
STUDY

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BEHAVIOR OF PRICES OVER THE BUSINESS CYCLE

ANALYSIS OF THE EVIDENCE FOR CHILE

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The assumption that prices follow a pro-cyclical behavior pattern has served to underpin various macroeconomics theories, one of its best known expressions being the “Phillips curve hypothesis”. Both for adherents and critics of this theory, the starting point for analysis has been a recognition that the price level displays a positive correlation with real output.

Recent studies, however, have challenged the validity of the assumption that prices follow a pro-cyclical behavior pattern. In particular, the publication of various papers confirming the existence of a negative correlation between cyclical movements of prices and output have dealt a significant blow to theories stressing the origin of the business cycle in movements of aggregate demand.

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The present study examines the correlation between the abovementioned variables using figures from the Chilean economy. As in other economies, in the Chilean case there is evidence of anti-cyclical price behavior. To explain this evidence recourse is made to aspects of economic policy, which allow us to venture the hypothesis that the observed correlation is basically explained by the stance of the fiscal authorities in confronting the business cycle.

Introduction

The hypothesis that prices follow a pro-cyclical behavior pattern has been a central aspect in studies of the business cycle. In fact, this assumption is present in both monetarist, or classical, inspired models¹ as well as in those of Keynesian origin.² The basic argument behind this hypothesis consists of a dominance of aggregate demand shocks³ on the behavior of aggregate output in the short run, as well as the existence of non-instantaneous adjustment of inflationary expectations in response to changes in supply and demand conditions prevailing in different markets. In models of classical inspiration, the speed of adjustment of expectations will determine the period during which increases in the inflation rate are accompanied by an increase in the rate of growth of output.⁴

Models of the Keynesian type usually posit the existence of costs associated with price and or wage adjustment, or of their rate of change. In this context the magnitude of adjustment costs relative to the magnitude of the disequilibrium will determine the speed of adjustment of aggregate supply in response to changes in the rate of inflation.⁵

Insofar as the hypothesis that prices follow a pro-cyclical behavior pattern is not supported by the evidence, a serious question is posed regarding theories emphasizing the role of aggregate demand in generating fluc-

¹ In this regard, see Friedman (1971) and Lucas (1973), among others.

² In this regard see Tobin (1980).

³ Blanchard and Quah (1989) argue that transitory disturbances in GDP are essentially provoked by demand factors, whereas permanent disturbances are likely to be explained mainly by disturbances arising from the changes in aggregate supply.

⁴ The idea that the "long run is just around the corner" is an illustration of the classical assumption of rapid adjustment in expectations on the part of economic agents in response to changes in market conditions. On the other hand, if one adopts the Keynesian standpoint that "in the long run we are all dead", what is being stressed is the slowness of market adjustment mechanisms, which would involve real costs for the economy.

⁵ An excellent survey of modern Keynesian theory can be found in Ball, Romer and Mankiw (1988).

tuations in the rate of growth of economic activity. The purpose of the present study is precisely to examine the validity of the assumption mentioned. With this aim, section 2 proceeds to a review of the recent literature on this issue. Section 3 uses three alternative methods to examine the cyclical behavior of prices in the Chilean economy, and finally Section 4 puts forward a preliminary interpretation of the evidence found.

2. Review of the literature

The appearance of the real theory of economic fluctuations (RBC)⁶ has led to new empirical studies being undertaken into the determinants of business cycles, as well as into the way in which the main aggregates relate to one another in this process. Among such studies, that by Kydland and Prescott (1990), stands out, because it presents evidence which runs counter to one of the basic pillars of modern macroeconomics, namely the procyclical behavior of prices. In addition, Kydland and Prescott find no evidence in favor of the monetarist hypothesis that some monetary aggregate such as base money issuance, or M1, drives the economic cycle. However, they do find that the difference between M2 and M1 ($M2 - M1$) would be a good leading indicator of the cycle, even better than M2.

The fact that a restricted definition of money (M1), which is linked to the level of transactions in the economy, moves contemporaneously with the activity cycle, whereas the broader definition (M2) leads fluctuations in activity, suggests that an analysis of the credit market might have an important place in future business cycle studies.⁷

In their empirical analysis of the business cycle, Kydland and Prescott use the methodology developed by Hodrick and Prescott (1980) to distinguish the trend and cyclical components of the various series, and then to relate the evolution of the cyclical component of the different variables to the cyclical component of GDP. Essentially, the study carried out by Hodrick and Prescott is aimed at establishing relations between the movements of the main macroeconomics variables and output over the course of the business cycle. For this purpose they develop a “filter” to capture the trend in movements of a given variable, allowing for the possibility that

⁶ In this regard see Kydland and Prescott (1982), Prescott (1986), Plosser (1990), among others.

