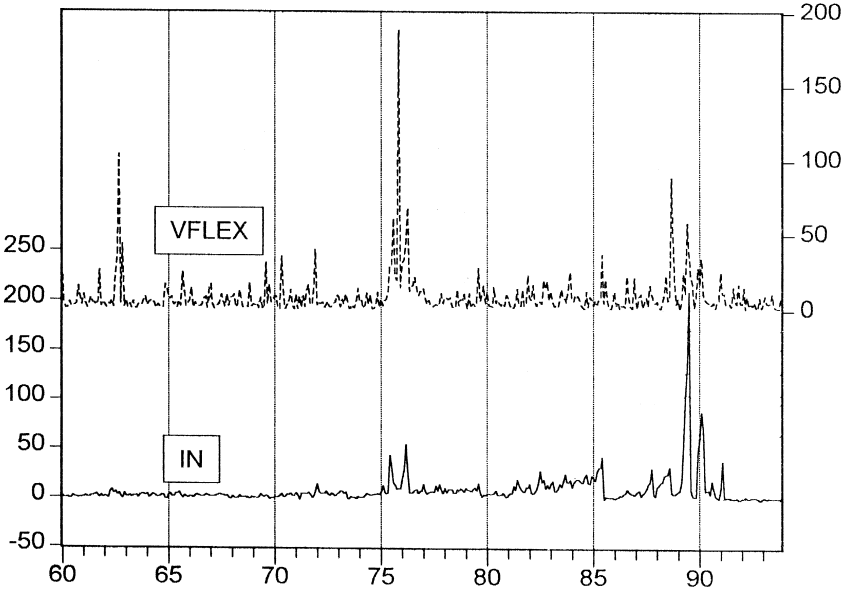


Fig. 2.

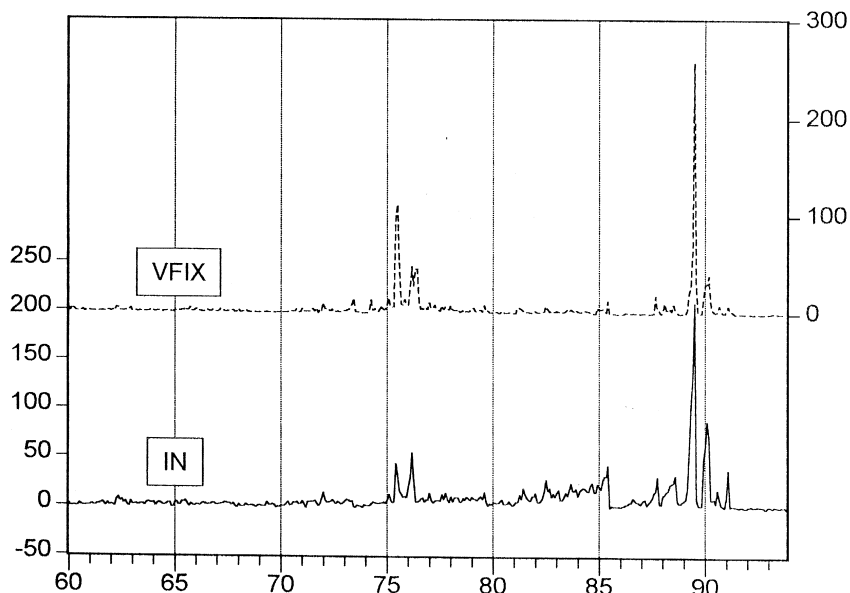


Fig. 3.

fluctuations of the inflation rate that are closely associated with increases of real price variations.

The positive association between inflation and price variability is more evident in terms of inflationary regimes. Table 1 shows that the inflation volatility, the absolute value of unexpected inflation and the relative price variability are — on the average — systematically and substantially higher at higher inflation, and in particular in extreme inflation. These results contrast with previous findings (for example Van Hoomisen, 1988; Palerm, 1990; Tommasi (1993)). We find a non-concave relation between relative price variability and inflation, and no evidence that hyperinflations tend to unify price revisions. Unlikely their evidence, we do not find the presence of some unifying forces in pricing at the highest inflation rates.

In addition, fix-price variability is lower than flex's at moderate, high and very high inflation, but it is higher at hyperinflation. This is only partially compatible with the findings of Moura and Kadota (1982) for Brazil and Palerm (1991) for Mexico. They found that flex-price variability is *always* higher than the fix-price one.

