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Essays on the determinants of private investment : the effects of relative price uncertainty and political instability

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ESSAYS ON THE DETERMINANTS OF PRIVATE INVESTMENT: THE EFFECTS OF RELATIVE PRICE UNCERTAINTY AND POLITICAL INSTABILITY

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Monica Escaleras

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To: Dean Arthur W. Herriott
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This dissertation, written by Monica Escaleras, and entitled Essays on the Determinants of Private Investment: The Effects of Relative Price Uncertainty and Political Instability, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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DEDICATION

I dedicate this thesis to my son, husband and parents. Without their patience, understanding, support, and most of all love, the completion of this work would not have been possible.

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ABSTRACT OF THE DISSERTATION

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Florida International University, 2003

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Professor Dimitrios Thomakos, Major Professor

The objective of this study was to provide empirical evidence on the effects of relative price uncertainty and political instability on private investment. My effort is expressed in a single-equation model using macroeconomic and socio-political data from eight Latin American countries for the period 1970-1996. Relative price uncertainty is measured by the implied volatility of the exchange rate and political instability is measured by using indicators of social unrest and political violence.

I found that, after controlling for other variables, relative price uncertainty and political instability are negatively associated with private investment. Macroeconomic and political stability are key ingredients for the achievement of a strong investment response. This highlights the need to develop the state and build a civil society in which citizens can participate in decision-making and express consent without generating social turmoil. At the same time the government needs to implement structural policies along with relative price adjustments to eliminate excess volatility in price movements in order to provide a stable environment for investment.

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CHAPTER I
INTRODUCTION

The objective of this chapter is to provide an overview of 1) the current situation and some economic problems Latin American countries have been facing, 2) the factors that determine private investment, and 3) the objectives of this research.

Current Situation

Almost two decades ago, the debt crisis set off a period of macroeconomic instability and lack of external financing that led to a drastic decline in capital formation in developing countries. This trend endangers the sustainability of stabilization and reform programs. For adjustment policies to be followed by growth a robust response by investment is required, particularly by the private sector, which is expected to play a key role in market-oriented reforms. However, for that investment response to materialize, and for the private sector to engage in intrinsically irreversible investment decisions, it needs to perceive adjustment as sustainable. Lack of confidence in the permanence of a policy leads to macroeconomic instability and creates uncertainty among investors. Therefore, we should expect that macroeconomic uncertainty will diminish private investment.

Many Latin American countries have undertaken both macroeconomic and structural changes in recent years to stimulate private investment. A casual examination of the data shows that the response of private investment to these reforms has been, so far, disappointing. As the continued predominance of capital flight demonstrates, few of these countries have managed to establish an "acceptable investment climate." One important reason is the high degree of uncertainty regarding future economic policies.

High-inflation countries like Argentina or Brazil have undergone a large number of failed stabilization programs. Even in a country like Mexico, which has (since 1983) maintained a consistent policy stance, there have been sharp unpredicted changes in certain areas of policy like trade and exchange rate policies.

The impact of macroeconomic uncertainty and political instability on private investment, a topic of obvious concern for policy makers, has attracted considerable interest in the theoretical as well as empirical literature. From the theoretical perspective, analytical work has pointed out a number of different channels through which macroeconomic uncertainty can impact investment, under various assumptions about risk aversion, adjustment costs to investment and other factors (see Caballero, 1991 and Abel and Eberly, 1994). Depending on the underlying assumptions, some approaches predict a positive relationship, while others predict a negative one.

Empirical studies on macroeconomic uncertainty and investment are less abundant, and mostly confined to single-country studies focusing on the U.S. and U.K. Overall, they are not conclusive in their assessment of the impact of macroeconomic uncertainty, although the majority does find a negative association between the two variables. In most cases, however, these studies use naïve measures of sample variability rather than uncertainty, often ignore important investment determinants, and/or fail to account for the simultaneity between investment and its determinants.

The prevalence of uncertainty and instability can be a serious obstacle to fixed investment decisions. Uncertainty can become a powerful investment deterrent, a conclusion that seems to be supported by empirical evidence and has important policy implications.

Trends in Fixed Private Investment and Related Indicators in Latin America

Table 1.1 provides some information regarding the trend of GDP growth, inflation and private investment from 1970 to 1999 for Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.

In the last three decades Latin America has experienced periods of high inflation, volatility in economic growth and macroeconomic instability. In addition, neither economic reforms nor the large-scale return of capital flows to Latin America that began in the late 1980s has led to a significant improvement in private investment performance. Incentives to invest continue to be weak. In some countries, progress towards the achievement of macroeconomic stability has been slow (Brazil and Venezuela), and in others, it still viewed as fragile (Argentina and Peru). In Argentina, Colombia, Mexico and Peru the appreciation of the real exchange rate, coupled with widespread trade liberalization and the dismantling of export incentives has discouraged investment in the export-oriented sector. In addition, in most countries, credit conditions remain tight partly in order to fight inflation and the scarcity of credit to the private sector is having a dampening effect on private investment.

Macroeconomic Determinants of Private Investment in Latin America

There is a great deal of literature on the determinants of private investment in developing countries. A paper by Serven and Solimano (1993) summarizes the literature and empirical findings regarding the determinants of private investment in developing countries. They conclude that theoretical considerations and empirical findings suggest that the variables affecting private investment that are relevant for developing countries are the rate of economic growth, the interest rate, the real exchange rate, and

macroeconomic stability (as proxied by either the variability of the exchange rate or the rate of inflation).

The rate of growth of output is normally included in empirical research of the determinants of investment in order to capture the accelerator effect. It usually enters investment equations in lagged form so as to avoid simultaneity problems.

The real interest rate is also considered an important determinant of private investment. However, there are competing views about the effect of real interest rate on private investment. A high level of real interest rates raises the real cost of capital, and therefore dampens the level of private investment. But there is another side. Poorly developed financial markets in these countries, and inadequate access to foreign financing for most private projects, implies that private investment is constrained largely by domestic savings. These, in theory, are expected to respond positively to higher real interest rates. Therefore, private investment could be positively related to real interest rates in developing countries (Green and Villanueva, 1990).

The level of the real exchange rate has also been considered to be an important determinant of investment. A real devaluation increases the replacement cost of capital goods and should therefore discourage investment. However, real exchange rate depreciation also changes the relative profitability of tradables and non-tradables in favor of the former. In small open economies, it is easier to sustain long waves of investment and growth when the engine is the export sector (which does not face demand limits to growth) than when investment is concentrated in non-tradables or importables. Sustained growth in output and investment in exportables could pull up investment in

non-tradables, even though the relative profitability of the latter sector would initially decline (Agosin, 1995).

Finally, it is important to take into account the fact that investment is an irreversible commitment of resources in exchange for a highly uncertain future stream of earnings (Pyndick, 1993; Caballero, 1993). It is usually impossible to recoup even a portion of the investment when future incomes turn out to be smaller than ex ante expectations. Therefore, the environment in which investment decisions take place must have a minimum of predictability as to future prices and demand conditions, which are inversely related to macroeconomic stability. Widely used proxies for macroeconomic instability are the rate of inflation, its variance and the coefficient of variation of the real exchange rate.