⁷ Kydland and Prescott (1990), *op. cit.* p.17. (Retranslated into English from a Spanish translation by the authors.)

changes occur in the trend. On the basis of obtaining the trend component of each variable, it is possible to establish its cyclical path, which is used in studying the relations of movement between the different variables considered.

The trend component of a given series, denoted by μ_t , for $t = 1, 2, 3, \dots, T$, is that which minimizes the following expression:

$$\sum_{t=1}^T (y_t - \mu_t)^2 + \phi \sum_{t=2}^T \left[(\mu_{t+1} - \mu_t) - (\mu_t - \mu_{t-1}) \right]^2$$

where ϕ is a parameter set arbitrarily depending on the “weight” of the hypothesis of constant growth rates. In this study by Kydland and Prescott, which refers to quarterly data for the USA and covers the period 1954-1989, the authors use a value of $\phi = 1600$.

It is interesting to note that Hodrick and Prescott (1980) found an inverse correlation between cyclical movements of output and those of prices for the USA in the period 1950.1-1979.2. This inverse relation is especially strong for the second half of the period considered. The scant impact this result initially had may be due to the lack of a theoretical framework consistent with such result at the moment of publishing that paper. However, the study by Kydland and Prescott (1990) mentioned above, achieved greater impact on the profession thanks to the theoretical developments that had occurred during the intervening ten years in putting forward a theory of real business cycles, which made it possible to give a theoretical interpretation to the evidence found.

Studies subsequent to that by Kydland and Prescott have ratified the evidence found by them. The study carried out by Backus and Kehoe (1992) for ten economies (Australia, Canada, Denmark, Germany, Italy, Japan, Norway, Sweden, Great Britain, and USA) with annual data, find evidence supporting the hypothesis that prices follow an anti-cyclical pattern.

In their paper, Backus and Kehoe also used the Hodrick and Prescott methodology. According to the evidence found in this study, there has been a general change in the behavior pattern followed by prices over time. Prior to the Second World War, prices behaved predominantly pro-cyclically, whereas in the period since they have become anti-cyclical.⁸

⁸ A similar conclusion is reached in the studies by Cooley and Hansen (1989), Cooley and Ohanian (1991) and Wolf (1991).

Backus and Kehoe also find a significant increase in the persistence of price movements in most of the countries considered, except for Japan.⁹

Holger Wolf (1992) repeats the exercise done by Kydland and Prescott, but break it down by period. Similar to Backus and Kehoe, Wolf finds relatively pro-cyclical price behavior up to the end of the 1960s, which then becomes contra-cyclical at the beginning of the 1970s. The same conclusion holds if one works with the producer price index instead of the index of consumer prices. Wolf disaggregates both price indices and finds a high degree of conformity in the behavior of this aggregate, so that in the expansionary phase of the cycle a global downward trend is detected in the growth rate (a reduction in the “log” of price) of the different prices.

Cooley and Ohanian (1991) use three alternative methods to establish the trend component and the cyclical component of both price and output series. The conclusion of this study is that except for the period between the two world wars and the end of the 19th century, there is little evidence to support the hypothesis that prices follow a pro-cyclical behavior pattern. Furthermore, for these authors, the relationship is predominantly negative and insensitive to the methods used to extract the series trend.

To avoid the influence of the “stagflation” period of the early 1970s on the result, the authors exclude this from one of their experiments, without the results altering appreciably. The results of the study do not change either if the annual series employed by Friedman and Schwartz (1982) in their study of the business cycle for the USA are used.

Using the method of autoregressive vectors (*unrestricted VARs*), and including money among the series considered, Cooley and Ohanian find evidence that output causes prices, even when the “impulse function” does not support the existence of a strong relation between the two series. “Although we have avoided drawing structural inferences from exercises carried out on a reduced model, in our view, in the best of cases, the evidence suggests the existence of periods when prices follow procyclical, anti-cyclical and non-cyclical behavior patterns, rather than the consistently pro-cyclical behavior assumed in traditional business cycle analysis”.¹⁰

A recent study undertaken by Chadha and Prasad (1992) has called into question the methodology used in the studies mentioned. In the opinion of these economists it is wrong to apply the same transformation to two non-stationary series, later to carry out regressions between them, as the results obtained would be spurious. Chadha and Prasad’s empirical analysis ratifies the results obtained by Kydland and Prescott, Backus and

⁹ A similar result is reached by Taylor (1986) and Sachs (1980), among others.

¹⁰ Cooley and Ohanian, *op. cit.* p. 54.

