FULFILLMENT OF OKUN'S LAW IN THE CITY OF POSADAS, ARGENTINA, USING DYNAMIC MODELS

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SUMMARY

The present paper contributes to the understanding to the functioning of the labor market in the city of Posadas, Misiones, Argentine Republic, and has as its objective to measure the relationship between the growth of the GGP of the Province of Misiones and the growth of unemployment in the same Province, by means of the use of the relationship known as of Okun's Law, using a dynamic specification.

In the traditional static version one supposes the normal growth rate, for the whole period analyzed. However, said rate is modified due to variations in the marginal productivity of the work, a situation which is evidenced in the provincial economy as a result of the structural change caused by Convertibility. The dynamic specification of Okun's Law allows to capture the impact, of said changes in the marginal productivity of the paper.

As a result of this paper such relationship is obtained that for each a point of growth of the GGP, above its tendency, it results in an unemployment rate decrease of 0.17%. Also, an asymmetry was established in the unemployment behavior which would evidence that when the economy grows 1%, unemployment drops 0.19%, and when the GGP drops 1%, always regarding its tendency value, unemployment increases only a 0.15%.

1 En el presente trabajo se desempañaron como asistentes de investigación la Lic. María E. Muguerza y el Lic. Juan A. Dip. Los autores agradecen su colaboración. Los errores y omisiones corresponden únicamente a los autores

2 Este trabajo se inscribe en el marco de un Proyecto de Investigación sobre Desarrollo Regional en el Centro de Estudios de Energía para el Desarrollo (CEED). Las opiniones expresadas en el mismo corresponden única y exclusivamente a los autores y no a las del CEED.

KEY WORDS: Okun's Law, GGP, growth, unemployment, dynamic models.

INTRODUCTION

The understanding of the economic situation of a region, as also the design and instrumentation of efficient public policies, depend in great measure from the availability of the pertinent information to the economic aspects that are sought to be embraced.

From an academic perspective, a scarce treatment of formal models is observed applied in the provincial economies. This situation is particularly valid in the Province of Misiones, which has motivated the present work, in which the functional relationship is identified between the GGP and unemployment, considering characteristics pertaining to the provincial economy, with the intention of making a contribution which in the future will allow to improve the process quality of making decisions related to the Province's macroeconomic situation.

In this paper through econometric models, the validity of the dynamic specifications of Okun's Law is studied, according to which the growth rate of the product and the unemployment rate are related in an inverse way. As a result of this paper, such a relationship is obtained that for each GGP growth point, above its tendency; there results a decrease of unemployment rate of 0.17%. Also, there was established an asymmetry in the behavior of the unemployment that would evidence that when the economy grows a 1%, unemployment drops a 0.19%, and when the GGP drops a 1%, always regarding its tendential value, unemployment increases only in 0.15%.

These results are consistent with the ones obtained in a previous paper[3] in which different specifications of static models, were estimated, proving in all of them the validity of this Law, in the case of the city of Posadas, with values which indicated, that for each percentage point of variation of the GGP growth, above the natural growth rate, unemployment diminished between 0.15% and 0.30%, which in turn was compatible with the results obtained in domestic and international literature.

In this sense one can mention as antecedent in economics literature, OKUN's (1962)[4] paper

3 Cumplimiento de la Ley de Okun en la ciudad de Posadas utilizando modelos estáticos. Fernández, R. A.; Simes, H. Visión de Futuro, Revista Científica, Año 3, Volumen 6, Julio – Diciembre 2006. Para evitar la reiteración de conceptos ya desarrollados: cuestiones históricas relativas a la Ley de Okun, especificación del modelo estático, antecedentes nacionales e internacionales, características de las series utilizadas; se remite al lector a éste trabajo.