Fix prices are “more flexible” at higher inflation, due to more frequent price adjustments (Leijonhufvud, 1990). Nevertheless, they do not follow some unifying forces in pricing in extreme inflation. On the contrary, fix prices are more variable than flex prices only when the economy enters hyperinflation. Hence, the sources

Table 1

Average evolution of inflation and relative price variability by inflationary regimes

Where IN is the monthly rate of inflation (WPI). ABDIN and DESVIN are measures of inflation volatility. ABDIN is the difference, in absolute value, between the inflation rate of two successive months (i.e. $ABDIN = |IN_t - IN_{t-1}|$, where IN_t : monthly inflation rate of the t period). DESVIN results from the difference, in absolute value, between the inflation rate and a centered moving average of six periods (months) of inflation (i.e. $DESVIN = |IN_t - (1/7) * \sum_i [(i = 3.3)[IN_{t-i}]]|$). ABINO is the absolute value of unexpected inflation (INO), which results from the difference of the actual and expected inflation (INE, and its absolute value ABINE). In turn, the expected inflation is obtained from a AR(1) model of inflation rate (technique developed in Parks, 1978), calculated “by regime of inflation”; for an extended discussion on the advantages and limitations of these measures see Dabús (1993). In turn, TRPV, VFLEX and VFIX are total, flex and fix price variabilities, respectively.

Regimes variables	Total period	Moderate inflation	High inflation	Very high inflation	Hyperinflation
IN	7.6	1.3	5.5	18.3	96.8
ABDIN	4.3	1.4	4.6	6.4	36.6
DESVIN	3.9	1.0	4.1	5.9	43.2
ABINO	2.6	1.1	2.4	5.9	10.1
TRPV ^a	6.6	3.0	5.0	12.4	64.1
VFLEX ^a	9.4	7.0	8.3	15.9	28.1
VFIX ^a	4.7	1.2	3.4	9.8	61.0

^a These variables are 10 times the actual ones.

of sectoral variabilities seem to be different in different inflation regimes, which is analyzed in the next section.

3. Inflationary regimes and relative prices

The high price variability observed in high inflation in Argentina suggests that such variability could be associated with a more volatile and less predictable inflation rate, because the highly inflationary environment degrades the informational contents of real prices (c.f. Dabús, 1993; Tommasi, 1993).

In this section, we study relative price variability as a function of the rate and volatility of inflation, and of expected and unexpected inflation, in a similar way as in Parks (1978), Blejer (1983) and Palerm (1990). But we state the analysis in the framework of four inflationary regimes: moderate, high, very high and hyperinflation.⁵

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

Table 2
Regressions of the total relative price variability, WPI, 1960–1993^a

Periods Regressions	Total period		Moderate inflation		High inflation		Very high inflation		Hyperinflation ^b	
	R ² coefficient	DW	R ² coefficient	DW	R ² coefficient	DW	R ² coefficient	DW	R ² coefficient	DW
Regression 1	0.66	1.28	0.07	1.60	0.13	0.73	0.26	1.08	–	–
Constant	0.05 (0.98)		0.18 (4.02)		0.31 (5.31)		–0.16 (–0.37)		–	
IN	0.05 (10.87)		0.04 (2.31)		0.02 (2.60)		0.04 (1.61)		0.13 (5.39)	
DESVIN	0.06 (8.14)		0.07 (2.40)		0.02 (3.93)		0.11 (2.79)		0.19 (9.01)	
Regression 2	0.60	1.19	0.04	1.66	0.06	0.69	0.17	0.73	–	–
Constant	0.08 (1.38)		0.20 (3.75)		0.25 (2.75)		–0.93 (–1.14)		–	
INE	0.08 (23.69)		0.09 (2.32)		0.04 (3.08)		0.12 (2.75)		0.13 (3.75)	
INO	0.08 (7.25)		0.04 (1.79)		0.02 (2.02)		0.07 (2.84)		0.23 (1.06)	
Regression 3	0.56	1.41	0.09	1.70	0.05	0.73	0.20	1.11	–	–
Constant	–0.001 (–0.01)		0.11 (1.89)		0.24 (2.61)		–1.01 (–1.25)		–	
ABINE	0.07 (17.98)		0.06 (1.65)		0.04 (2.61)		0.08 (1.96)		0.13 (3.75)	
ABINO	0.05 (2.85)		0.11 (3.32)		0.01 (1.06)		0.11 (3.22)		0.47 (1.32)	

^aAll regressions were made by means of OLS. Besides, the figures within parenthesis contain the *t* value of the coefficients. For an explanation of these variables, see Table 1, above (the same is valid for the following tables).