Kehoe, Cooley and Ohanian, and others, by applying similar methodologies. However, when the relation between the inflation rate and the cyclical component of GDP is studied, they find evidence supporting the hypothesis of a positive relation between the two variables.¹¹

It is interesting to mention that Friedman and Schwartz (1982) also found a negative correlation between prices and output in the USA for the period after the Second World War, and in the United Kingdom for the average of the period under study (1873-1975).

In the face of this evidence Friedman and Schwartz put forward the following explanations:

a) The first explanation is basically of a statistical type. According to this, the variables “nominal output”, “real output” and “prices” are not statistically independent, as nominal income and one of its components would usually be estimated independently. Then, the remaining variable is obtained as the quotient between the other two, being influenced by changes in the component estimated independently. Thus, for example, if there is one estimation of nominal income and another of prices, any disturbance affecting prices will have negative repercussions on output, thereby provoking a negative correlation between the two variables.

It should be pointed out that this explanation by Friedman and Schwartz for the evidence they found relates to the levels of the variables considered and not to their deviations or cyclical components, and this raises an important difference from the analysis discussed above.

As regards this “statistical” interpretation of the evidence, it needs to be mentioned that in numerous economies, such as Chile’s, the estimation of real output and the different price indicators are independent, so the problem raised by Friedman and Schwartz would not exist.

b) A second explanation proposed by Friedman and Schwartz for the negative correlation between prices and output relates to the dynamics of adjustment of nominal income in response to changes in aggregate demand conditions.

The second economic reason, which is considerably more complex, relates to the difference that exists in the response of real output and prices to autonomous movements of nominal income, whether these be of monetary origin or otherwise. In general, real output reacts more rapidly than prices to an acceleration in the rate of growth of

¹¹ Guier (1993) finds that the application of the Chadha and Prasad proposal to Chilean data produces a negative correlation, although not significant, between the inflation rate and different measures of cyclical deviations of output.

TABLE N° 1 EVIDENCE OF ANTI-CYCLICAL MOVEMENT OF PRICES

Authors. Year of publication	Period	Trend derivation method	Correlation Deviation (P,V)	Countries
Friedman & Schwartz 1982	Annual data Post WW2	First difference	Negative	USA
Meltzer 1986	Quarterly data Post Korean War	Kalman Filter	Negative	USA Canada, Germany, UK
Kydland & Prescott 1991	Quarterly data Post Korean War	Hodrick- Prescott Filter	Negative	USA
Wolf 1991	Quarterly data Post Korean War	Hodrick- Prescott Filter	Negative	USA
Cooley & Ohanian 1991	Quarterly data Post WW2	First differences Line trend H-P filter	Negative	USA
Backus & Kehoe 1991	Annual data 100 years	Hodrick- Prescott Filter	Negative	USA, UK, Australia, Canada, Denmark, Italy, Japan, Norway, Sweden
Chadha & Prasad 1991	Quarterly data Post Korean War	First differences Linear trend H-P filter	Negative	USA

nominal income. Thus, for example, real output growth accelerates after a brief period (about six months in the United States and in the United Kingdom), with a small initial effect on prices. Later the change in nominal income is translated into prices (after a further 15 to 20 months in the United States and United Kingdom). As the rise in prices accelerates, the opposite occurs with output. Then the positive correlation between prices and real output tends to be offset by the differences in the speed of reaction of the two variables in response to movements in nominal income.

From these considerations one can derive the fact that the positive correlation between prices and output will occur only when disturbances to nominal income are significant enough to overcome the statistical effect mentioned above, and the economic forces which give rise to a negative correlation. This is precisely what our results indicate.¹²

Friedman and Schwartz exemplify the hypothesis that with significant changes in nominal income (quantity of money and/or velocity of circulation) a positive correlation between prices and output would be verified with the recessionary periods 1920-21 and 1929-33.

We suspect that these episodes —so dramatic and important— explain our initial assumption that the correlation ought to be positive.¹³

An aspect of Friedman and Schwartz' analysis of the post-war evidence which draws one's attention relates to the transmission mechanisms for changes in aggregate demand on output and prices. In particular, from Friedman and Schwartz' analysis it can be inferred that the distribution of a given change in aggregate demand on nominal income would depend on its magnitude. Even though this may be a reasonable hypothesis for explaining the prices policy of firms in a context of uncertainty and/or imperfect competition, what attracts ones attention is the fact that this theory seems more consistent with neo-Keynesian menu-cost type theories,¹⁴ than with a neoclassical view of the cycle. In particular, this approach leaves expectations of price changes out of the analysis —an essential aspect of modern

¹² Friedman and Schwartz (1982), *op. cit.* p. 403. (Retranslated into English from a Spanish translation by the authors.)