4 OKUN, A.M. (1962) “Potential GNP: Its Measurement and Significance” American Statistical Association Proceedings of the Business and Economic Statistics Section, 98-104.

itself, which outlines the original static model. More recent works establish the existence of asymmetry in Okun's Law, as for example in Harris, R., Silverstone, B., (2001)[5] who carry out a traverse section study in seven countries of the OECD (Organization for Economic Co-operation and Development), corroborating the general validity of the Law in all the countries, and the asymmetry in six of them. In the application of macroeconomic instrumental in the analysis regional economies, one can mention, as a recent contribution the case of Spain, Perez-Rodnguez-Usabiaga (2002)[6], who carry out a study of the validity of the dynamic version of Okun's Law, for the case of Andalusia, in comparison to the rest of Spain, corroborating the existence of the asymmetry in the relationship. In the domestic environment, not many papers have been found which try to estimate this relationship for Argentina. However, Abril-Ferrullo-Cordoba's (1998)[7] recent work stands out, who estimated Okun's relationship for the country using information of the 1980-1996 period.

The present article has as its objective to constitute a complementary contribution to the mentioned work, already incorporating to the measurements already made, and the existent relationship between the product variation rate, and unemployment variation rate in the Province of Misiones, some conclusions which are derived from a specification different from Okun's Law model.

Why is a dynamic specification necessary?

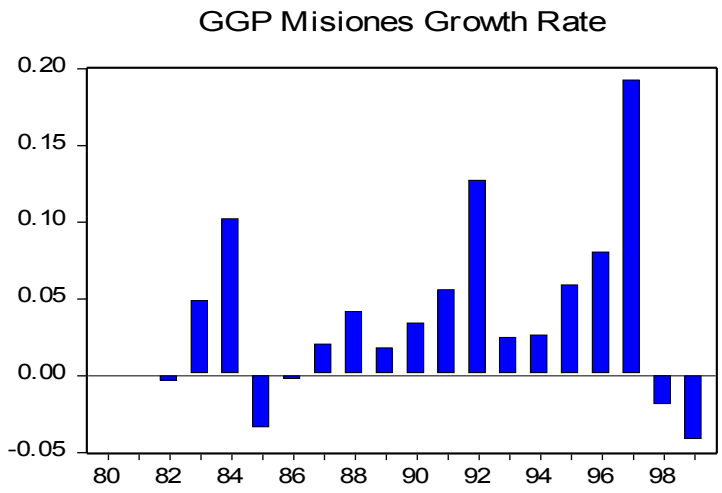
It is necessary to remember that static specifications impose on the model constant growth rate of the GGP, as can be seen in Chart 1, the same one is far from being so, but rather, on the contrary it presents cycles with tendencies of accelerating:

5 HARRIS, R., SILVERSTONE, B., (2001) "Testing for asymmetry in Okun's law: A cross−country comparison.", Economics Bulletin, Vol. 5, No. 2 pp. 1−13.

6 PÉREZ, J., RODRÍGUEZ, J., USABIAGA, C., (2002), "Análisis Dinámico de la Relación entre Ciclo Económico y Ciclo del Desempleo en Andalucía en comparación con el Resto de España", Fundación Centro de Estudios Andaluces.

7 ABRIL, J.C., FERULLO, H.D., CÓRDOBA, A.G , (1998) "Estimación de la relación de Okun: Argentina 1980-1996", Facultad de Ciencias Económicas, Universidad de Tucumán y CONICET.

Chart 1



Source: Made as from IPEC -INDEC -EPH

The specification of the static models might not be correct, introducing Specification Biases, when supposing constant, a variable that shows high volatility.

On the other hand, the very growth rate own dynamics of the economy would seem to suggest an adaptation model to the prevailing national macroeconomic conditions in the environment, when from 1985 up to 1991 the rate is increased from a negative value near to 4%, until a positive one of 5%; also, excluding 1992 which presents a jump characteristic of some numeric readjustment in the series of data, even when this fact is not mentioned in the explanations of the managed series of data, in the series of data once again there is an elevation model of the rate growth from 2% in 1993 and to nearly almost 19% in 1997.