From a policy perspective the credibility of policy reforms is an important source of uncertainty. Governments can reverse adjustment policies, but investors cannot undo decisions about fixed capital. In such conditions the value of waiting arises from the losses that investors would incur if the policies were reversed in the future.

According to Seven and Solimano (1993) any given set of policies will affect investment depending on the level of public confidence. Stabilization may entail marked social and economic costs if the government's credibility is low, because the investment response will be too low to offset the deflationary bias of demand constraint. Thus a deep recession may develop before investors are persuaded that the government will maintain the adjustment measures. This skepticism is particularly relevant in economies with a history of frequent policy swings or failed stabilization attempts: two features shared by many Latin American countries.

Objective

The objective of this research is to examine the effect of relative price uncertainty, political instability and attempts of policy reversal on private investment. Relative price uncertainty makes price signals less informative about the relative profitability of investment across sectors, and will likely hamper the investment decision. In addition, social unrest disrupts market activities and can affect investment for reasons different than the uncertainty associated with high expected investment turnover. In fact, mass violence, civil wars, political disorder and physical threats to workers and entrepreneurs engaged in productive activities can have direct effects on productivity and therefore on the rate of return on investment. Thus, political instability measured by the number of assassinations, general strikes, guerilla warfare, major government changes, purges, riots and revolutions is expected to have a negative effect on investment. Finally, government policy instability is another source of discouragement for investors. Unless investors view the adjustment as internally consistent and are convinced the government will carry it out despite the implied social costs, the possibility of reversal will become a key determinant of investment decisions. Therefore, attempts of policy reversal are expected to have a negative effect on private investment.

This paper contributes to the political economy of private investment in several ways. First, as shown in the literature review, there is a collection of studies that exclusively analyze the impact of macroeconomic uncertainty on private investment while there is another set of studies that solely analyze the impact of political instability on private investment. A more appropriate assessment will be to jointly examine the effect of macroeconomic uncertainty and socio-political instability on private investment, as it is

done in this paper. Second, for policy implications it is important to examine the impact of macroeconomic uncertainty and political instability on private investment by controlling for each other. Third, there are many studies examining exclusively the link between macroeconomic uncertainty and private investment. A new contribution to the literature is that I examine which socio-political factors affect macroeconomic uncertainty. Fourth, there are several methods to measure political instability; some authors have used an index while others have used individual variables that represent political instability. A more appropriate approach will be to analyze which of these two approaches conveys more information regarding political instability instead of choosing a-priori a method of measurement of socio-political instability. Fifth, for policy implications it is interesting to analyze the effect of policy reversal on private investment.

We are specifically interested in the following questions:

1) Does relative price uncertainty reduce private investment?
2) Does political instability in addition to relative price uncertainty affect private investment? And, moreover, does relative price uncertainty remain relevant when one controls for political instability?
3) Do attempts of policy reversal influence private investment?

I provide some evidence that relative price uncertainty and political instability are strong discouraging factors in private investment decision. In addition, a proxy for the possibility of policy reversal has a significant negative effect on private investment.

Chapter Preview

Chapter 2 provides a review of the main studies related to private investment, uncertainty and political instability. Chapter 3 analyses the link between private investment and relative price uncertainty, using macroeconomic data for Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. Chapter 4 examines the effect of relative price uncertainty and political instability on aggregate private investment, using macroeconomic and socio-political data for eight Latin American countries.

Table 1.1 Summary of Economic Indicators, Decade Averages (Percentages)

Country	1970-1979	1980-1989	1990-1999
Argentina:			
Log y_t	2.93	-0.73	2.15
Log(i_t)	3.08	-3.11	7.83
Log (i_t/y_t)	0.30	-2.24	3.55
p_t	132.94	565.69	252.91
Bolivia:			
Log y_t	4.23	-0.41	4.06
Log(i_t)	4.24	-4.88	12.57
p_t	15.91	1383.15	10.41
Brazil:			
Log y_t	8.48	2.99	1.85
Log (i_t)	-1.06	0.38	0.30
p_t	354.52	843.28	19.86
Chile:			
Log y_t	2.48	4.40	6.49
Log (i_t)	1.81	7.27	5.56
p_t	N/A	354.52	823.44

Notes:
Log y_t represents GDP growth
Log(i_t) represents Private Investment Growth
p_t represents the inflation rate

(con't) Table 1.1 Summary of Economic Indicators Decade Averages (Percentages)

Country	1970-1979	1980-1989	1990-1999
Colombia:			
Log y_t	5.81	3.40	2.84
Log (i_t)	3.53	1.98	-2.73
p_t	13.31	23.47	22.46
Mexico:			
Log y_t	6.43	2.29	3.38
Log (i_t)	5.71	1.47	7.27
p_t	14.68	69.05	20.41
Peru:			
Log y_t	7.50	0.34	3.30
Log (i_t)	7.64	1.71	6.91
p_t	26.51	481.32	807.90
Venezuela:			
Log y_t	3.97	-0.17	2.44
Log (i_t/y_t)	6.88	-8.70	3.29
p_t	6.61	23.02	47.44

Notes:
Log y_t represents GDP growth
Log(i_t) represents Private Investment Growth
p_t represents the inflation rate

CHAPTER II
LITERATURE REVIEW

The objective of this chapter is to review prior research related to the determinants of private investment. Although there are several publications dealing with similar issues, it remains unclear what factors other than the traditional ones influence private investment.

Articles are classified in three sections. The first sections deals with the theory of investment decision under uncertainty, the second section summarizes the empirical evidence of the link between uncertainty and private investment, and the third section presents the empirical evidence of the relationship between private investment and political instability.

Theory of Investment Decision under Uncertainty

The relationship between uncertainty and investment has been studied theoretically. Nevertheless taken as a whole the theoretical predictions are ambiguous; depending on their underlying assumptions, some approaches predict a positive relationship, while others predict a negative one. Much of the theoretical work regarding uncertainty and investment has been developed in the framework of risk-neutrality. The impact of uncertainty in standard models of a risk-neutral firm-level decision process basically depends on the relationship between the expected marginal revenue product of capital and the uncertainty variable(s), typically the output price or the real wage. For example, if the marginal revenue product of capital is a convex function of the variables whose evolution is uncertain, then higher uncertainty raises expected profitability and, ceteris paribus, the desired capital stock and hence investment (Oi 1961, Hartman 1972,

1976, Abel 1983). Bar-Ilan and Strange (1992) find a similar effect in a model which includes costly entry and exist and time-to-build. In Stiglitz and Weiss (1981) uncertain projects are more desirable since bankruptcy limits downside risk.

The main class of models that predict a concave marginal revenue product of capital are those with irreversible investment. Irreversibilities make returns to investment asymmetric. If the future turns out to be worse than expected, the marginal revenue product of capital falls, and the investor is stuck with low returns. If, on the other hand, prospects improve, the incentive is to invest more, hence limiting the rise in the marginal revenue product of capital. This assymetry implies that the marginal revenue product of capital is a concave function of wages and prices. Pyndick (1982, 1988) introduces adjustment costs, implied by the acquisition and installation of capital, emphasizing the irreversible nature of most fixed investment projects. Therefore, investment takes place only when expected profitability exceeds a certain threshold.