¹³ Friedman and Schwartz, (1982), *op. cit.* p. 404. (Retranslated into English from a Spanish translation by the authors.)

¹⁴ This is so because the reaction of entrepreneurs, in their pricing policy, to a change in market conditions will essentially depend on the discrepancy between the ruling price and that which would clear the market, and this is directly related to the magnitude of changes in aggregate demand. In this regard, see Ball, Romer and Mankiw, *op. cit.*

aggregate supply theory, and which was developed on the basis of an important paper by Friedman himself, among other economists.¹⁵

3. Thoughts on the Chilean case

The Chilean economy has a long inflationary history, during which time frequent and significant fluctuations in its growth rate have also been recorded. According to output and inflation data collected in a study carried out by Hernán Cortés and Sergio de la Cuadra (1984) on the recessions recorded in the Chilean economy between 1926 and 1982, there is a slightly negative unlagged correlation between the growth of output and inflation, amounting to -0.25 for the period considered. Despite the fact that the negative sign on this statistic might lead to the temptation to assign a counter-cyclical nature to inflation, it needs to be made clear that consideration of the gross rate of GDP growth in its calculation does not permit conclusions to be drawn on the cyclical pattern of inflation, so this exercise only provides preliminary data. On the other hand, the absolute value of the coefficient mentioned is relatively low, which makes it necessary to explore the potential existence of lags in inflation in relation to the business cycle.

In order to achieve a more rigorous analysis for Chile of the behavior of inflation over the business cycle, the following sub-section applies the techniques used in the abovementioned studies to Chilean data. The period considered in the empirical analysis covers the years 1926-1991.

3.1 Evidence for the Chilean case

The present section examines the correlation between the output and prices time series for the Chilean economy. Annual figures from 1928 to 1991 are used. The contemporary price index series is taken from the Central Bank of Chile. Real output figures for 1928-82 were taken from the study by De La Cuadra and Cortés (1982) and the remainder (1982-92), from the Central Bank. In the data transformation carried out to obtain the cyclical component of each series, three methods were used: first differences, calculation of deviations from the trend, obtained through regression, and the Hodrick-Prescott filter. In each case we worked with series expressed in logarithms.

¹⁵ Friedman (1968).

a) Method of first differences

In order to explore the direction of joint movements between prices and real economic activity, the first differences of the log of each series were taken, eliminating the non-stationary part of the trend. Calculating the correlation between the first difference of the log of real GDP in year t (TYR_t) and prices lagged and advanced by three years (TP_t), negative measures of the relation are obtained, with the greatest intensity between the two variables in the unlagged correlation (Table N° 2).¹⁶

TABLE N° 2

First differences of logarithm Annual, 1928-1991					
Variable X	Correlation of real GDP with				
	X(t-2)	X(t-1)	X(t)	X(t+1)	X(t+2)
Price level					
First differences (1)	-0.03	-0.09	-0.26	-0.17	-0.04

(1) Equivalent to the Inflation Rate

b) Method of ordinary least squares (OLS)

In this case the trend of the series analyzed is obtained via a simple linear regression as a function of time, applying ordinary least squares. As can be seen in Table N° 3, the correlations between real GDP and prices advanced and lagged are negative.

TABLE N° 3

Cyclical deviations obtained by OLS Annual, 1928-1991					
Variable X	Correlation of real GDP with				
	X(t-2)	X(t-1)	X(t)	X(t+1)	X(t+2)
Price level					
Deviation of prices	-0.02	-0.31	-0.38	-0.32	-0.19

¹⁶ To investigate the significance of the correlation coefficient, the student-t version of a global significance F-test was used. For a sample 63 observations a correlation coefficient greater than 0.24 is needed to be able to overcome the critical “t” test value (1.96). In the three methods used, the hypothesis of a non-significant correlation coefficient is rejected.

c) The method developed by Hodrick-Prescott

As was pointed out above, Hodrick and Prescott (1980) provide a procedure for calculating the trend of a time series.¹⁷ The statistical breakdown of the data is carried out on the basis of neoclassical growth theory analysis, so this method predicts that if the rate of technological change were constant, then the trend of the logarithm of real GDP would be a linear function of time. However, it has been observed empirically that the rate of technological progress tends to vary not only between countries but also over time, so it would be advisable to use a method that made it possible to give some flexibility to the trend over time.