This cyclic behavior with acceleration tendency would be consistent with the adaptation of the entrepreneurs to the macroeconomic conditions, and with the delays characteristic of the maturation of the investment programs of the companies and it could be related with changes in work productivity, a parameter that is also considered constant in the static specification. In particular for the period 1991 - 1997, the depreciation of the real exchange rate could have motivated the investment in strange technologies which would have increased the work productivity, partly justifying the aforementioned acceleration in the growth rate.

In this sense, and adopting as a supposition the possibility of change in work productivity, the fundamental contribution of this article establishes itself, which tries to carry out a measurement of

the negative relationship between unemployment in the Posadas, (Misiones) agglomerate, and the growth of the provincial economy during the years 1980-1999, adjusting the natural unemployment rate to the modifications work in productivity. On the other hand, the dynamic specification itself, has allowed to establish an asymmetry in the relationship between the expansible and recessive phases of the Misiones economy.

The usefulness of the results obtained allows to get to know the main characteristics of the existent relationships between two outstanding macroeconomic variables, in terms of Okun's Law relational structure, favoring in this way the design and instrumentation of efficient public policies.

From the static to the dynamic version

The relationship of static Okun is expressed in the following way:

$$u_t - u_{t-1} = \theta * \left(g_t - gn_t \right) \quad (1)$$

On the other hand, the estimated specification in the previous paper was expressed as follows:

$$u_t - u_{t-1} = \beta * \left(g_t + \alpha \right) \quad (2)$$

In the traditional static version the normal growth rate is supposed for the whole period, from 1980 to 1999. This has difficulties when appropriately estimating Okun's relationship; specially, one would be overestimating the relationship between growth and unemployment, since, adopting the supposition according to which the entrepreneurs react optimally to the macroeconomic signs, during the 90's there would have been given the conditions to favor the introduction of external technologies that would have redounded in an increase of the marginal productivity of the work factor, which in turn would have been translated into a proportional increase of the normal growth rate.

A way of modeling this phenomenon in a dynamic way consists on determining the tendential component of the variables so that the Equation 1 becomes the following expression:

$$u_t - u_t^{TEND} = \theta * \left(\ln \left(PBG_t \right) - \ln \left(PBG_t^{TEND} \right) \right) \quad (3)$$

In Equation 3 have changed: the defasated unemployment rate, now is substituted by the natural rate of unemployment, and the normal growth rate constant, is now replaced by the natural logarithm of the GGP of Misiones tendential, of long term for the same period.

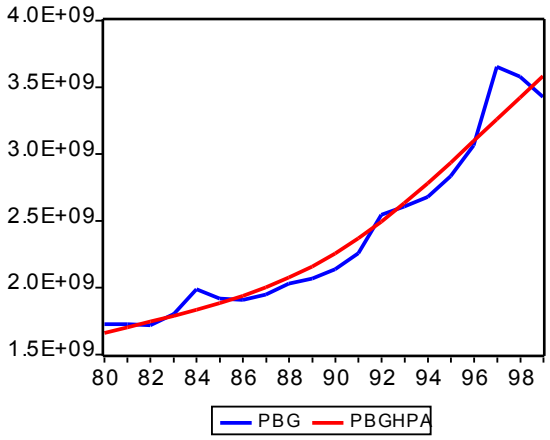
The procedure to obtain the tendential evolution of the variables consists on the application of the so called Hodrick-Prescott Filter[8] (filter HP), which is frequently used in the applied and academic macroeconomics field, as long as it allows to decompose a series in its cyclic and tendential components.

The HP filter, allows to obtain a smoothed series minimizing the variance of the original series regarding the new series, subject to a certain penalization, regarding the concavity of the smoothed component. In the mathematical expression the smoothing is achieved by means of the application of a smoothing parameter λ , in such way that when increasing it you increase the smoothing. It is fit to mention that in the literature the following values are suggested for the parameter λ: 100 for annual series data, 1600 for quarterly series data and 14400 for monthly series. In this paper, the suggested criterion has been adopted.

