Growth and Macroeconomic Fluctuations: The Case of Latin America

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Abstract: Based on time-series from 1960 to 1995, we show the existence –for Latin American countries– of a short and long run negative correlation between economic growth and uncertainty. The probable cause of such relationship is time-variant; it is only after 1990 that investment-based theories on the link between uncertainty and growth cannot be rejected by the data. Further, the data cannot support the claim that government expenditure explains the correlation between growth and uncertainty.

Our results suggest that the average growth rate is endogenous to policy innovations. This implies that the long –run depends on short– run movements in activity, thereby casting some doubts on the conventional wisdom that assumes the dichotomy between an invariant steady state path and fluctuations around it.

Resumen: Haciendo uso de la evidencia estadística para América Latina de los últimos 35 años, mostramos la existencia de una correlación negativa –en el corto y largo plazos– entre crecimiento económico e incertidumbre. La causa de tal correlación aparenta ser variable en el tiempo; sólo a partir de 1990 la inversión parece explicar tal correlación. Más aún, la evidencia impide aceptar la hipótesis de que es el gasto público el causante de dicha correlación.

Nuestros resultados sugieren que el comportamiento de largo plazo de la economía depende de las fluctuaciones macroeconómicas de corto plazo. En este sentido, se pone en duda el supuesto tradicional que predica la ortogonalidad entre la senda de crecimiento y las fluctuaciones alrededor de ella.

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1. Introduction

Much of the literature on economic growth fails to consider the volatility of macroeconomic fluctuations as a possible explanatory variable of the rate of economic growth. Thus, it is commonly assumed that the average growth rate is exogenous to policy innovations. Examples of such assumption may be found in Solow (1956), Lucas (1983) and more recently in Lucas (1987) when he suggested that the possible returns from understanding business cycles are trivial compared to those from understanding growth –as if they were independent. One of the consequences of such a practice is that economic policy fluctuations are usually not taken into consideration when examining the growth rate of an economy. That is, macroeconomic performance and growth are usually perceived as separate issues.

The aim of this paper, in this regard, is to present evidence that suggests the existence of a negative correlation between economic growth and the unexpected volatility of macroeconomic fluctuations. We will show that the probable cause for such relationship is time-variant. Specifically, the structural changes of the 90's have made –contrary to what happened in the past– private investment become a major explanatory variable for the existence of a negative relationship between growth and uncertainty. To do this, events from 1960 to 1995 in a set of 17 countries in Latin America were taken as a sample.[1] We believe these results are important for two reasons. First, by showing that short-term policies do have a long-term impact, this result may help to acquire a better understanding of how macroeconomics and growth interact. As Blanchard (1997) recently said "if the long run depends on short run movements in activity, this is a serious modifier to the dichotomy between an invariant steady state path and fluctuations around it, which underlies the core" (pp. 244-245). Put differently, this study puts to a test the assumption that macroeconomic fluctuations do not affect the path of economic growth. Second, it may help understand why similar policies in different countries may not lead to similar outcomes: economic history matters.

Regarding the relationship between growth and macroeconomic volatility in Latin America, the 1995 Inter-American Development Bank Annual Report shows the existence of a positive although not

[1] The countries included were: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.

statistically significant relationship between them. In their regressions, though, they include variables (such as terms of trade volatility) which have a significant negative effect on output growth. If these variables were correlated with the volatility of innovations, then this positive correlation may be capturing the effect of predictable movements in growth, which largely depend on the persistence of output growth. While interesting, this analysis, however, has two main drawbacks. The first one is its use of the *average* growth rate of GDP per capita as a dependent variable. In this regard, the use of one observation per country minimizes macroeconomic fluctuations, thereby reducing the importance of this phenomenon *ex-ante*. The second flaw in the study was its failure to distinguish expected volatility from unexpected volatility –being the latter an approximation for uncertainty. Since conventional theory suggests that volatility can influence growth inasmuch as it reflects existing uncertainty, the failure to distinguish expected from unexpected volatility may bias the results.