Let Y_t be a time series for $t = 1, 2, \dots, T$. According to this method, the trend component, denoted by m_t for $t = 1, 2, \dots, T$ is that which minimizes the following expression:

$$\sum_{t=1}^T (y_t - \mu_t)^2 + \phi \sum_{t=1}^T \left[(\mu_{t+1} - \mu_t) - (\mu_t - \mu_{t-1}) \right]^2 \quad (4)$$

for an appropriate positive value of ϕ . The value of ϕ is chosen so as to obtain the desired degree of stability or smoothness in the trend. In this way, if $\phi = 0$ the original time series results, and if ϕ tends to infinity, the trend values are represented by the straight line of ordinary least squares. In the analysis of Chilean data a value of $\phi = 1600$ was also used, like that used by Backus and Kehoe also with annual data, despite the fact of the value $\phi = 1600$ is used by Hodrick and Prescott with quarterly figures. However, in order to evaluate the sensitivity of the results to the value of ϕ , an exercise was carried out using a value of $\phi = 400$.¹⁸

The contemporary degree of co-movement of the price indicator with real GDP is shown in column X(t) of Table N° 4. The statistics reported in this column are correlation coefficients of the cyclical deviations of prices with respect to the cyclical deviations of real GDP. A number close to one indicates that the series is highly procyclical; a number close to one but of opposite sign indicates that the series is anticyclical. A num-

¹⁷ McCallum (1986) states that in six years since the appearance of the Hodrick-Prescott filter, no controversy has arisen over the method and it has been generally accepted.

¹⁸ It is important to emphasize that one of the advantages of this technique of obtaining the trend from the series under study is that the trend obtained is a linear transformation of the original series and, therefore, its first two statistical moments are a function exclusively of the first two moments of the original series.

ber close to zero indicates that the series does not vary contemporaneously with the cycle: in this case one can say that the series is not correlated with the cycle.

The other columns of Table N° 4 also present correlation coefficients, only that the price series has been advanced and lagged between one and three years in relation to real GDP.

The purpose of this is to decide whether movements in the price series are out of step with movements in real output. If, for example, the figure in the center of the table is positive but less than that which appears under column X (t-i), where $i > 0$, this would indicate that “prices cycle” leads the activity cycle. If on the other hand, the prices cycles lags the activity cycle, then the bigger correlation coefficient is found in column X (t+j).

TABLE N° 4

Hodrick-Prescott filter							
Deviations of the trend for real GDP and prices							
Annual, 1928-1991							
Correlation between real GDP and							
Variable X	X(t-3)	X(t-2)	X(t-1)	X(t)	X(t+1)	X(t+2)	X(t+3)
Price level							
Both $\phi=1600$	-0.15	-0.28	-0.39	-0.46	-0.42	-0.31	-0.19
Both $\phi=400$	0.02	-0.14	-0.29	-0.39	-0.36	-0.25	-0.14

According to the figures in the table above, the behavior of prices in the Chilean economy between 1928 and 1991 is anticyclical. As can be appreciated, this result is independent of the value of ϕ .¹⁹ The cycles in prices and real GDP are contemporaneous taking an annual frequency.

3.2 Certain features of the economic cycle in Chile

According to evidence by De La Cuadra and Cortés, the rate of growth of Chilean GDP is strongly influenced by the behavior of the relevant external scenario (terms of trade and interest rates), which reflects an

¹⁹ Apart from the “ ϕ ” reported in the table, various values below 1600 were used. In no case did the direction of co-movement between the two series change; only the correlation coefficients changed, in a not very significant way.

eminently real origin to the cycles observed in the Chilean economy. Insofar as the authorities respond to the impact of terms of trade changes on national income and output through a contemporaneous increase in the nominal exchange rate, it would be reasonable to expect an inverse correlation between the output and inflation cycles.²⁰ However, to the extent that there is some degree of “waiting” on the part of the authorities, before reacting to a fall in the terms of trade, a lagged response ought to be detected in the real exchange rate and prices in response to the business cycle. Moreover, insofar as the economic authorities were subject to the discipline of a fixed nominal exchange rate for a significant part of the period, then a procyclical behavior pattern on the part of prices would be expected, because in this case the rise in the real exchange rate required by the contractionary phase of the cycle would be achieved by a deflation of domestic prices, or, more generally, by below-trend growth in international prices. In this sense, the verification of evidence supporting the hypothesis of anticyclical price behavior suggests the existence of an adjustable exchange rate rule for most of the period considered.

According to evidence reported in the study by De La Cuadra and Cortés, there would indeed appear to be a tendency on the part of the authorities to delay making adjustments in domestic spending in response to deterioration in the level of national income caused by a fall in the terms of trade. This is reflected in the fact foreign debt rose at the start of nine out of twelve recessionary episodes recorded. In only three out of eleven periods when there has been a fall in the terms of trade, has the real exchange rate risen in the same year. The usual thing has been for adjustment to be delayed, expecting the maintenance of this fall.²¹

De La Cuadra and Cortés also find that the monetary authorities often reacted to adverse external change by applying an expansionary monetary policy. More specifically, monetary policy was expansionary in ten out of twelve years in which a recessionary phenomenon began.²²

²⁰ This, assuming the existence of some type of friction in the adjustment process, or in the management of economic policy, which leads to the rate of inflation going up and the real exchange rate rising.