The application procedure for filter HP to the GGP of Misiones is direct and the smoothing can be observed in Chart II.

Chart II

Smoothing Resulting from the Application of HP Filter Application
Variable: Misiones GGP

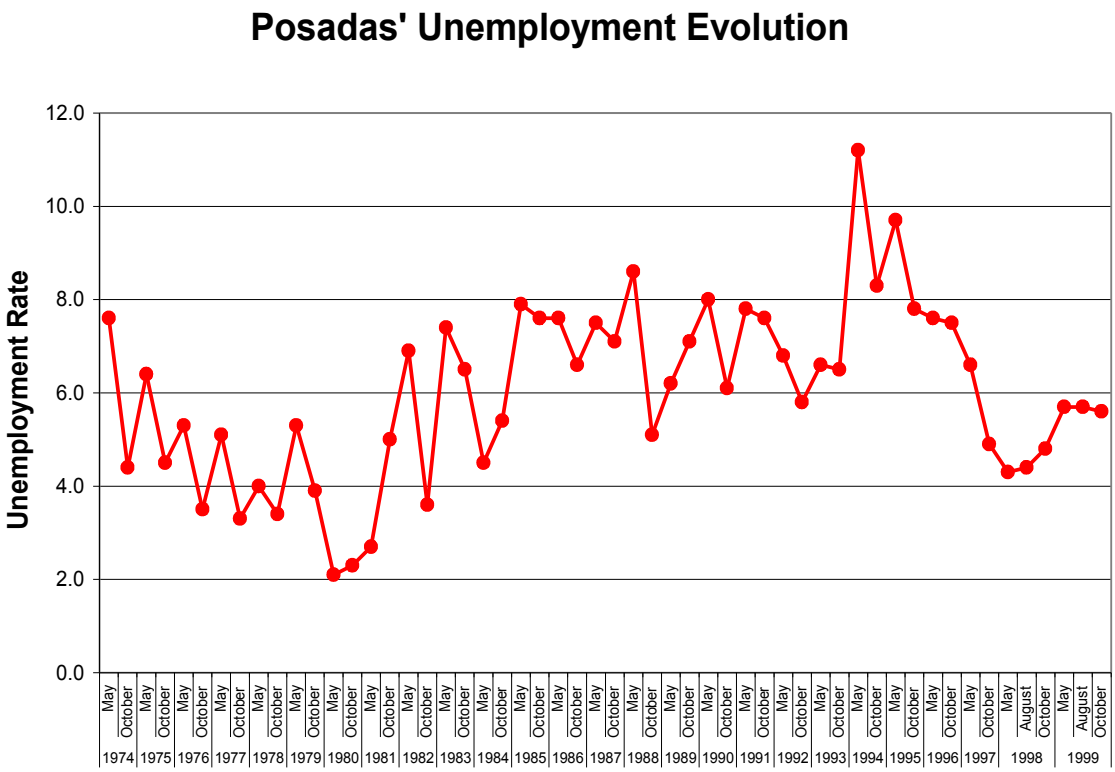


Note: Misiones GGP in 1993 pesos
Source: IPEC

8 The method was used for the first time in the 80's to analize the United States economy cycles, in the period after the Second World War. He seminary paper, published late in 1997 is, HODRICK, R. J. and E. C. PRESCOTT (1997), "Postwar U. S. Business Cycles: An Empirical Investigation" Journal of Money, Credit and Banking, 29, pp 1 – 16

In the case of the application of filter HP to the unemployment series, with the objective of estimating a smoothed unemployment rate, it presents an inconvenience. To limit the sample to the 1980 - 1999 period would imply to print in the smoothing an underestimate bias, since the 1980 unemployment rate is especially low[9] Following, Chart III is presented with the evolution of the unemployment rate as it arises from the EPH, for the period 1974-1999.