From the preceding discussion, however, it should be clear that irreversibility is not sufficient to turn around the positive impact of uncertainty on investment that follows from the convexity of the profit function. To reverse this result, it is necessary to bring in additional assumptions such as imperfect competition or decreasing returns to scale (or both). When combined with irreversibility, they make the marginal revenue product of capital a decreasing function of the capital stock. Consequently, higher uncertainty leads to lower investment (Caballero 1991).

According to Bertola and Caballero (1994), even if the threshold effect dominates so that irreversibility and uncertainty reduce investment in the short run ex-ante, little can be said of their long-run impact. Higher degrees of irreversibility and/or uncertainty

make it more likely that firms will find themselves holding too much capital ex-post. This "hangover effect" tends to increase the long-run capital stock above the level that would have prevailed with a lower degree of less irreversibility or less uncertainty.

However, some inferences about the impact of uncertainty on investment can still be drawn from these models. In particular, temporary increases in uncertainty should reduce investment, at least in the short run, because fewer projects will exceed the higher investment threshold resulting from increased volatility.

The private investor incorporates into his decision-making uncertainty from two sources: uncertainty of relative prices and uncertainty regarding the sustainability of the present macroeconomic policy. A model by Conway (1990) is used in this paper to explain the effect of uncertainty on private investment. Consider an economy in which trade and financial reforms have just been introduced. These reforms will be represented by an increase in the return to capital in the export-oriented sectors from some lower value to a higher specific level denoted r. Let $r*$ be the uncertain real return to capital in the loanable funds market. $r*$ is more volatile in the presence of financial liberalization. Now, let's assume that r exceeds the expected uncertain real return to capital in the loanable funds market, $E(r*)$. Policy uncertainty will be modeled in the form of a probability δ that the reform will be reversed. Assumed to be constant over time, δ measures the likelihood (per unit of time) of policy reversal. Entry costs will be represented by ε.

Capital investment is partially irreversible since there are sunk costs of entry and exit when physical capital is committed or moved from one sector to another. This aspect of the model, together with uncertainty, places it within the literature on hysteresis (see

Dixit (1987), Krugman (1988) and Pindyck (1988)). The main idea of this literature is that with costly resource reallocation, uncertainty plays an important role in decision-making by having significant effects on behavior even without risk aversion. Also, large enough changes in the environment can produce lasting effects on resource allocation even when the initial changes are eventually fully reversed.

Let's consider the investment decision of an entrepreneur who has a single unit of capital immediately after the reform. He must choose if and when to finance an investment earning a return r per period. There are two periods, and the investor faces three mutually exclusive options: not to invest, to wait and invest in the second period, or to invest now. The payoffs are shown in Table 2.1.

Table 2.1

Payoffs to Investors Net of Opportunity Cost (per unit of capital)

	Period 1	Period 2
Opportunity cost	r_1^*	r_2^*
Wait: invest later	0	$\delta r_2^* + (1-\delta)(r-\varepsilon) - r_2^*$
Invest now	$r-\varepsilon-r_1^*$	$\delta(r-t) + (1-\delta)r - r_2^*$

The opportunity cost is the real interest rate prevailing in the loanable funds market. The investor, by waiting and investing only in the second period, can avoid the policy instability and/or take advantage of a lower interest rate in the loanable funds market. If the reform if reversed, then with probability δ the return to the investor is r_2^*; otherwise, the investor receives a return r less the entry cost ε. Investment in period one

leads to a return r in both periods. There will be the entry cost ε in the first period and a cost of policy reversal t in the second.

The following question can be addressed within this framework: will reform lead investors to invest in the first period rather than waiting to invest in the second period or not invest at all? The discount rate on the second period returns will be represented by ρ and the question can be answered by comparing the returns of the three strategies in Table 2.1.

Investment in period two is preferable to no investment at all if $r_2^* < r - \varepsilon$; it is assumed that this lower bound on returns on physical investment is met. Therefore, investment in the first period is preferable to that in the second period if:

$$r > r_1^* + (\delta/(\rho+\delta))[r_1^* - r_2^*] + (1/(\rho+\delta))[\delta t + \varepsilon(\rho+\delta-1)] \qquad (2.1)$$

The above equation illustrates the importance of the two kinds of uncertainty as they relate to the investment decision. The first kind, the real interest rate uncertainty, is captured in the second term on the right-hand side. The second kind, policy sustainability, is represented by δ throughout. The third term of the right-hand side captures the fixed costs of investment, indicating that in equilibrium the real return on physical investment will in general exceed the real return to capital in the loanable funds market.

From an econometric perspective it is difficult to separate these two kinds of uncertainty since variability in real interest rates can be strongly correlated with the probability of the collapse of the reforms. Conway (1990) uses a simple proxy to

represent policy reversal. Suppose the evolution of government debt over time takes the form (as ratios of output):

$$d_t = d_{t-1} + b_t + (r_0 - g_0)d_{t-1} \tag{2.2}$$

where d represents debt, b represents borrowing, r_0 is the long-run average real interest rate and g_0 represents the long-run growth rate of the economy. Based on development theory it can be said that fiscal instability is a reason for the reversal of trade and financial reform: as the government looks to finance budget deficits, it may seek to assert greater control over financial markets or increase tariffs. Within this framework, government debt becomes unstable in the steady state if the real interest rate exceeds the growth rate of output. An indicator that looks at this relationship will provide a test of the relative importance of policy collapse. Steady-state variables are not observed, but there are observable real interest rates and growth rates in each period, and these could be used to construct an indicator.

Empirical Evidence of the Impact of Uncertainty on Private Investment

The empirical literature on the relationship between uncertainty and investment is considerably smaller than the corresponding theoretical literature. Most empirical studies, particularly those using macroeconomic data, adopt a non-structural approach, in which various uncertainty proxies are used instead of the conventional reduced-form investment equations.

Conway (1990) estimates the impact of relative-price uncertainty (real exchange rate and interest rate) and policy uncertainty on Turkey's real private investment. He finds that relative-price uncertainty has a negative effect on the private investment

decisions. However, the proxy used for the possibility of policy reversal has no significant effect on the private investment.

A few studies have examined the impact of uncertainty on U.S. and U.K. investment. Federer (1993) finds a negative effect on U.S. equipment investment, while Price (1996) finds a likewise negative effect on U.K. manufacturing investment. In turn, Goldberg (1993) explores the impact of real exchange rate uncertainty on U.S. industry-level investment. She finds virtually no effect at the aggregate level, while at the subsector level her results vary in sign and significance.

Cross-country empirical studies using aggregate data are somewhat more abundant. Hausmann and Gavin (1995), report a negative association between an index of macroeconomic volatility (which combines real GDP and real exchange rate volatility) and the aggregate investment/GDP ratio, using a large sample of developing countries. Bleaney (1996) finds that measures of volatility negatively affect growth performance in developing countries, but do not affect aggregate investment.