²¹ Thus, for example, in the “Great Depression” the terms of trade began to fall in 1930 (-2%), a situation which was met by an increase in external borrowing in that year. In 1931, the terms of trade fell again (-15%), and this led to a 5% increase in the real exchange rate together with a further rise in external borrowing, until in 1932 a violent real devaluation of the peso took place, which De La Cuadra and Cortés estimate at 249%.

²² In this regard, see De La Cuadra and Cortés (1984).

TABLE N° 5

Years	GDP Growth	% Change in Prices
1928-37	4.3	6.2
1938-47	2.0	15.1
1948-57	4.6	35.6
1958-67	4.5	25.9
1968-77	1.3	174.1
1978-87	3.5	24.2
1983-92	5.5	20.4

Source: S. De la Cuadra and H. Cortés, *op. cit.* and Central Bank Monthly Bulletin.

4. An attempt to interpret the evidence

From the evidence obtained by De La Cuadra and Cortés, one possible interpretation for the anticyclical behavior of inflation would be the economic policy strategy adopted in response to variations in Government revenues. In particular, the evidence seems to suggest a certain bias on the part of the authorities who behave as if adverse national income shocks were transitory, so in this type of scenario they would opt to borrow so as to avoid expenditure adjustment or a rise in taxes. As the chances diminish for financing growth in expenditure above the rise in income, incentives are generated for borrowing from the Central Bank as a means of continuing to delay adjustment.²³ The rise in the rate of inflation which usually follows the monetary financing of public expenditure has been an important mechanism for adjusting expenditure in the case of the Chilean economy.

This type of behavior by the authorities is present in various economic policy experiences. In fact, in an analysis of fiscal policy applied in six countries (Argentina, Brazil, Chile, Mexico, Peru, Venezuela) from the beginning of the 1970s to the mid-1980s, Larraín and Selowsky (1991) find evidence to support the hypothesis that governments tend to delay adjustments in domestic spending in adverse scenarios, and accelerate the expenditure growth in favorable cycles.

²³ Normally, the strategy used to confront adverse changes in the external conjuncture has included the establishment of exchange controls as an important ingredient. One of the causes usually of this type of policy has usually been a desire on the part of the monetary authorities to maximize the revenue obtained from the inflation tax. Evidence supporting this hypothesis can be found in Alesina, Grilli and Milesi-Ferreti (1993).

“What is remarkable is that both oil importing and oil exporting countries — in spite of having different income effects from the oil shock— responded alike, all expanding their public sector. This behavior can be explained perhaps by a curious asymmetry in perceptions of external shocks — what one might call a “best expectation theory” (BET). Countries that gained from the shock tended to consider it permanent, and consequently they expanded. Countries that lost may have thought of the shock as temporary, and consequently decided to finance the loss rather than adjust.”²⁴

In the search for an explanation for the authorities’ behavior in response to adverse national income shocks, recent developments in the theory of public decisions and the political cycle can provide a useful analytic framework. In the Chilean case, changes recorded in the terms of trade and/or the rate of output growth have a direct effect on public sector revenues and, consequently, on the opportunities for non-inflationary public sector spending. So, the strategy the authorities adopt in the face of changes in the relevant external scenario —in terms of whether these movements are estimated as transitory or permanent— will have a significant influence on the path of external debt, inflation and the real exchange rate.

To the extent that the authorities have no interest in incurring the costs of carrying out orthodox fiscal adjustment, i.e. cutting spending and or raising taxes, they will tend to use public borrowing and/or inflationary financing as a mechanism for cutting aggregate expenditure, whether public or private.²⁵

Whether due to political difficulties associated with changing tax rates, or the choice of a tax stabilization program as a public finance strategy, the observed behavior of the rate of inflation and foreign debt in smaller economies, where there is significant government involvement as has historically been the case in the Chilean economy, can be explained in terms of a simple model structured on the basis of an assumption of a constant average tax rate.

In the interpretation of the authorities’ behavior in the economic cycle we will assume that they set their policies for each period in a framework which they see as their inter-temporal budget constraint. This

²⁴ Larraín and Selowsky, *op. cit.* p.310.