On this same topic, using a sample of 92 countries, Ramey *et al.* (1995) report the existence of a negative correlation between economic growth and unexpected volatility. Searching for an explanation for this correlation, these authors find that investment-based theories on the link between volatility and growth do not seem to be verified by the data. Further, the results of evaluating whether the behavior of government expenditure may help explain such correlation were mixed. Thus when the entire sample is used, they find that government expenditure helps to explain why uncertainty and growth are correlated. However, when only considering OECD countries, they find that such correlation is statistically significant even after controlling for the behavior of government expenditure. This mixed outcome may be the result of a potential problem: the working assumption that the data belonging to developed and less developed countries are drawn from the same distribution. A second problem this paper may have is that the dependent variable –GDP per capita– may be biased. There are three reasons for such conjecture. First, because annual population growth rates are by definition *ad-hoc* constructions. Second, their use of GDP measured at purchasing power parity may imply to leave out the macroeconomic volatility originated in distorted exchange rate policies. Third, because the use of purchasing power parity implies the assumption that all consumption goods included in the consumer price index are internationally traded.

While analyzing the relationship between growth and uncertainty in Latin America, this paper will examine how important are the problems found in the above-mentioned papers. In so doing, our objective will be twofold. First, to analyzed whether such relationship exists and what the possible reasons for its existence are. Second, to study whether the aforementioned problems are of such magnitude that the results reported by the Inter-American Bank (1995) and Ramey *et al.* (1995) should be taken with caution. For these purposes, we will proceed as follows. The first section analyzes the statistical properties of some of the variables traditionally used in the area of growth. We will show that some of these variables contain significant measurement problems. Thus, studies that fail to consider these measurement errors will certainly provide biased estimates and therefore wrong conclusions.

In the second section, we analyze the relation between growth and volatility. To do this, following Levine and Renelt (1992) we first estimate the expected path of growth. Since we might encounter problems of spurious correlation, we constructed a measure of unexpected volatility on the basis of the coefficients for each country. Once this is done we measure the impact of unexpected volatility on growth. In general, our results suggest the existence of a statistically significant relation between unexpected volatility and economic growth.

One possible explanation for this inverse relationship between growth and uncertainty is that the latter may affect investment. To test such hypothesis, we first polish our measurement of uncertainty by including in the expected growth path different indicators of investment. Further, we also included a variable that could summarize the numerous existing distortions as well as take into account the extremely varied economic policies followed in the region. In this context, we explore the effect that the continuous changes in economic policy and the resulting variations in the private sector's opportunity set could have had on the expected path of growth. Results from such procedure suggest that investment does not appear to be the channel through which uncertainty affects growth.

While this result is similar to that reported by Ramey *et al.* (1995), we will show that Ramey's result may be biased because of the use of erroneous per capita figures. Thus, we will show that the use of per capita figures provokes a sharp decline in the value of the estimated parameter –of uncertainty– as well on its statistical significance. Such result implies that the conclusions reported by Ramey *et al.* (1995) must be taken with caution.

One possible reason for why investment does not appear to be the channel through which uncertainty affects growth is the large government involvement in investment activities during most of the period considered. In this regard, it is possible that for most of the period, public investment may have offset private investment fluctuations. Further, the imposition and variability of several regulations may have severely dampened private investment. To test such hypothesis, we divided our sample and analyzed whether the process of deregulation and privatization produced a significant change in the explanatory power of investment. In this regard, we find that for the period 1990-1995, investment appears to be the channel through which uncertainty affects growth. Thus, contrary to Ramey's result, we find that the probable cause for the existence of a relationship between growth and uncertainty is time-variant.

Given the volatility of government expenditure, next we examine if this variable may help explain the correlation between uncertainty and growth. In so doing, we put to a test the results reported by Ramey *et al*. (1995). Finally, we analyze whether the impact of uncertainty over growth differs in the short and long-run. Section three provides concluding remarks.