Most of the cross-country empirical studies ignore the time-series variation in the data. However, there are a few exceptions. Pindyck and Solimano (1993) test for the effect of uncertainty on aggregate investment following the irreversibility approach. Using panel data for industrial and developing countries, they construct proxies for the profitability threshold, and examine its relation with the volatility of profitability itself. They also estimate reduced-form investment regressions including the volatility of inflation and the exchange rate. They found that the volatility of the exchange rate has a negative effect on investment. Serven (1998) estimates a private investment equation using panel data on a group of developing countries. He uses five measures for

uncertainty of which only the real exchange rate has a robust adverse impact on private investment.

Empirical Evidence of the Impact of Political Instability on Private Investment

There are numerous studies interested in the relationship between political instability and private investment. Alesina and Perotti (1996), Barro (1991) find that sociopolitical instability reduces investment in a sample of seventy-one countries. Their result is consistent with Barro (1991, 1997) and Alesina, Ozler, Roubini, and Swagel (1996) who find that political and social instability leads to a decrease in the investment share of GDP.

A number of empirical studies have shown the relationship between democracy, investment and economic growth. Feng (2001) examines whether democracy and other major characteristics of political institutions have an impact on private investment in developing countries. Pastor and Hilt (1993) and Pastor and Sung (1995) analyze the relationship between democracy and private investment in Latin America and they found that democracy has a positive impact on private investment.

A collection of studies focus on uncertainties generated by changes in policies rather than in the political system that affects investment. The impact of different forms of uncertainty on private investment has been discussed by Serven an Solimano (1993), Rodrik (1991), Federer (1993), Price (1996), Goldberg (1993), Bleaney (1996), Aizenman and Marion (1993), Price (1995), Pyndick and Solimano (1993), Hausmann and Gavin (1995), an Brunetti and Weder (1998). All of them found that policy uncertainty has a negative effect on private investment since uncertainty creates a reward

for waiting; therefore, an increase in uncertainty will reduce private investment (Dixit, 1989).

A number of studies concentrate on the impact of democracy, and institutional solvency on economic policy. Haggard and Webb (1994) argue that decentralization can provide powerful incentives for good policy. Conversely, poorly designed federal arrangements can generate a variety of undesirable outcomes, from severe macroeconomic imbalances and slow growth, to poor delivery of services, corruption and inequity across jurisdictions. Haggard and Kaufman (1995) argue that differences within regime types are likely to have more effect on the capacity to initiate reform than is regime type itself. On the other hand, Remmer (1990) argued that regime type makes no difference to economic reform, at least in Latin America. Kubota and Milner (1999) show how democratization of political system reduces the ability of governments to use trade barriers as a strategy for building political support.

The distinction between this paper and others is that: first, this study jointly examines the effect of macroeconomic uncertainty and political instability on private investment; second, it analyzes several methods to measure political instability; third for policy implications, it examines the impact of political instability and macroeconomic uncertainty on private investment by controlling for each other in order to determine which one has a larger impact on private investment; and fourth, it examines which socio-political factors affect relative price uncertainty. This is important because policy makers can use this information to develop the necessary instruments to ensure that adjustment is not only efficient, but also shared in a socially acceptable manner.

CHAPTER III
RELATIVE PRICE UNCERTAINTY, POLICY SUSTAINABILITY AND PRIVATE INVESTMENT

The objectives of this chapter are 1) to estimate an "uncertainty measure" to proxy relative price uncertainty, 2) analyze the effect of relative price uncertainty and attempts of policy reversal on aggregate private investment, 3) describe the data and discuss individual country analysis as well as panel analysis, and 4) provide conclusions and recommendations for further research.

Measure of Relative Price Uncertainty

The volatility in relative prices is high in Latin America. How does this volatility affect investment decisions? A high volatility in real exchange rates makes price signals less informative about the relative profitability of investment across sectors, and will likely hamper the investment decision.

Various proxies of uncertainty have been implemented in empirical studies. A simple approximation of uncertainty is given by the standard deviation of the variable in question. This measure, adopted by Akhat and Hilton (1984) and Gotur (1985), would be consistent only if the distribution of the variable in question is normally distributed. Evidence, however, shows that exchange rates are usually not normally distributed (Friedman and Vandersteel, 1982).

One way to overcome this problem is to use the standard deviation of the rate of change of the exchange rate. This approach captures higher frequency movements and avoids the mean-variance critique. However, the results are in general very volatile and a procedure for smoothing the series is usually recommended (Cushman, 1983; Kenen and Rodrik, 1986). The use of either a four or an eight moving average process of the

exchange rate makes the proxy exceedingly dependent on past values. As pointed out by Pagan and Ulah (1986), this procedure could lead to an underestimation of the effect of variability on decision.

A proxy of exchange rate calculated from observed, past values would be unconditional and ex post (Seabra, 1995). Entrepreneurial decisions are influenced by expected, ex ante uncertainty. Exchange rate uncertainty should, then, be defined conditional on some information set. Forward exchange rates could be viewed as the expected exchange rate and then the difference between forward rates and actual rates could be seen as a measure of variability. However, the problem of forward exchange rates is that they tend to be exceedingly volatile and not representative of the market as a whole. Besides, forward exchange rates are not developed in many Latin American countries (Seabra, 1995). Therefore, the predicted exchange rate has to be estimated under the assumption that firms form their expectations making use of all available information.

In Kenen and Rodrik (1986) the exchange rate uncertainty variable is proxied by forecast errors derived from simple time-series models of the real exchange rate (AR(1) processes and log-linear trends). In this type of model the uncertainty measure is the unconditional estimated variance, which does not account for all relevant available information. To include all the relevant information we computed the conditional variance of the exchange rate as the relevant proxy of the exchange rate uncertainty by estimating a generalized autoregressive conditional heteroscedasticity model (GARCH) for the exchange rates.

The GARCH Model

The GARCH model, originally developed by Bollerslev (1986), allows for a type of heteroscedasticity in time-series models in which the conditional variance of the forecast error depends on previous conditional variances and squared forecast errors. The conditional variance is a function of all relevant available information. The square root of the estimated conditional variance will represent the "uncertainty measure", therefore encompassing the investors' expectations[1]. For each country i, I estimated the following GARCH(1,1) model:

$$reri_{it} = \alpha_0 + \alpha_1 reri_{it-1} + \varepsilon_{it} \tag{3.1}$$

$$\sigma_{it}^2 = \tau_{i0} + \tau_{i1}\ \varepsilon_{it-1}^2 + \tau_{i2}\ \sigma_{it-1}^2 \tag{3.2}$$

where $reri_{it}$ represents the real exchange rate index, σ_{it}^2 denotes the conditional variance of ε_{it} (the forecast error for the exchange rate equation) based on information up to period t. I estimated this two-equation model. The square root of σ_{it}^2 from equation (3.2) represents the "measure of uncertainty" of the real exchange rate.

Using ordinary least squares on observed data to estimate the real exchange rate equation has two drawbacks: it uses all the sample data to set the forecasting rule for the beginning of the sample, and it presupposes that the parameters α are time-invariant. GARCH avoids these problems by creating a forecast based only on available information up to time t.