Chart III



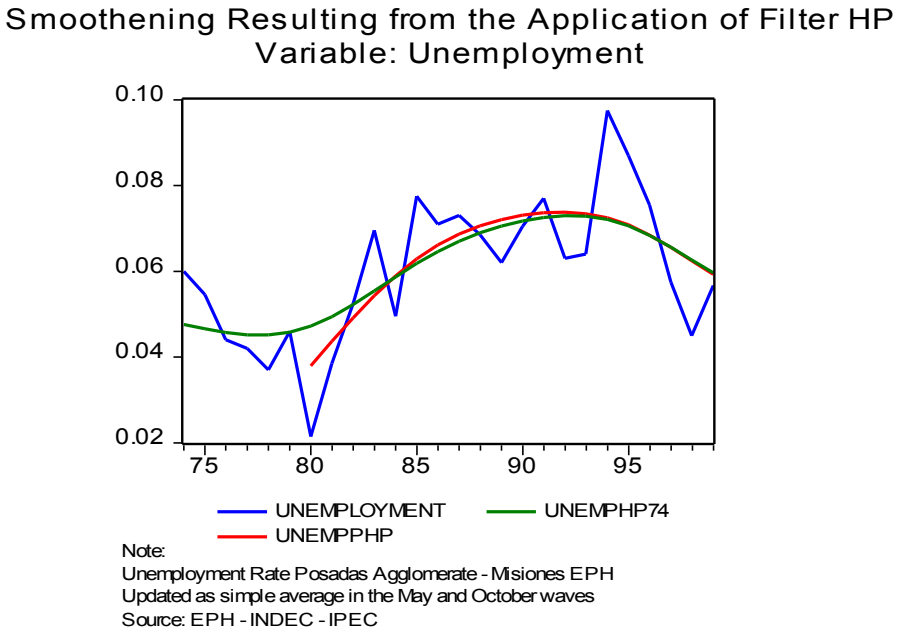
Source: INDEC - EPH

In Chart III one can clearly see the abrupt fall in the 1980 unemployment rate, for this reason one decided to apply filter HP to the complete unemployment series from 1974.

The application procedure of filter HP to Misiones unemployment is direct, in Chart IV one can compare the smoothing that would have resulted if one considered 1980 as the beginning of the series, and that which resulted from the amplified series to incorporate the unemployment rates up to 1974.

9 At the beginning of the 80's, there is an exogenous intervention in the Provinces of Misiones and Corrientes, due to the building of the Yacyretá, in the Main Construction, built near Ituzaingó – Corrientes Province, and the Complementary Works and the bridge which would join Posadas, Misiones, with the neighboring city of Encarnación – Paraguay. The labor dynamic market, has been the subject of numerous impact studies, one which stands out is the, "Estudio de Impacto Yacyretá" Work Document Nº 6, FREAZA, M. A. (1982)

Chart IV



Relationship of dynamic OKUN

In the elaboration of the model one tried to minimize, insofar as possible, the use of DUMMYS ad - hoc, reason for which an autoregressive structure was outlined from the beginning, so that the terms corresponding to straggled unemployment, contains the relevant information. The evaluated general form is shown in the following expression that corresponds to Regression V:

$$u_t - u_t^{TEND} = \theta * \left(\ln\left(PBG_t\right) - \ln\left(PBG_t^{TEND}\right) \right) + \sum_{i=1}^{n} \left(\beta_{i,t-i} * \left(u_{t-i} - u_{t-i-1} \right) \right) \quad (4)$$

At the end of the following section one presents Figure Nº 1 with the comparison of the regressions corresponding to the dynamic models. There the main model resultant statistics are shown, under the name of Regression V, using the differences of the unemployment series and GGP regarding their tendential values, according to Equation 4[10].

Interpretation of the results obtained:

a. It is observed that the variables of the proposed model in Regression V have the expected sign.