2. Some comments on the data

Since this is an empirical study, it is necessary to ensure the quality and content of the data to be used. In the literature, economic growth is traditionally measured on the basis of output per capita. In this regard, next we discuss how reliable population statistics are.

It is a well-known fact that population censuses in Latin America are generally conducted every 10 years, and therefore, statistics should reflect a constant population growth rate in the intercensal period. This would therefore imply that the volatility of output and that of output per capita should be identical for the intercensal period. Thereby, the value added of using per capita figures is relatively small.

However, there are several publications registering annual population growth rates that show the existence of *variable* annual rates in the intercensal period. An example of this is the data that appears in the International Monetary Fund's *International Financial Statistics*. The existence of such information would imply that the statement made in the preceding paragraph would be wrong. However,

such information shows variations in the population growth rates that are contrary to demographic experience. Thus, for several countries in the region, this publication reports situations in which *a)* growth rates change sign from year to year; and *b)* rates vary by over 200% from year to year. To get a better understanding of this problem, Table 1 shows the annual mean rate of population growth (*r)* and the standard deviation of the latter *(Sd)* for certain countries at specific time intervals.

On the basis of such Table, we can infer that the use of these growth rates may imply the existence of serious errors in the estimation of output per capita. For example, using this dataset, the variability of GDP per capita would be in average four times greater than that of GDP!

As a result, although there are publications which report variable annual population growth rates, these will not be considered inasmuch as they are necessarily *ad-hoc* estimates (since the censuses, as we mentioned earlier, are taken every 10 years), with significant errors.[2] Finally, although the *censal* population growth rates were available, we decided not to use them since this might imply a leap in the per-capita variable as a result of collecting information at a specific point in time.

In the papers by Ramey *et al.* (1995) and by the Inter-American Development Bank (1995), the dependent variable is the growth rate of output per capita (expressed in international prices). Here, we will use the growth rate of output (expressed in domestic prices) as the dependent variable. There are two reasons behind our decision to measure economic growth in this way. The first is related to what we said earlier about the errors that may arise when calculating per capita variables. The second one is related to the use of international prices. As is well known, once we use a cross section and take economies with different currencies into account, we come up with the familiar problem of how to compare output measurements in different currencies. The traditional solution is to use the purchasing parity exchange rate.

[2] For purely comparative purposes, below we list the *censal* rate of population growth for some countries in the past three decades:

	1960	*1970*	*1980*
Argentina	1.84	1.50	1.64
Bolivia	2.15	2.32	2.53
Brazil	3.01	2.74	2.73
Colombia	2.88	2.93	2.31
Venezuela	4.04	3.46	3.48

Table 1. Annual Mean Growth Rate (*r*) and Standard Deviation *(Sd)* of Population for Selected Years and Countries according to the International Monetary Fund's Statistics

	1960-1964	*1965*	*1966-1974*	*1975*	*1976-1979*	
Argentina	r = 1.51 Sd = 0.07	r = 4.8	r = 1.43 Sd = 0.15	r = 3.3	r = 1.62 Sd = 0.02	
	1960-1966	*1967-1973*	*1974-1975*			
Bolivia	r = 2.52 Sd = 0.15	r = 0.81 Sd = 0.38	r = 2.3 Sd = 0.84			
	1960-1979	*1980*	*1981-1995*			
Brasil	r = 2.70 Sd = 0.28	r = 4.79	r = 2.34 Sd = 0.21			
	1960-1965	*1966-1976*	*1977*	*1978-1979*	*1980-1995*	
Colombia	r = 3.19 Sd = 0.02	r = 2.75 Sd = 0.18	r = –0.41	r = 2.34 Sd = 0.65	r = 1.82 Sd = 0.19	
	1971	*1972-1979*	*1980*	*1981*	*1982*	*1983-1987*
Costa Rica	r = 4.40	r = 2.36 Sd = 0.40	r = 3.68	r = 0.88	r = 6.6	r = 2.81 Sd = 0.40
	1960-1966	*1967*	*1968-1969*	*1970*	*1971-1973*	*1974-1976*
Guatemala	r = 2.74 Sd = 0.42	r = 4.44	r = 3.34 Sd = 0.52	r = 4.98	r = 2.83 Sd = 0.05	r = 2.57 Sd = 3.13
	1960-1966	*1967-1968*	*1969-1970*	*1971-1995*		
Honduras	r = 3.29 Sd = 0.24	r = 1.05 Sd = 0.35	r = 6.91 Sd = 1.19	r = 3.26 Sd = 0.22		
	1960-1973	*1974*	*1975-1995*			
Venezuela	r = 3.31 Sd = 0.17	r = 8.9	r = 3.05 Sd = 1.45			