^bIn both hyperinflations, the regressions were made taking only one explanatory variable in each case due to the lack of available data (the same is valid for the following tables).

Table 3
Regressions of the flex-price variability, WPI, 1960–1993

Periods Regressions	Total period		Moderate inflation		High inflation		Very high inflation		Hyperinflation	
	R^2 coefficient	DW	R^2 coefficient	DW	R^2 coefficient	DW	R^2 coefficient	DW	R^2 coefficient	DW
Regression 1	0.08	1.66	0.01	1.65	0.02	0.97	0.00	1.77	–	–
Constant	0.75 (9.97)		0.54 (4.38)		0.66 (5.92)		1.05 (1.54)		–	
IN	0.02 (3.01)		0.02 (0.43)		0.017 (1.09)		0.01 (0.23)		0.014 (1.36)	
DESVIN	0.01 (1.00)		0.14 (1.71)		0.016 (1.90)		0.06 (1.00)		0.018 (1.31)	
Regression 2	0.08	1.65	0.00	1.71	0.00	0.95	0.00	1.72	–	–
Constant	0.74 (9.86)		0.55 (3.84)		0.59 (3.51)		–0.15 (–0.12)		–	
INE	0.026 (6.02)		0.13 (1.25)		0.04 (1.52)		0.09 (1.46)		0.017 (1.65)	
INO	0.007 (0.49)		0.004 (0.06)		0.01 (0.80)		0.01 (0.32)		–0.025 (–0.55)	
Regression 3	0.10	1.72	0.03	1.69	0.00	0.96	0.02	1.80	–	–
Constant	0.63 (7.66)		0.38 (2.40)		0.59 (3.45)		–0.19 (–0.16)		–	
ABINE	0.017 (3.58)		0.08 (0.77)		0.04 (1.36)		0.08 (1.17)		0.017 (1.65)	
ABINO	0.068 (3.34)		0.21 (2.34)		0.01 (0.31)		0.06 (1.10)		0.165 (3.78)	

Table 4
Regressions of the fix-price variability, WPI, 1960–1993

Periods Regressions	Total period		Moderate inflation		High inflation		Very high inflation		Hyperinflation	
	R^2 coefficient	DW	R^2 coefficient	DW	R^2 coefficient	DW	R^2 coefficient	DW	R^2 coefficient	DW
Regression 1	0.65	1.08	0.25	1.27	0.09	0.62	0.31	0.83	–	–
Constant	–0.14 (–2.69)		0.06 (5.35)		0.17 (2.73)		–0.64 (–1.50)		–	
IN	0.05 (10.45)		0.02 (5.17)		0.016 (1.83)		0.05 (1.94)		0.14 (5.60)	
DESVIN	0.06 (8.51)		0.03 (4.29)		0.018 (3.59)		0.12 (3.05)		0.19 (9.38)	
Regression 2	0.59	1.05	0.16	1.13	0.04	0.60	0.21	0.54	–	–
Constant	–0.11 (–1.91)		0.09 (6.45)		0.83 (0.85)		–1.28 (–1.55)		–	
INE	0.07 (23.21)		0.025 (2.58)		0.046 (2.87)		0.124 (2.82)		0.13 (3.90)	
INO	0.08 (7.62)		0.028 (5.04)		0.013 (1.18)		0.086 (3.38)		0.23 (1.02)	
Regression 3	0.54	1.27	0.13	1.45	0.04	0.61	0.21	0.90	–	–
Constant	–0.18 (–2.78)		0.056 (3.62)		0.076 (0.78)		–1.37 (–1.65)		–	
ABINE	0.07 (17.54)		0.016 (1.59)		0.04 (2.55)		0.088 (1.95)		0.13 (3.90)	
ABINO	0.04 (2.70)		0.04 (4.41)		0.01 (0.63)		0.124 (3.34)		0.49 (1.34)	