10 This paper is presented as an extension to a previous one, one opted not to change the Regressions numbers, so as to be able to compare the results of both papers.

b. The associated coefficient only to the GGP variation, presents a value of -0.17547; statistically significant to 1%. In this dynamic version it lacks sense to speak of the normal growth rate that is implicit.

c. The combined probability, determined starting off from statistical F, is significant to 1%.

d. The Adjusted correlation coefficient R^2 is of 0.77195.

e. The variable CAMBMOD02 was incorporated, used in Regression IV, to capture the negative interferences identified in the first democratic government.

f. A term MA(1) was incorporated that supposes a structure of error of moving averages, which explains the improvements in the estimate.

g. An autoregressive errors structure in the order 5 was incorporated, reflected in the term AR(5).

h. The combined significance of the considered variables is highly significant.

From the results of the regression one can conclude that for each 1% of variation of the product above their tendency value, unemployment diminishes an average of, 0.17%.

Structural change in the relationship of dynamic Okun

Similarly to that carried out for the traditional version, the behavior of the relationship in the first democratic government was considered for the dynamic version, as well as during Convertibility.

In Regression VI the main statistics of the resulting model are shown when including the DUMMYS: DEMOCALF and CONVERTIB, for the aforementioned periods respectively.

Interpretation of the obtained results:

a. Variables of the model proposed are observed in Regression VI, they have the expected sign.

b. The associate coefficient only to the variation of the GGP, presents a value of -0.188795; statistically significant to 1%. In this dynamic version, there lacks the sense to speak of the normal growth rate, which is implicit.

c. The combined probability, determined starting from the statistical F, is significant to 1%.

d. The correlation coefficient R^2 Adjusted is of 0.699391.

e. A term MA(1) is incorporated that supposes an error structure of moving averages, which

explains the improvements in the estimate.

f. An autoregressive structure in the errors order of 5 is incorporated, reflected in the term AR(5).

g. The combined significance of the considered variables is highly significant.

The results of the model indicate that when there is an increment of the product of 1% on its tendency value, unemployment it diminishes, on the average, of around 0.19%.

Although the statistical of the DUMMYS: DEMOCALF and CONVERTIB are not significant, their signs are consistent with the interpretation made during the Convertibility period, regarding the manpower ejector effect, and of productivity increase, in comparison during the first democratic government, each percentage point of growth compared a slight additional improvement in unemployment reduction.

Asymmetry in the relationship of OKUN's dynamic

Some current works research the possibility of an asymmetric relationship between unemployment and growth, in such way that the variation in unemployment would be different in the recessions than in the peaks or expansions.

When analyzing the economy of the United States, several autho[11] have established that asymmetry is proven in such a way that unemployment is more sensitive to the negative deviations than to the positive ones. In general, this behavior associates itself to the presence of hysteresis in unemployment, which implies that the current unemployment would depend on the previous unemployment values[12]. Another explanation for the existence of asymmetry is based on the characteristics of the labor market itself, where the exit costs of the industries would be inferior regarding the entrance ones[13], a sustainable explanation only for labor markets highly de-regulated.

The characteristics of the Argentine labor market, and in particular the functioning of the Province of Misiones labor market, starting from the possible changes in the economic structure

11 SILVAPULLE, P., I. A. MOOSA, M. J. SILVAPULLE (2002) "Asymetry in Okun's Law", mentioned in PEREZ, J. RODRIGUEZ, J. USABIAGA, C., (2002). This interpretation is also suggested in SCHORDERET, Y., "Revisiting Okun's Law: An Hysteretic Perspective", Dicussion Paper 2001 – 13, University of California, San Diego.

12 The economy fundament for the justification of the presence of histereses in unemployment based in the salary fixation models of Insiders-Outsiders, as due to negative perturbations, the insiders, who keep their jobs manage to get their salaries fixed, in function of their own interests, in a higher level, which would be allowed by unemployment return to its previous values, thus one would observe a permanent increase in the unemployment level.