[1] In the preliminary analysis I estimated equations (3.1) and (3.2) for other measures of uncertainty: inflation, interest rate, the growth of output and the terms of trade. However, only the relative price uncertainty had a statistically significant effect on private investment. Thus, I dropped the other measures from the study.

Estimating the Relationship Between Aggregate Investment and Uncertainty

Assuming that investment is an increasing function of the expected profitability of a sector, one can set up the following empirical equation:

$$I_{it} = \beta_{i0} + \beta_{i1} I_{t-1} + \beta_{i2} Y_{t-1} + \beta_{i3} r_{t-1} + \beta_{i4}\sigma_t + \beta_{i5} INDIC_t + \beta'_{i6} d_t + u_t \qquad (3.3)$$

where I_t represents the logarithm of private investment, I_{t-1} represents the logarithm of lagged private investment, Y_{t-1} represents the logarithm of lagged Gross Domestic Product, r_{t-1} represents the lagged real interest rate measuring the cost of capital, $INDIC_t$ is the proxy for the probability of policy reversal due to budgetary irresponsibility, d_t is a vector of dummy variables, and σ_t is the "uncertainty measure". The residual u_t is assumed to have standard regression properties. Equation (3.3) is estimated using ordinary least squares[2].

Following Conway's (1990) work, to proxy for the possibility of policy reversal due to budgetary irresponsibility, an indicator variable $INDIC_t$ is constructed, taking the value of "1" for the year in which the real interest rate exceeds the growth rate of real GDP. Otherwise it takes the value of "0".

Several econometric issues must be addressed for proper estimation of equation (3.3). First, since we are using annual data for fixed private investment, real GDP, real interest rate, and index for the real exchange rate, unit roots may be present; therefore, I check for non-stationarity. Unit root tests and correlograms gave opposite results: none of the correlograms indicated slowly decaying correlations while all unit root tests indicated non-stationarity. Given the small sample of observations and the low power of

[2] I added to equation (3.3) a dummy variable to capture the type of regime and only in the case of Argentina and Bolivia it was negative and statistically significant.

unit root tests, we followed the correlogram results and treated the variables as stationary. Also, regression (3.3) was estimated in differences using OLS and they yielded similar results to those obtained utilizing the levels of the economic variables.

The second important issue is the problem of endogeneity between real GDP and private investment. I initially estimated equation (3.3) using contemporaneous values of GDP, and rir; then, I used the DWH (1978) test and the results indicated that there are no endogeneity problems. Nevertheless, equation (3.3) was estimated using the lagged values of the right hand side variables in order to rule out completely the possibility of endogeneity.

Macro Data

This project was completed using data compiled yearly between 1970-1996 from eight Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. All data was gathered from the World Development Indicators database of the World Bank. Real private investment is at constant prices; the nominal interest rate is represented by the lending rate (presented as the average for the year); other series include the real gross domestic product at constant prices, the real exchange rate index (1990=100), and inflation (the annual percentage change in the consumer price index). Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. The real interest rate is calculated by subtracting the concurrent inflation from the nominal interest rate.

Individual Country Analysis

Tables 3.1 and 3.2 present the empirical results for the private investment model[3]. Examining the results, it can be seen that the measure of private investment uncertainty has a negative coefficient significantly different from zero. The R^2 in most of the regressions is above 0.70 indicating that the model has good explanatory power. Overall, the regressions seem to be well-specified. The modified Durbin Watson (1951) test indicated that serial correlation is not present, except in a couple of regressions. The Jaque-Bera statistic showed normality of the residuals. The Hausman test statistic showed that there are no simultaneity problems. The stability tests, Cusum and Cusum Square, indicated coefficient stability in almost all regressions[4,5].

All the tables follow the same format. Those coefficients marked with asterisks are significantly different from zero at 10 percent level of significance and those with two asterisks are significantly different from zero at 5 percent level of significance; standard errors are in parenthesis. There are three variables that are systematically significant in their contributions to private investment decisions: lagged private investment, lagged real gross domestic product and relative price uncertainty.

Argentina

The estimated coefficients from regressing equation (3.3) and the appropriate statistics are shown in table 3.1. Examining the results, it can be seen that most of the

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[3] Variable addition/deletion tests were used to obtain the final form of the estimated regression. Real Gross Domestic Product is not taken into account in some regressions because the R^2 falls and the Akaike Information Criterion increases when this variable is included.

[4] See Greene (2000) for a discussion of these diagnostic statistics.

[5] The Cusum and Cusum Square tests were applied after incorporating a number of structural dummy variables in the regressions.

coefficients are statistically significant either at 0.05 level or 0.10 level. The adjusted R^2 is above .88 indicating that the model has good explanatory power. The lagged private investment has a positive significant effect on private investment. The real interest rate and the real exchange rate uncertainty have a negative significant effect on private investment.

These findings are supported by historical events. Argentina tried unsuccessfully to stabilize inflation in the 1970s through crawling peg. Over the course of the 1980s, Argentina governments implemented successive inflation stabilization plans involving currency reforms, price controls, and other measures.

The fundamental problem of government deficits was not repaired and the new programs, after a short initial period of success, failed. Pervasive economic instability spilled over to affect private investment. Argentina faced hyperinflation.

Finally in 1991 Argentina turned to radical institutional and economic reforms to end its sad history of inflation. Import tariffs were slashed, government expenditures were cut, major state companies were privatized and tax reforms led to increase government revenues.

The most important component of the economic reforms was the Convertibility Law. This new approach had a dramatic effect on inflation, which has remained very low after dropping from 800 percent in 1990 to well under 5 percent by 1995. Continuing inflation in the first years of the convertibility plan, despite a fixed exchange rate, implied a steep appreciation of the peso. From 1990 to 1995 the currency appreciated in real terms by about 30 percent.

After the Mexican financial crisis, speculators attacked Argentina's currency and domestic interest rates rose sharply. Unexpectedly higher borrowing cost and uncertainty of the real exchange rate created a decline in private investment.

Argentina used the Convertibility Law in an attempt to control the uncertainty of the exchange rate. However, in December of 2001 Argentina experienced a large budget deficit, an overvalued currency and recession for 4 years. These factors created uncertainty about the exchange rate, people demanded more dollars and this putted pressure on the Argentinean peso. The Convertibility Law ended in January of 2002.

Bolivia

The estimated coefficients from regressing equation (3.3) and the appropriate statistics are shown in table 3.1. Examining the results, it can be seen that most of the coefficients are statistically significant either at 0.05 level or 0.10 level. The adjusted R^2 is above .92 indicating that the model has good explanatory power. The lagged private investment, the lagged real GDP and the dummy D98 have a positive significant effect on private investment. The real interest rate has a negative (not statistically significant) effect on private investment. Finally, the real exchange rate uncertainty has a negative significant effect on private investment.

These findings are supported by historical events. Investment declined steadily during the 1980s. The first half of the decade was characterized by macroeconomic turbulence that ended in the hyperinflation of 1984-85. Then, in August of 1985 the government introduced a sharp and successful program to stabilize inflation, which went form the five-digit level of hyperinflation to an average of about 20 percent in the second half of the 1980s. The main problem Bolivia experienced in its stabilization effort was a

lack of per capita growth and any significant response by private investment in the aftermath of the stabilization.