²⁵ Cukierman, Edwards and Tabellini (1992) have argued that friction inherent in political competition would lead to the preferential use of inflation as a mechanism for adjusting aggregate spending in scenarios of strong polarization. Similar conclusions are reached in context of political competition involving groups with strong ideological motivation, which is manifested in substantially different spending programs. In this case no group is disposed to facilitate the management of economic policy for their adversaries, which encourages the use of inflation as a mechanism for financing Government spending.

means that the spending program in each period is designed according to what the authorities themselves estimate the future trend of Governments revenues will be. In this context the BET hypothesis would be expressed as an excessively optimistic projection of the future evolution of the Government' spending capacity, compared to the estimation of an infinite lived rational agent.

The inter-temporal budget constraint implicit in the fiscal authorities' management, according to their projection of the behavior of current revenues in the medium term is given by:

$$\sum_0^{\infty} Tt^*/(1+r)^t = \sum_0^{\infty} Gt/(1+r)^t + Bo \quad (1)$$

The asterisk indicates that this is an estimation by the authorities of the future path of the variable in question.

For simplicity it is assumed that the only tax is income tax, with a proportional rate equal to μ , such that $Tt = \mu Yt$.

Then it is assumed that the authorities in period t choose the tax rate (μ) which satisfies equation (2), below.

$$\mu = \frac{\sum_0^{\infty} [Gt/(1+r)^t]}{\sum_0^{\infty} [Y^*t/(1+r)^t]} \quad (2)$$

As was indicated above, to determine the average income tax rate, the projection the government makes of future Gross National Product is fundamental, because its optimistic view of the duration and/or depth of the adverse terms of trade shock will essentially be reflected in the revenues estimate on which government spending and borrowing policy is based.

Equations (3) and (4) make it possible to transform the Government's budget constraint so as to achieve greater clarity in exposing the effects of the cycle on public finances. In (3), the variable "k" indicates the trend growth rate of fiscal spending, which is a variable under the authorities' decision given the estimation that they make of future revenues. In (4) the variable "g" indicates the authorities' estimation of the trend growth of output.

$$Go \sum_0^{\infty} [(1+k)/(1+r)]^t = \sum_0^{\infty} [Gt/(1+r)^t] \quad (3)$$

$$Yo \sum_0^{\infty} [(1+g^*)/(1+r)]^t = \sum_0^{\infty} [Yt/(1+r)^t] \quad (4)$$

Given (3) and (4), and assuming the long-run equilibrium condition included in the design of fiscal policy is given by $k = g^{*26}$, then it is possible to write equation (2) in a more analytically attractive form, as shown in (5).

$$\mu = \frac{G^* + (r - g^*)Bo}{Y^*} \quad (5)$$

In the case where there is no initial government debt, the choice of m reduces to the quotient between the government's "permanent spending" and the income it estimates as "permanent".

The government's period by period budget constraint is given in (6).

$$B(t) - B(t-1) = G(t) + r(t)B(t-1) - \mu Y(t) \quad (6)$$

Substituting equation (5) in (6) we arrive at an equation that is intuitively more interesting.²⁷

$$B(t) - B(t-1) = G(t) - G^*(t) + [(Y^*(t) - Y(t)/Y^*(t))] [G^*(t) + rB(t-1)] g^* B(t-1) \quad (7)$$

²⁶ This, assuming a sufficiently long horizon for the intertemporal constraint.

²⁷ In Barro (1986), evidence is presented favorable to the explanatory capacity of this simple model. In the study mentioned, Barro finds an adequate explanation for the fiscal deficits seen in the United States between 1916 and 1983 using an equation similar to (7).

In an open economy, an excess of public sector spending is essentially channeled towards the external sector, being reflected in the balance of payments on current account. In this way, transitory negative incomes lead to an increase in external debt.

Insofar as the monetary financing of public spending is permitted, then equation (7) will have to be modified so as to incorporate this term, as shown in equation (8). Here “ m ” represents the real stock of money and “ π ” the inflation rate. It is assumed, for simplicity, that the income elasticity of demand for monetary base is unity. In equation (8) it is also assumed that the demand for money grows at the rate of growth of permanent income. This assumption could be modified without altering the basic results of the exercise.

$$B(t) - B(t-1) = [G(t) - G^*(t)] + [(Y^*(t) - Y(t)/Y^*(t))][G^*(t) + (rB(t-1))] + g^*(B(t-1)) - (\pi + g^*)m \quad (8)$$

From the same equation (8) the effect of an adverse cycle on inflation can be derived, under conditions of partial or total external financing restrictions.

$$\pi = 1/m \left\{ [G(t) - G^*(t)] + [(Y^*(t) - Y(t)/Y^*(t))][G^*(t) + rB(t-1)] + g^*(B(t-1) - m) - B(t) - B(t-1) \right\} \quad (9)$$