13 MAYES, D.G., VIRÉN, M., (2000) "Asymmetry and the problem of aggregation in the EURO Area", BANK OF FINLAND DISCUSSION PAPERS 11/2000.

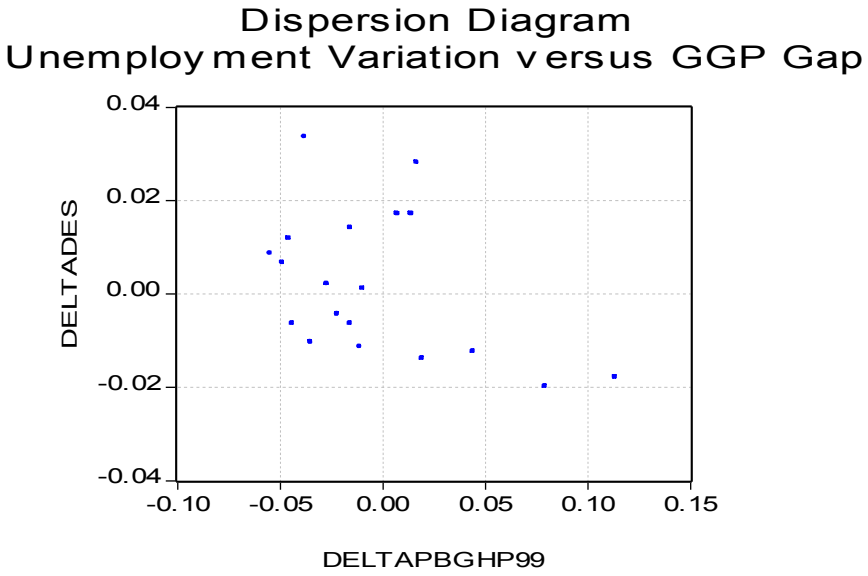
which would have taken place during Convertibility and the reformations faced during the 90's, demand a careful treatment of the hypotheses, when formulating the explanatory models.

For this reason, this paper, tries to identify and quantify the relationships between unemployment and GGP behavior in the Province, before establishing an explanatory theory on the operation of the local labor market, a task that would be for further papers.

However, as general criteria, it is considered that in the local labor market, in spite of the implementation of those so called First Generation Reforms[14] and of the flexibility introduced in the outlines of labor contracts, inflexibilities related with the costs of lay offs are observed. In this sense an inverse behavior to the aforementioned one would be expected, with a greater unemployment sensibility to the periods of expansion, than to the recessive ones.

Beginning with the analysis of the dispersion diagram between unemployment variation and the GGP gap, regarding their tendential value, one can observe in Chart V a first visual evidence of asymmetry.

Chart V



Note:
Estimated GGP Gap applying Hodrick - Prescot Filter
Misiones GGP in 1993 Pesos - IPEC
Updated Unemployment Rate as Simple Average - EPH
Source: EPH - INDEC - IPEC

A way to model asymmetry, considering the phenomenon in a dynamic way, consists on

14 WELLER, J., (2000), "Reformas Económicas, Crecimiento y Empleo: Los mercados de trabajo en América Latina y el Caribe", Comisión Económica para América Latina y el Caribe (CEPAL), Naciones Unidas. Editorial: Fondo de Cultura Económica. Chile.

determining the tendential component of the variables, just as was carried out previously in Equation 4, but differentiating the situations in which the GGP is superior and inferior regarding its tendential value, that which is shown in the following expression:

$$u_t - u_t^{TEND} = \theta_1 * \left(\ln\left(PBG_t\right) - \ln\left(PBG_t^{TEND}\right) \right)^{+} + \theta_2 * \left(\ln\left(PBG_t\right) - \ln\left(PBG_t^{TEND}\right) \right)^{-} \quad (5)$$

In Equation 5, the natural unemployment rate depends on the GGP gap. In the case of the positive gap that shows an exponent "+", the negative values adopt the value zero, and to the inverse the positive values adopt the value zero in the case of the negative gap. In Regression VII the main statistical ones are shown of the resulting model, according to this equation.