Regressions for relative price variability, reported in Tables 2–4, show that the results from considering the total period are more satisfactory than the results for the individual regimes. In most cases, for example, R^2 coefficients and the significance of the explanatory variables are substantially higher for the total period. This could indicate that changes in the level of inflation imply structural changes in these regressions, which will be analyzed in the next section. In most cases the most significant variables are inflation and inflation volatility. Besides, the significance of the explanatory variables is generally higher in hyperinflation. This result is compatible with the fact that price variability was highest in hyperinflation. However, in contrast with previous findings, our results do not show a clear effect of the components of expected and unexpected inflation (Parks for the USA and Palerm for Mexico did find that these are the main explanatory variables of relative price variability).

On the other hand, the results are very different in both sectors: like in Palerm (1991) for Mexico, our results show that also in Argentina the inflation affects mainly fix price variability, while the results for the flex price sector are poor: in most cases the explanatory variables are not significant. In low inflation this fact could be explained by price stickiness. However, the irrelevance of these rigidities, and the very fast increase of fix price variability, which occurs in hyperinflation, suggest the presence of other factors underlying price variability. The regressions could indicate that one of these factors is the higher inflation volatility, present in hyperinflation.

4. Structural change

In this section, we test whether there are structural changes in the regressions presented in the previous section, related to a different behavior of relative prices at different levels of inflation. The analysis is done applying the Chow test (Chow, 1960).

The results of the structural change test are presented in Table 5. These results are very similar for total and fix price variability. In both cases there are two main results: (1) no structural change exists in any case between moderate and high inflation, but (2) there is a very significant structural change in all regressions when the four regimes are grouped into two, of lower and higher inflation, respectively. In fact, these changes are due to increases in the parameters at higher inflation. Besides, and confirming our previous results, there exists structural changes in most cases between high and very high inflation, and between this and hyperinflation.

On the contrary, the regressions of flex price variability do not suffer structural changes in any case, except when the regimes are grouped. Structural changes are mainly associated with the fix price sector, so that price flexibility is not irrelevant

Table 5

Chow's structural change test for relative price variability regressions^a

NO: no structural change was verified.

5, 1: Structural change was verified for confidence levels of 1% and 5%, respectively.

2: The values found were more than twice bigger than the statistical ones, for a confidence level of 1%.

Regimes regressions	Moderate to high inflation	High to very high inflation	Very high to hyperinflation	Lower to higher inflation ^b
TRPV = F(IN)	NO	5	1	2
TRPV = F(IN,ABDIN)	NO	2	2	2
TRPV = F(IN,DESVIN)	NO	2	NO	2
TRPV = F(INE,INO)	NO	5	2	2
TRPV = F(ABINE,ABINO)	NO	1	1	2
VFLEX = F(IN)	NO	NO	NO	5
VFLEX = F(IN,ABDIN)	NO	NO	NO	5
VFLEX = F(IN,DESVIN)	NO	NO	NO	5
VFLEX = F(INE,INO)	NO	NO	NO	5
VFLEX = F(ABINE,ABINO)	NO	NO	NO	5
VFIX = F(IN)	NO	1	2	2
VFIX = F(IN,ABDIN)	NO	2	2	2
VFIX = F(IN,DESVIN)	NO	2	5	2
VFIX = F(INE,INO)	NO	1	2	2
VFIX = F(ABINE, ABINO)	NO	1	2	2

^aFor an explanation of the variables, see Table 1.^bLower inflation groups the regimes of moderate and high inflation, and higher inflation contains the cases of very high and hyperinflation.

to determine the non-neutrality of inflation. Perhaps the lower frequency of price adjustment and the monetary rigidity related to fix prices could imply a different effect of inflation on the price variability at different levels of inflation.

5. Conclusions

This paper shows some explanatory factors of the relative price behavior for a case of high inflation. We found two main facts. First, the virtual rupture of price system in extreme inflation, jointly with a more significant relation of relative price variability with inflation and inflation volatility. Second, when inflation increases gradually, as it did in the 1981–1985 period, price variability diminishes with inflation. This suggests that discontinuous jumps of inflation affect the behavior of relative prices.