Table 2. Structure and Variability Coefficient of Imports for Some Latin American Countries during the period 1970-1992[3]

	Composition of Imports (%)			*Private Consumption*
	Final Consumption Goods	*Intermediate Goods*	*Capital Goods*	*Imported Goods (%)*
Argentina	8.79	63.92	27.29	1.01
	(0.643)	(0.135)	(0.187)	(0.623)
Brazil	7.06	69.46	23.49	0.81
	(0.463)	(0.121)	(0.275)	(0.397)
Chile	17.53	54.23	28.24	6.05
	(0.321)	(0.106)	(0.177)	(0.430)
Colombia	11.97	58.24	29.81	2.37
	(0.138)	(0.057)	(0.112)	(0.154)
Costa Rica	21.50	59.38	19.15	12.70
	(0.236)	(0.090)	(0.175)	(0.307)
Ecuador	12.82	52.80	34.33	4.76
	(0.236)	(0.122)	(0.167)	(0.239)
El Salvador	23.34	60.13	16.54	9.46
	(0.135)	(0.092)	(0.313)	(0.207)
Honduras	21.08	58.50	20.40	10.19
	(0.156)	(0.067)	(0.181)	(0.318)
Mexico	11.97	52.32	35.66	2.12
	(0.388)	(0.103)	(0.143)	(0.558)
Peru	16.23	55.20	28.56	4.05
	(0.359)	(0.094)	(0.121)	(0.493)
Venezuela	19.04	45.58	37.50	8.09
	(0.182)	(0.088)	(0.254)	(0.335)

Although the "law of one price" is generally accepted, several studies have suggested that this may not be true in the short run. In this respect, using the theoretical framework proposed by Sanyal and Jones (1982), Mena (1997) presents evidence for 52 countries which suggests that the international trade of goods involves primarily intermediate and capital goods (over 80%) rather than final goods. These figures (Table 2 shows a summary of those for Latin America), which were calculated for the period 1970-1992, suggest that tradable goods are mainly inputs and therefore are subject to increases in value due

[3] The figures in parenthesis are the variability coefficient. The source for these figures is Mena (1997).

to "domestic value added". At the same time, these figures show that final consumer goods are basically non-traded. In this respect, the application of the law of one price to consumer goods may prove irrelevant. As a result, it may be pointless to measure output growth rates using international prices.

In conclusion, due to statistical problems regarding population data and to the composition of international trade, we decided –contrary to other authors– not to use as dependent variable GDP per capita measured at purchasing power parity.

3. Estimates

To analyze the relation between volatility and growth we followed Ramey *et al.* (1995) methodology. The estimation is made in two steps. In the first one we regress (Δy_{it}) output growth rate of country i in year t against a matrix of control variables (X_{it}) of country i in period t. Thus, the estimation equation is:

$$\Delta y_{it} = \phi X_{it} + \varepsilon_{it} \text{ where } \varepsilon_{it} \sim N(0, \sigma_{\varepsilon}^{2}) \qquad (1)$$
$$i = \{1, \ldots 17\};\ t = \{1960, \ldots 1995\}$$

The ε_{it} residuals are the economic growth deviations on the basis of the X_{it} characteristics. To avoid the problem of inducing a spurious correlation –countries whose real coefficients are far from average might just be those with slower growth– we estimated the expected growth for each country and calculated the residuals on the basis of each estimate. With this at hand, we constructed –for each country– the standard deviation of these residuals (U_i). Then in the second stage we use panel data to estimate Δy_{it} against the control variables (X_{it}) and the standard deviation of the non-predicted path of economic growth (U_i). Thus, the estimation equation in this second stage is:

$$\Delta y_{it} = \lambda U_i + \varphi X_{it} + \eta_{it} \text{ where } \eta_{it} \sim N(0, \square) \qquad (2)$$

The results of this second stage are the ones reported in this paper.