Interpretation of the results obtained:

a. It is observed that the variables of the proposed model in Regression VII have the expected sign, and the relationship is also the expected one with a greater sensibility in the case of the expansions.
b. The coefficient associated to the GGP's positive gap, presents a value of -0.193655; statistically significant to 1%; and the associated to the negative gap presents a value of -0.149034.
c. The combined probability, determined as from statistical F, it is significant to 1%.
d. The correlation R^2 Adjusted coefficient is of 0.689568.
e. A term MA(1) was incorporated that supposes an error structure of moving averages, which explains the improvements in the estimate.
f. An autoregressive structure was incorporated in errors of order 5, reflected in the term AR(5).
g. The combined significance of the considered variables is highly significant.

The results of the model indicate that before a product increase of 1% on its tendency value, unemployment diminishes, on the average, of around 0.19%, while before a fall of the product of 1%, unemployment is increased in 0.14%. This result is consistent with the suppositions of departure of the model, regarding the inflexibilities or lay off costs, and of the largest reaction velocity re the expansion situations starting off from the flexibilities for the contracting for testing

periods.

Graph Nº 1

Variable	Regression V	Regression VI	Regression VII
DHPGGP	-0.175470	-0.188795	---
t- statistical	-6.055465	-5.477972	---
DELTAHPMAS	---	---	-0.193655
t- statistical	---	---	-3.647926
DELTAHPMENOS	---	---	-0.149034
t- statistical	---	---	-6.722238
D(DESEMP(-1))	0.211653	---	---
t- statistical	2.044238	---	---
AR (5)	-0.801614	-0.806632	-0.845890
t- statistical	-7.215743	-4.799521	-5.949851
MA (1)	-0.962680	-0.989948	-0.989936
t- statistical	-14.77709	-796.4605	-2.542580
DUMMIES	UNA	DOS	---
R^2	0.837107	0.785280	0.756089
Adjusted R^2	0.771950	0.699391	0.689568
Probability (F-statistical)	0.000595	0.002249	0.001072
Akaike info criterion	-7.280673	-7.004429	-7.010297
Schwarz criterion	-7.044656	-6.768412	-6.821484
Source: Own Elaboration			

CONCLUSIONS

In the paper dynamic models have been considered to analyze Okun's relationship, incorporating the possibility of modifications in the work productivity and its effect in the growth rate of the provincial economy.

In the static models, estimated in the previous paper, the parameters associated to the growth rate are placed between -0.15 and -0.30, indicating that for each growth variation point, above the growth natural rate, unemployment diminishes between 0.15% and 0.30%. These values had demonstrated to be consistent with the range of values obtained for different countries.

The incorporation of the specification changes does not alter significantly, neither the values nor the conclusions of the previous paper, as long as parameters can be observed of between -0.14 and -0.19, with similar interpretation.

However, thanks to the new specification one could identify the relevance that the national economy interferences, as recessions, hyperinflation, and Convertibility and the process of economic reformations impelled in this period, have had in the provincial macroeconomic behavior.

In this sense, when comparing the operation of the relationship in the 80's during the first democratic government, and the following one, starting off from the implementation of Convertibility, the classic results are obtained in the Argentine economy literature, regarding the impact of the reformations on the labor market, as well as the derivative due to increases in productivity and the consequences on Okun's relationship. It is outstanding that the same conclusions are obtained, be it in the static models as in the dynamic ones.

Finally, the asymmetry was established as to the unemployment behavior in the expansion and recession situations, obtaining a result contrary to the aforementioned one, in international economic literature, but that is consistent with the characteristics, belonging to the national and provincial labor markets.

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