Why private investment remained stagnant after the reforms? Inflation was under control but the fiscal deficit was still high (near 5 percent in 1986-90) and the economy highly dollarized (Morales, 1991), the macroeconomic environment was still unstable hampering a recovery of private investment. Consequently, macroeconomic instability and uncertainty of the real exchange rate affect negatively private investment.

Brazil

The results for equation (3.3) are shown in table 3.1. Most coefficients are statistically significant at 0.05 level or 0.10 level. The adjusted R^2 is above .75 indicating that the model has good explanatory power.

Lagged private investment, lagged real GDP and the dummy D80 have a positive effect on private investment. On the other hand the real interest rate has a negative impact on private investment. Finally, real exchange rate uncertainty has a negative effect on private investment.

These findings have useful implications. Inflation tends to result in overvaluation: investors fear the exchange rate risk as well as economic instability. Uncertainty about prices brings about short horizons for production decisions and capital flight also rises with inflation. Brazil has a history of experiencing high levels of inflation and it has used several stabilization programs to reduce inflation. For example, the Real Plan was used to bring about a rapid reduction of inflation, without having large, harmful costs in term of output. This kind of program is called an exchange rate-based stabilization because it is based in a pegged exchange rate. Experience has shown that

the first result of stabilization policies is recession. How long the recession lasts depends on how fast the economy adjusts to new relative prices. In the meantime, falling standard of living and political unrest often become a result of such policies. This leads to overvaluation, uncertainty about the economy, and finally to foreign exchange crises.

Capital flight is a consequence of stabilization programs based on pegged exchange rate. For example, in 1997 there were expectations that the real would devaluate and this created capital flight. Brazil in order to defend its overvalued currency pushed interest rates to 35% more than inflation and ordered tax rises and spending cuts. The high interest rates deter investment in capital goods. Both effects, uncertainty in the exchange rate and high interest rates hampered private investment.

Chile

The estimated coefficients from regressing equation (3.3) and the appropriate statistics are shown in table 3.1. Examining the results, it can be seen that most of the coefficients are statistically significant either at 0.05 level or 0.10 level. The adjusted R^2 is 0.93 indicating that the model has good explanatory power. The lagged private investment and the real interest rate have a negative (not statistically significant) effect on private investment. The lagged GDP has a positive significant effect on private investment. Finally, the real exchange rate uncertainty and the dummy D73 (capturing the effects of the stabilization reforms) have a negative significant effect on private investment.

The experience of Chile is interesting in several respects. First, it started its reforms earlier (in the mid 1970s) than the countries in the region. Second, at the time the reforms started to be applied, the Chilean economy exhibited large macroeconomic

instability in the form of high rates of inflation (over three digit by the mid-1970s) and a large fiscal deficit.

On taking power in September 1973, the regime of Agusto Pinochet sharply devalued the currency, eliminated price controls, demobilized labor, and restricted monetary growth. As a result of these measures, interest rates went from –24 percent to 178 percent, businesses were forced into bankruptcy, unemployment increased, inflation was far from under control, and GDP fell 14 percent in 1975 while prices quadrupled. All these facts hampered private investment (Cardoso, 1993).

Monetary reform introduced the peso, each worth 1,000 escudos, and in 1976, the government adopted a policy of preannouncing the exchange rate for each month. The monthly devaluations lagged behind inflation, and in 1979, the regime went even further, fixing the exchange rate at 39 pesos per dollar, a rate that lasted for three years.
Borrowing was easy in the late 1970s, especially because Chile enjoyed some attractive characteristics. By preannouncing the exchange rate, the government assured investors that, at least in the short run, they would not be caught by a sudden drop in the dollar value of their earnings from local investments. Furthermore, the liberalization of financial markets had increased Chilean interest rates well above international rates. This meant that deposits and short-term loans to Chilean firms were both lucrative and relatively riskless. Finally, bankers' concerns about political instability declined.

Inflation dropped with the implementation of exchange rate stability. The economy grew rapidly for four years, finally recovering the level of output it had enjoyed in 1972 by 1978.

Then what went wrong? The fixed exchange rate resulted in the increasing overvaluation of the peso. Despite high copper prices, export growth fell while imports rose to 1.7 times the level of exports in 1981 (Cardoso, 1993). Across-the board tariffs of only 10 percent (except for automobiles) put local products at a new disadvantage relative to imports. Combined with overvaluation, the new openness of the economy stifled production for the domestic market. Tight monetary policy produced high interest rates. Banks collapsed, and capital flight began.

Chile was hit by the debt crisis. GDP fell 14 percent in 1982 and unemployment rose to 21 percent. Investors' lack of confidence in the local currency held their assets in dollars putting pressure on the peso. The peso was sharply devalued in 1982, bringing to a close any attempt to achieve disinflation with a fixed rate. Consequently, once again macroeconomic uncertainty created capital flight.

Colombia

The estimated coefficients from regressing equation (3.3) and the appropriate statistics are shown in table 3.2. Examining the results, it can be seen that most of the coefficients are statistically significant either at 0.05 level or 0.10 level. The adjusted R^2 is 0.93 indicating that the model has good explanatory power. The lagged private investment, the lagged real GDP, and the dummy D9394 have a positive statistically significant effect on private investment. The real interest rate and the dummy D99 (captures the decline in real GDP due to political unrest) have a negative effect on private investment. Finally, the real exchange rate uncertainty has a negative significant effect on private investment.

Private investment was pretty much stable during the seventies. The debt crisis of the early 1980's created a decrease in economic growth as well as in private investment. The macroeconomic climate was more stable than that prevailing in the other countries at the time of the reforms, and the country's microeconomic strength was greater in relation to the smaller countries in the region (Moguillansky, 2001). These two factors boosted private investment. However, trade liberalization introduced a high degree of uncertainty into investment decisions. Another factor contributing to increased uncertainty was the political unrest that they face until today.

Mexico

The estimated coefficients from regressing equation (3.3) and the appropriate statistics are shown in table 3.2. Examining the results, it can be seen that most coefficients are statistically significant at 0.05 level of significance or 0.10 level of significance. The adjusted R^2 is 0.95 indicating that the model has good explanatory power. The lagged of private investment is statistically significant and has a positive effect on private investment. The real interest rate has a negative impact on private investment. The dummy variables D83 and D95 have a statistically significant negative effect on private investment. Mexico experienced two major episodes of capital flight. The dummy variable D83 is used to capture the sharp decline in private investment growth due to capital flight in 1983 as a consequence of the debt crisis that erupted in 1982. The variable D95 captures the "Tequila Crisis". The real exchange rate uncertainty has a negative impact on private investment.

These findings have useful implications. Expected depreciation of the currency is important in the context of periods of overvaluation. When it is widely perceived that

an extreme devaluation lies ahead, capital flight becomes massive. Therefore, any private investment abroad is disadvantageous to the domestic economy. Mexico experienced two major episodes of capital flight. The first one was after the debt crisis in 1983 and, the second one was in 1994 known as the "Tequila Crisis". Private Investment declined sharply as a result of capital flight.