Since conventional theory suggests that volatility can influence growth inasmuch as it reflects existing uncertainty, the aim was for the X_{it} matrix to include variables that would describe expected economic growth. To this end, we included in such matrix the average

rate of investment during the period *(Iprom),* the investment rate for 1962 (*I*62) and for 1966 (*I*66), the growth rate of gross domestic product of 1962 (GDP62), lags of output growth (GDP (–1) and GDP (–2)), a variable describing a temporal trend (*TREND*) and another describing a time trend squared (*TRENSQ*). In this respect, we are considering a subset of the variables suggested by Levine and Renelt (1992) since neither the growth rate of the population nor the years of schooling are considered.

As mentioned before, one reason for not choosing population growth rates is because of statistical problems. Further, the existence of a significant informal sector in Latin America implies that changes in the growth rate of population as well as in employment may not necessarily be linked to variations in the growth rate of measured output. On the other hand, we decided not to include the schooling variable because of Glewwe's (1996) result. Glewwe finds that when the quality of education varies over time and space (as in Latin America), years of schooling are a biased indicator of productivity. Thus, for example, if the number of years of schooling correlates positively with the quality of education, family characteristics and innate abilities, then the estimated parameter will have an upward bias. Conversely, if we try to estimate the impact of human capital through schooling, the estimated parameter will have a downward bias due to measurement errors. Thus it is not possible to indicate the type of bias *a priori*. With regard to this, Glewwe finds that once the quality of teaching is considered, the number of years of schooling does not help explain productivity.[4]

As is well known, one possible explanation for the inverse a relationship between growth and uncertainty is that the latter may affect the investment rate. To test such relationship, we first polished our measurement of uncertainty by including in the expected growth path different indicators of investment. Three different variables were used to record investment performance: the average rate for each country *(Iprom)*; the 1962 investment rate (*I*62) and the 1966 investment rate (*I*66). Next, we introduce in the matrix X_{it} a variable closely related to the behavior of private investment. Since the profitability of investment depends on the net present value of its income stream, such

[4] In addition, it is likely that human capital accumulation (through education and health care) may affect output possibilities with a quite significant time lag. We believe growth models pay little attention to this asymmetry between physical capital accumulation and human capital accumulation.

variable should summarize the numerous existing distortions commonly occurring in Latin America as well as take into account the extremely varied economic policies followed in the region. We believe that one such variable could be the volatility of the market exchange rate.[5]

Given the variability of the real exchange rate in these countries[6] the relative constancy of the share of imported machinery and equipment suggests a lack of locally available substitutes for these imports. Put differently, Latin American countries may be characterized as being net importers of capital goods.[7] In this respect, the volatility of the nominal market exchange rate might be more relevant –for explaining the development of machinery and equipment– than that of the real exchange rate.

In general, results in Table 3 suggest that uncertainty alters economic growth –even when the volatility of the exchange rate as well as different indicators of investment are considered– in an statistically significant fashion. This implies that investment must not be the main channel that explains the relationship between uncertainty and growth.

This result is consistent with Ramey's *et al.* (1995). However, Ramey's results were based on a larger sample and on the use of growth rates of GDP per capita. As we explained before, figures of annual population growth may be misleading and may produce biased results. To confirm this hypothesis, in Table 4 we show what would have happen if using the same sample and same independent variables –as in Table 3– we use growth rates of GDP per capita. The outcome of such change is clear: the use of per capita figures provokes a sharp reduction in the estimated parameter of the proxy for uncertainty. Further, such parameter becomes statistically insignificant. Consequently, the results reported in Ramey *et al.* (1995) should be taken with caution.