According to equation (9), the authorities will have recourse to inflation as a financing source to the extent that its financing needs can not be met by borrowing. Where this option is not available, for example due to the fact that the economy's previous level of borrowing is considered excessive by the external financial community, an exact inverse relation is obtained between the activity and inflationary cycles. In other words, when an adverse shock occurs, the authorities are tempted to judge this as transitory, just as the BET hypothesis would predict. So the response that is consistent with this consists of increasing net external borrowing so as to stabilize the growth of consumption. As long as financial markets are willing to participate in this gamble, the model predicts an increase in foreign debt as indicated above.²⁸ However, as the country's external debt

²⁸ De La Cuadra and Cortés find that in 19 instances of a fall in the terms of trade, 12 are accompanied by a contemporaneous increase in foreign borrowing.

increases, without a recovery in national income, access to foreign resources will become restricted. In this case governments will have to work out mechanisms through which to achieve harmony between aggregate spending with the supply of goods. The political difficulty that is commonly seen in implementing adjustment programs of an orthodox type, either through reductions in the level of government spending or taxes increases, frequently results in inflation being the mechanism through which a significant part of this adjustment is carried out.²⁹

4. Conclusions

The appearance of numerous studies reporting evidence favorable to the hypothesis that prices follow an anticyclical behavior pattern, has given rise to close questioning of theories that see economic fluctuations as the result of movements in aggregate demand. According to the available evidence this result is relatively insensitive to the method used to determine the cyclical behavior of each series.

When the behavior of prices in Chile is examined, evidence is also found that prices tend towards anticyclical behavior.

The available evidence suggests that fluctuations recorded in the rate of growth of output in Chile are intimately linked to the evolution of the world economy and, especially, to the terms of trade. In addition, there is a tendency on the part of the authorities to delay adjusting fiscal policy when adverse changes in national income occur. Such conduct by the authorities is also present in other economies of the region.

In order to reconcile these two regularities —anticyclical price behavior and optimism on the part of the authorities— a simple model was developed, from which it is concluded that inflation is a “residual tax” whose use in the case of small open economies such as Chile, is inversely correlated with the business cycle.

Despite the fact that this argument is not new to students of the economic policy design process in Latin American economies, it is important to stress its consistency with the empirical results obtained from an analysis of the price series over the cycle. Moreover, despite the essentially real nature of the cyclical movements that have occurred in the Chilean economy, one should not forget the role of institutional factors, such as those relating to fiscal policy design. According to the argument presented

²⁹ Cukierman, Edwards and Tabellini (1992).

above, this probably explains the anticyclical behavior of inflation. Consequently, the introduction of institutional arrangements such as autonomy for the Central Bank, should lead to a change in the direction and/or intensity of cyclical movements in the price series.

ANNEX

FIGURE N° 1 PRICE LEVEL AND REAL GDP

First difference of Log: Both Normalized

Annual: 1928-1991

Source: Central Bank of Chile and Authors' calculations

FIGURE N° 2 DEVIATIONS OF REAL GDP AND PRICES

Based on a lineal regression estimated by OLS

Source: Authors' calculations

FIGURE N° 3 LOG OF REAL EFFECTIVE GDP AND ITS TREND

Hodrick-Prescott Filter, Parameter: 1600

Source: Authors' calculations

FIGURE N° 4 LOG OF PRICE LEVEL AND ITS TREND

Hodrick-Prescott Filter, Parameter: 1600

Source: Authors' calculations

FIGURE N° 5 LOG OF REAL EFFECTIVE GDP AND ITS TREND

Hodrick-Prescott Filter, Parameter: 400

Annual, 1928-1991

Source: Authors' calculations

FIGURE N° 6 LOG OF PRICES AND TREND

Hodrick-Prescott Filter, Parameter: 400

Annual, 1928-1991

Source: Authors' calculations

FIGURE N° 7 LOG OF REAL GDP AND ITS TREND

Hodrick-Prescott Filter, Parameter: 100

Annual, 1928-1991

Source: Authors' calculations

FIGURE N° 8 LOG OF PRICE LEVEL AND TREND

Hodrick-Prescott Filter, Parameter: 100

Annual, 1928-1991

Source: Authors' calculations

FIGURE N° 9 DEVIATIONS OF REAL GDP AND PRICES

Hodrick-Prescott Filter, Parameter: 1600

Source: Authors' calculations

FIGURE N° 10 DEVIATIONS OF GDP AND PRICES

Hodrick-Prescott Filter, Parameter: 400

Annual, 1928-1991

Source: Authors' calculations

FIGURE N° 11 DEVIATIONS OF REAL GDP AND PRICES

Hodrick-Prescott Filter, Parameter: 100

Annual, 1928-1991

Source: Authors' calculations

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