Capital flight from Mexico increased Mexican interest rates and decreased the value of the Mexican peso in the market for foreign-currency exchange. This is exactly what was observed in 1994. From November 1994 to March 1995, the interest on short-term Mexican government bonds rose from 14 percent to 70 percent, and the peso depreciated in value from 29 to 15 U.S. cents per peso. The increase in interest rate to reward asset holders for the "risk" of holding domestic assets hinders private investment in capital goods. Therefore, the reduced capital formation implies slower growth of the economy.

Peru

The estimated coefficients from regressing equation (3.3) and the appropriate statistics are shown in table 3.2. Examining the results, it can be seen that most coefficients are statistically significant at 0.05 level or 0.10 level. The adjusted R^2 is 0.89 indicating that the model has good explanatory power. The lagged of private investment and lagged real GDP, and the dummies D90 and D9495 are statistically significant and have a positive effect on private investment. The real interest rate has a negative impact on private investment. Finally the real exchange rate uncertainty and the dummy D8385 are statistically significant and have a negative influence on private investment.

Peruvian private investment was weakened by economic and political instability of the 1980s. The capacity of investors to adopt defensive strategies in the face of liberalization was adversely affected not only by hyperinflation, but also by stabilization measures. Economic reform therefore contributed more to the weakening of private investment than to its strengthening.

The low levels of private investment are explained by the high incidence of idle capacity, severe microeconomic weakness, the absence of any stimulus from export-oriented production, and a lack of interest on the part of transnationals in achieving positions in the domestic market (Moguilansky, 2001).

Such microeconomic uncertainty combined with and was fuelled by unfavorable macroeconomic conditions that hindered investment decisions. The stabilization of prices and of political and social conditions introduced the minimum necessary conditions for a recovery in investment. However, private investment was still hindered by high interest rates and a current account deficit. The external disequilibrium generated uncertainty about future macroeconomic performance, and it introduced a considerable degree of caution into investment decisions (Moguillansky, 2001).

Venezuela

The estimated coefficients from regressing equation (3.3) and the appropriate statistics are shown in table 3.2. Examining the results, it can be seen that most of the coefficients are statistically significant either at 0.05 level or 0.10 level. The adjusted R^2 is 0.71 indicating that the model has good explanatory power. The lagged private investment and the dummy D84 (captures the increase in real GDP after the devaluation

of the bolivar in 1983) have a positive significant effect on private investment. The real exchange rate uncertainty has a negative significant effect on private investment.

These findings are supported by historical events. For example, in 1989 Venezuela experienced high fixed interest rates in order to attract foreign capital, however investors where concern with the political unrest and the stability of the economy. The macroeconomic instability deterred private investment.

The second Perez administration launched substantial policy reforms which included the elimination of budget deficits, restructure of the financial sector by allowing the interest rates to fluctuate with market rates, and exchange rate adjustments. Despite their initial inflationary effect, these policies created incentives for saving and investment among investors, thereby attracting and retaining capital.

Summary of Results

The common characteristic of all equations is the robust negative impact of relative price (real exchange rate) uncertainty on private investment. This result is supported by historical events. Latin American countries to stabilize their economies have relied on a combination of policies that reduce expenditures and switch spending toward domestic goods. The switch generally includes a real devaluation that leads to relative price uncertainty creating significant consequences for investment. Thus, uncertainty plays a key role in investment decisions because they are largely irreversible. From a policy perspective, a stable incentive structure and macroeconomic policy environment are as important as the level of the tax incentives or the interest rates. In other words, if uncertainty is high, investment incentives may have to be very large to have any significant effect.

Output was found to be significant only in the case of Brazil. This means that changes in output is an important determinant of private investment. Therefore, a contraction in demand induced by adjustment measures is likely to have an adverse short-run effect on investment because of its negative effect on the growth of output. This effect can be explained in the context of the Q theory of investment. Solimano (1992) showed that in Chile aggregate investment profitability is procyclical, so the market value of capital, and hence investment, would be expected to fall in the short run in response to an exogenous slowdown in economic activity.

The downturn may also affect investment through its effect on expectations. A recession, for instance, could lead investors to postpone investing until the economy is recovered. This response might in turn delay the recovery, and the economy might get stuck in a low investment equilibrium because of self-fulfilling pessimism.

The level of the real interest rate, so often found important in earlier studies, plays an insignificant and unpredictable role here; only in Argentina is its contribution as predicted by theory.

The variable $INDIC_t$, used as a proxy for policy reversal, is insignificant in explaining private investment when entered in the equation; therefore, it has been deleted from all the equations. Some of the dummy variables representing trend changes are statistically significant in all the countries, and are important in allowing the uncertainty variable to explain private investment.

Panel Data Analysis

In this section I combine annual data covering the period of 1970 to 1996 for Argentina, Bolivia, Chile, Colombia, Mexico, Peru and Venezuela and estimate a dynamic panel model for private investment. The empirical equation now takes the form:

$$I_{it} = \lambda_{i0} + \lambda_1 I_{i,t-1} + \lambda_2 Y_{i,t-1} + \lambda_3 r_{it} + \lambda_4 \sigma_{it} + \lambda_5 D83 + \varpi_{it} \qquad (3.4)$$

where the left hand side variable denotes the log of fixed private investment in country i and year t, rir_t is the real interest rate, Y_t is the real gross domestic product, σ_t is the relative price uncertainty measure, and D83 is a dummy variable used to capture the sharp decline in private investment growth due to capital flight in 1983 as a consequence of the debt crisis that erupted in 1982. The residual ϖ_{it} is assumed to have standard regression properties.

A dynamic panel model was used due to the fact that one of the explanatory variables is the lagged value of the dependent variable. Since there is correlation between the lag of private investment and the error term, equation (3.4) cannot be consistently estimated using least squares (see Greene [2002], chapter 13). Therefore, the model is estimated in differences using instrumental variables utilizing as instruments the differences of the exogenous variables and the lagged difference of the dependent variable.

Panel Analysis: Policy Reversal

In this section I am interested in examining the link between relative price uncertainty, reversal of policy and private investment for Argentina, Bolivia, Chile, Colombia, Mexico, Peru and Venezuela.

My hypotheses that policy reversal and relative price uncertainty have a negative effect on private investment can be explained by the following reasoning. First, uncertainty about government effectiveness can be more adverse than the policy itself by deterring investors from committing their assets. Given a bad policy with certainty about its execution, the investor can still find ways to make money. However, if the government lacks consistency in its policy execution, investors will delay their investment until becomes clear that the government is consistent in executing policy. The fundamental rationale for the negative effect of policy uncertainty on private investment is that the uncertainty regarding government effectiveness creates a reward for waiting; therefore, an increase in uncertainty will reduce private investment (Dixit, 1989) Second, relative price uncertainty measured by the implied volatility of the exchange rate has important effects on profitability through its impact on the relative price of capital goods. When sunk costs of entry are combined with uncertain future real exchange rates, firms are discouraged from entering the market even though favorable current exchange rates would seem to make entry profitable.