Going back to the estimations reported in Table 3, one possible reason for why investment appears not to be the channel –as for why

[5] The exchange rate used is the official rate, unless an informal exchange market exists in which case that rate will be used.

[6] Using data from Edwards (1991) it was found that in the case of Chile, the variability of the real exchange rate was 23 times higher than that of the imported component of machinery and equipment. In the cases of Colombia, Ecuador and Peru, the rates were 4.2, 3.3 and 1.6, respectively.

[7] In the case of Chile, for the period 1960-1982, 82% of all machinery and equipment was imported. Similarly, for the period 1980-1991, the figure for Colombia was 80%. Finally, in the case of Ecuador the figure was 91% for the period 1970-1992. In all three cases, the variability coefficient was less than 6 percent.

Table 3. Dependent Variable: Growth Rate of GDP[8]

	Estimation No. 1	*Estimation No. 2*	*Estimation No. 3*	*Estimation No. 4*	*Estimation No. 5*
Constant	4.29	5.38	4.43	5.38	5.92
	(3.79)	(5.83)	(3.86)	(6.31)	(6.23)
U	–0.31	–0.27	–0.33	–0.27	–0.27
	(–2.19)	(–1.71)	(–2.21)	(1.94)	(1.94)
IPROM	6.83	—	—	—	—
	(1.45)				
*I*62	—	–0.005	—	—	—
		(0.001)			
*I*66	—	—	8.25	—	—
			(1.23)		
GDP62	0.05	0.06	0.007	0.06	—
	(1.10)	(1.28)	(0.12)	(1.29)	
GDP(–1)	0.34	0.35	0.35	0.35	0.37
	(8.87)	(9.05)	(8.92)	(9.07)	(8.72)
GDP(–2)	—	—	—	—	–0.04
					(–0.88)
TREND	–0.20	–0.20	–0.20	–0.20	–0.21
	(–2.79)	(–2.77)	(–2.78)	(–2.77)	(2.62)
TRENSQ	0.003	0.003	0.003	0.003	0.004
	(1.88)	(1.87)	(1.88)	(1.88)	(1.82)
adjustedR^2	0.194	0.192	0.194	0.192	0.190
F	23.64	23.21	23.52	27.90	26.71
observations	593	593	593	593	593

uncertainty affects growth– is because of the large government involvement in investment activities during most of the period considered. In this regard, it is possible that for most of the period, public investment may have offset private investment fluctuations. Further, the imposition and variability of several regulations may have severely dampened private investment. The lack of reliable time series data for public and private investment makes it difficult to test such proposition. However, one way to examine the significance of government intervention would be to test whether the structural reforms of the 90's affected the relationship between growth and uncertainty. As is well known, those reforms meant an important process of deregula-

[8] The figures in parenthesis are the *t*-statistics.

Table 4. Value of Parameter Estimated and *t*-test for Uncertainty using Two Different Dependent Variables

	Estimation No. 1	*Estimation No. 2*	*Estimation No. 3*	*Estimation No. 4*	*Estimation No. 5*
Using per capita figures	–0.232 (–1.54)	–0.247 (–1.48)	–0.252 (–1.67)	–0.207 (–1.40)	–0.268 (–1.85)
Not using per capita figures	–0.314 (–2.19)	–0.272 (–1.71)	–0.326 (–2.21)	–0.272 (–1.94)	–0.274 (–1.94)

tion and privatization that brought as a result the strengthening of market forces. In this regard, one way to examine the significance of government intervention throughout the period considered would be to test whether the explanatory power of investment increases during the 90's. As Table 5 shows, the probable cause for the existence of a relationship between growth and uncertainty is time-variant. Once the sample is broken so as to differentiate the sample period according to the nature of the economic policy being followed, the power of investment to explain the relation between growth and uncertainty varies substantially. Thus, contrary to what happened during the period 1960-1989, during the 90's investment-based theories on the link between growth and uncertainty appear to be accurate.