The systematic increases of price variability at higher inflation levels supports the hypothesis of non-neutrality of inflation in Argentina. The figures of Section 2 show a close relation between price variability and inflationary shocks. Inflation volatility is a significant explanatory variable in most regimes. This would explain the very large increase of price variability verified for extreme inflation. In

general, this variability is explained through the rate and volatility of inflation, while the effects of the components of expected and unexpected inflation are ambiguous.

Another conclusion is obtained from the sectoral analysis. The notable differences between results for flex and fix-price variability indicate the relevance of price flexibility in a high inflation environment. Fix price variability is increasing in inflation. Nonetheless, the higher frequency of price adjustment does not suggest the presence of some unifying force in pricing at highest inflation. Agents do change their price setting practices in adapting to high inflation, but these “new” practices may not be successful enough to avoid high real price variations.

In short, price variability is increasing in inflation, and the positive relation between price variability and inflation is particularly clear in terms of inflationary regimes: all measures of price variability are, on the average, systematically higher at higher inflation. However, our results contrast with previous findings. We do not obtain a concave relation between inflation and relative price variability, but a convex one. Hyperinflation does not bring about unification of price changes.

On the other hand, structural changes associated with different inflationary regimes may be an interesting peculiarity of Argentina, or perhaps these are phenomena shared by all high inflation economies. Total and fix-price variability regressions verify significant structural changes once the economy surpasses the limits given (approximately) by monthly inflation rates of 10% and 50%, respectively. In most cases, structural changes are explained by the increase of the parameters at very high and hyperinflation. These changes suggest important modifications in the economic environment beyond high inflation, and especially when the economy enters hyperinflation. The high level of “noise” and the loss of information, resulting from higher inflation, could bring about a greater effect of inflation on the relative prices.

This paper provides evidence that shed some light on the mechanisms by which inflation affect relative prices. But this evidence also poses new questions. For example, are the structural changes found here robust? What other factors may affect price variability? Finally, this work needs to be extended in two main directions. First, in a theoretical sense: we must give more theoretical explanation to our findings. Furthermore, similar studies with data from other countries, with different inflationary processes, will provide future evidence about how inflation affects the price system.

Acknowledgements

This research was supported by the SCGyT of the Universidad Nacional del Sur, under the grant ZE11. Thanks are due to Daniel Heymann, Axel Leijonhufvud, Mariano Tommasi and Fernando Tohmé for valuable comments. Naturally, all remaining errors are my own.

References

- Blejer, M., 1981. The dispersion of relative commodity prices under very rapid inflation. *Journal of Development Economics* 9, 347–356.
- Blejer, M., 1983. On the anatomy inflation: the variability of relative commodity prices in Argentina. *Journal of Money, Credit and Banking* 15, 469–482.
- Chow, G., 1960. Tests of equality between sets of coefficients in two linear regressions. *Econometrica* 28, 591–605.
- Dabús, C., 1993. *Inflación y precios relativos: Estudio del caso argentino*. Doctoral dissertation, Universidad Nacional del Sur, Argentina.
- Debelle, G., Lamont, O., 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.
- Heymann, D., Leijonhufvud, A., 1995. *High Inflation*. Oxford Univ. Press, Oxford.
- Leijonhufvud, A., 1990. Extreme monetary instability: High inflation. Lecture given at the University of Hoheneim, Germany.
- Moura, A., Kadota, D., 1982. *Inflação e preços relativos: medidas de dispersão*. *Pesquisa e Planejamento Econômico* 12, 1–21.
- Palerm, A., 1990. Prices formation and relative price variability in an inflationary environment. UCLA PhD Thesis.
- Palerm, A., 1991. Market structure and price flexibility. *Journal of Development Economics* 36, 37–54.
- Parks, R., 1978. Inflation and relative price variability. *Journal of Political Economy* 86, 79–95.
- Theil, H., 1967. *Economics and information theory* (Rand McNally, Chicago).
- Tommasi, M., 1993. [Inflation and relative prices: evidence from Argentina] In: Sheshinski, E., Weiss, Y. (Eds.), *Optimal Pricing, Inflation and Cost of Price Adjustment*. MIT Press, Cambridge, pp. 487–513.
- Van Hoomissen, T., 1988. Search information and price dispersion: evidence from Israel. *Journal of Political Economy* 96, 1303–1311.