Given Latin America's variability of economic policies, this last result should make us wonder how reasonable it is to combine into one dataset information belonging to developed and less-developed countries. If underdevelopment is associated with bad and erratic economic policies, data belonging to countries in different stages of development may not be drawn from the same distribution. In this regard, this may constitute a second reason for why Ramey's result should be taken with caution.

Another way to examine whether the relationship between growth and uncertainty is sensitive to government's involvement on the economy would be to consider the growth rate of government consumption as an additional explanatory variable. There are three reasons for such a choice. First, we have the statistical properties of government expenditure in Latin America. As Table 6 shows, public consumption has been the second most volatile factor and has –relative to net exports– a bigger share in GDP. Even though such volatility could just be a reflection of the underlying economic environment, Gavin *et al.* (1997) work suggest that this is not the case. A second reason for

Table 5. Value of Parameter Estimated and *t*-test for Uncertainty using Three Different Time Periods

	Estimation No. 1	*Estimation No. 2*	*Estimation No. 3*	*Estimation No. 4*	*Estimation No. 5*
Using data 1960-1995	–0.314 (–2.19)	–0.272 (–1.71)	–0.326 (–2.21)	–0.272 (–1.94)	–0.274 (–1.94)
Using data 1960-1989	–0.400 (–2.47)	–0.338 (–1.87)	–0.432 (–2.59)	–0.342 (–2.14)	–0.349 (–2.18)
Using data 1990-1995	0.167 (0.58)	0.084 (0.26)	0.202 (0.69)	0.110 (0.39)	0.0007 (0.002)

Table 6. Some Latin American Statistics: 1964-1995

	Unweighted Mean	*Standard Deviation*	*Coefficient of Volatility*
GDP growth rate	3.949	1.316	0.333
Total Consumption as % of GDP	83.134	5.021	0.061
• Public Consumption as % of GDP	11.795	2.481	0.210
• Private Consumption as % of GDP	70.338	5.413	0.076
Investment as % of GDP	18.979	3.517	0.185
Net Exports as % of GDP	–1.86	5.616	2.43

choosing such variable would be the existence of a literature that suggests that government spending may explain why uncertainty and growth are correlated. Thus for example, based on the assumption that government spending is a substitute for private spending, Rossi (1988) shows that the volatility of government expenditure may affect the decisions of the private sector. Finally, a third reason to pick up government consumption is to test Ramey's result concerning the explanatory power of such variable. As explained before, using a sample of 92 countries, Ramey *et al*. (1995) found that government expenditure helps to explain why uncertainty and growth are correlated. Notwithstanding, when only considering OECD countries, they found that such correlation is statistically significant even after controlling for the behavior of government spending.

Table 7. Value of Parameter Estimated and *t*-test for Uncertainty for the period 1964-1990

	Estimation No. 1	*Estimation No. 2*	*Estimation No. 3*	*Estimation No. 4*	*Estimation No. 5*
Not including government expenditure	–0.315 (–1.70)	–0.396 (–2.03)	–0.419 (–2.18)	–0.328 (–1.76)	–0.351 (–1.94)
Including government expenditure	–0.308 (–1.71)	–0.388 (–2.04)	–0.405 (–2.16)	–0.322 (–1.77)	–0.343 (–1.95)

Table 8. Value of Parameter Estimated and *t*-test of Uncertainty in the Short and Medium Term

	Estimation No. 1	*Estimation No. 2*	*Estimation No. 3*	*Estimation No. 4*	*Estimation No. 5*
Using annual data 1960-1989	–0.400 (–2.47)	–0.338 (–1.87)	–0.432 (–2.59)	–0.342 (–2.14)	–0.349 (–2.18)
Using five-year average data	–0.704 (–2.75)	–0.605 (–2.09)	–0.736 (–2.77)	–0.574 (–2.26)	–0.518 (–1.79)

Statistics of government expenditure were available for all Latin American countries starting in 1964. The only exceptions were Argentina –for whom the *International Financial Statistics* does not provide information– and Brazil whose statistical data starts in 1966. Further, taking into account the results reported in Table 5 –regarding the impact of the structural reforms of the 90's– we restricted our sample estimation from 1964 to 1990. Given this change of sample, to measure the importance of government expenditure, we compared the results that arise from using the same independent variables that appeared in Table 3 from those where the growth rate of public consumption and its lagged value are considered. Results of these estimations may be found in Table 7. As we can see, the inclusion of government expenditure has no effect on the relationship between growth and uncertainty: neither the parameters nor their statistical significance vary. Thus, contrary to Ramey's result we can not claim that

government expenditure helps to explain the relationship between growth and uncertainty.

Even though fiscal variables were not capable of explaining the relationship between growth and uncertainty, their inclusion was valuable for other reasons. We found that the estimated parameter of the growth rate of public consumption was positive and statistically significant while the estimated parameter of the lagged value of the growth rate of public consumption was negative and also statistically significant. Further, results suggest that the positive impact of public consumption on growth disappears after three years. Such result provides a signal of the fragility of the fiscal multiplier in Latin America.

Finally, we examined whether the impact of uncertainty on growth was larger in the long run. To do so, we compared the results using annual data *vis-à-vis* those resulting from the use of a five-year average data. As explained before, the presence of the structural reforms of the 90's made us decide to restrict our sample estimation from 1964 to 1990. The results shown in Table 8 clearly suggest that uncertainty has a bigger impact in the long run.

4. Conclusions

Using the experience of Latin America over the past 35 years, we show the existence of an inverse relation between economic growth and the unexpected volatility of macroeconomic fluctuations. In this regard, the conventional assumption that exists in the literature regarding the lack of a relation between economic growth and short-term fluctuations may not be right. Furthermore, we show that the probable cause of such relationship is time-variant.

Several papers have been written about this topic and the conclusions they have reached vary from paper to paper. In general, all of them use as dependent variable the average growth rate of GDP per capita measured as purchasing power parity. Furthermore, most of them use a database that includes data belonging to developed and less-developed countries. Even though such features are consistent with how conventional theory measures and analyzes economic growth, we show why some of the data for Latin American countries may have important measurement errors. Furthermore, we show that these measurement errors produce important changes in the statistical significance of the relationship between growth and uncertainty.

Once the existence of a negative relationship between growth and uncertainty is found, researchers usually test whether investment is responsible for its existence. In this regard, the outcome reported appears to be mixed. While some do find investment to be the probable cause, others report that government spending is responsible. We find that the explanatory power of investment varies with the period considered. If the whole sample is used, we find that investment is not statistically responsible for such relationship. However, when we break down the sample and only consider the data belonging to the 90's, results change dramatically: investment explains why uncertainty and growth are correlated. We believe such change reflects the process of structural reforms that the region has experienced during those years. Such policy changes meant a relatively important process of deregulation and privatization that brought about a strengthening of market forces. In this context, the increasing importance of the private sector in the economy should be augmenting the sensibility of investment on economic growth. One consequence of this outcome is that given Latin America's variability of economic policies, one should put into question the reasonability of combining into one dataset information belonging to developed and less-developed countries. If underdevelopment is associated with bad and erratic economic policies, data belonging to countries in different stages of development may not be drawn from the same distribution. If this were true, many of the results reported by papers that use such type of datasets should be taken with caution.

Even though government expenditure has been very volatile, the data for Latin America cannot support the claim –made by Ramey *et al.*– that government expenditure may explain the correlation between growth and uncertainty. Notwithstanding, the inclusion of fiscal variables provides a signal of the fragility of the fiscal multiplier in Latin America. While a contemporaneous increase in expenditure may lead to an increase in the growth rate, such positive impact disappears within three years.

Finally, we found that the impact of uncertainty on growth increases substantially in the long run. Thus, the conventional assumption regarding the lack of a relationship between economic growth and short-term fluctuations may not be right. Hence, the path of economic growth depends on both the economic fundamentals and on the underlying uncertainty.

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