I examine the association between policy reversal and relative price uncertainty with private investment by estimating the following empirical equation:

$$I_{it} = \gamma_{i0} + \gamma_1 Y_{i,t-1} + \gamma_2 r_{i,t-1} + \gamma_3 \sigma_{i,t-1} + \gamma_4 INDIC_{i,t-1} + \gamma_5 D83 + \psi_{it} \qquad (3.5)$$

where the left hand side variable denotes the log of fixed private investment in country i and year t, rir_t is the real interest rate, Y_t is the real gross domestic product and σ_t is the relative price uncertainty measure, and $INDIC_t$ is the proxy for policy reversal. The

residual ψ_t is assumed to have standard regression properties[6]. Equation (3.5) is estimated in differences using GLS with fixed effects and Cross Section Weights.

Results

Table 3.3 presents empirical results for the Dynamic Panel Model. The main results can be summarized as follows. First, the uncertainty measure has a negative and statistically significant impact on private investment. As argued earlier in this paper, the stability of the exchange rate is a crucial variable for sustained growth in private investment levels. The failure of investment to pick up in several Latin American countries may reflect the lack of confidence on the part of the private sector in the ability of the authorities to keep the exchange rate from depreciating again, and hence expectations are that the decline in inflation may be only temporary.

Second, the coefficient of the real interest rate is statistically significant and of the expected sign. This finding suggests that monetary and credit policies included in stabilization packages affect private investment in two ways: they raised the real cost of bank credit; and, by raising interest rates, they increase the opportunity cost of retained earnings. Both mechanisms raise the user cost of capital and lead to a reduction in investment. Also, most Latin American countries experience high fiscal deficits. High fiscal deficits push interest rates up or reduce the availability of credit to the private sector, or both, crowding out private investment.

Third, the real gross domestic product has a positive and statistically significant effect on private investment. As mentioned before, this implies that a contraction in

[6] I added to equation (3.5) a dummy variable to capture the effect of the type of regime on fixed private investment and it was found that it has not a significant impact on fixed private investment.

aggregate demand induced by adjustment measures most likely will have an adverse short-run effect on investment because of its negative effect on output growth.

Table 3.4 reports the results using both relative price uncertainty and policy reversal as factors affecting fixed private investment. All economic variables with exception of the real interest rate are significant at the 5% level and have the expected sign in column (1). An increase in output will increase investors' optimism of the future motivating them to invest more. Also, a decrease of relative price uncertainty will create a stable climate for private investment inducing investors to invest more today. The results are consistent with the ones of the dynamic panel model confirming the robustness of my results.

Examining the coefficient of column (2) in table 3.4 we can say that the proxy for policy reversal is statistically significant and has a negative impact on private investment. This means that if policy measures are perceived to be inconsistent or temporary investors will prefer to wait and see before committing resources to irreversible fixed investments. Therefore, transitory investment incentives can be used as tools to spur investment, in practice they run the risk of destabilizing public finances, which often are key element in adjustment programs. In contrast, sufficient external support for the stabilization effort may raise investor's confidence in the sustainability of the adjustment and set the stage for investment to takeoff (Dornbusch, 1991).

Column (3) in table 3.4 presents the results of the regression that includes relative price uncertainty and possibility of policy reversal as determinants of private investment. All the economic variables as well as the proxy for policy reversal are significant at the 5% level and have the expected sign. For policy implications, policy-makers have to take

care of both problems at the same time, relative price uncertainty and possibility of policy reversal, order to attract private investment. This will be discussed in depth in the next section.

In summary in the panel estimation we have achieved the same results as in the single country estimation with exception of policy reversal. The most important result is that the relative price uncertainty measure has a statistically significant adverse effect on private investment in both cases. However, reversal of policies has statistically significant impact on private investment only in the panel analysis due to the fact that I have more observations.

Conclusions and Policy Implications

Most Latin American countries had gone through structural reforms, stabilization programs, and privatization in order to stimulate private investment. So far, analysis on the empirical determinants of private investment behavior has focused on the movements in relative prices of credit and final goods. This paper suggests that it is equally important to consider the effect of the uncertainty in these relative prices. Using a proxy for relative price (real exchange rate) uncertainty and policy reversal rates, two principal conclusions emerge: 1) relative price uncertainty has a negative and statistically significant impact on private investment; and 2) proxy for the possibility of policy reversal has a significant negative effect on private investment.

The relevance of these results for macroeconomic policy in Latin American countries is very important. Latin America suffers from high, unpredictable inflation and variability of relative prices. The findings on irreversible investment suggest that changes in prices affect sectoral incentives may then be ineffective in stimulating

investment. It may take some time before investors are convinced that the changes are permanent. The decision to implement an adjustment program may well increase uncertainty in the short run, as private agents get mixed signals about the efficiency and consistency of the policy. Therefore, the government has to take care of both problems, relative price uncertainty and policy consistency, in order to provide a stable environment for private investment.

Countries attempting structural change through relative-price adjustment, such as depreciations of the exchange rate, should take into account not only the positive efficiency gains anticipated through the relative-price adjustments; but also the losses in private investment and the impact on future economic growth due to the increased uncertainty. Necessary changes in relative prices could still occur, but government policy should focus on eliminating excess variability in price movements in order to provide an appropriate environment for investment.

Government policy instability is another source of discouragement for investors. Unless investors view the adjustment as internally consistent and are convinced the government will carry it out despite the implied social costs, the possibility of reversal will become a key determinant of investment decisions. In order to activate and maintain an inflow of private investment in their economies, governments in Latin American countries should emphasize consistent policy. They should develop the necessary instruments to ensure that adjustment is not only efficient but also consistent. In this context the choice between gradual and abrupt stabilization is important. Gradual adjustment involves modest objectives that can be achieved and that are intended to strengthen the government's reputation. In contrast, an abrupt adjustment involves drastic

changes, for example a large devaluation of the exchange rate to stimulate the quick reallocation of resources; even though it could also increase the social costs. The choice will largely depend on the social distribution of the costs of adjustment. Therefore, this highlights the importance of social safety nets and a progressive flexible tax system to balance equity and efficiency in order to maintain the radical change, to build institutional credibility, and over time to help reduce investors' fear of policy reversal.

In summary, from a policy perspective, a stable incentive structure and macroeconomic policy environment may be important for investment as the level of the tax incentives or the interest rate. In other words, if uncertainty is high, investment incentives may have to be very large to have any significant effect.

This study is a first attempt to measure the impact of relative price uncertainty and policy reversal on private investment in developing economies in Latin and Central America. However, we have to be aware that a reversal of policy is an endogeneous outcome, since the private sector ultimately determines whether the adjustment program can be sustained. Therefore, further research should analyze this indeterminacy between private investment and policy reversal for policy implications.

Also, further research should be directed in finding other factors that can affect private investment. Latin America has been characterized by experiencing political instability; therefore it will be interesting to examine the link between socio-political instability and private investment in Latin America.

Table 3.1 Private Investment and Relative Price Uncertainty: Argentina, Bolivia, Brazil and Chile (dependent variable: log of real fixed private investment)

	Argentina	Bolivia	Brazil	Chile
Constant	3.22	-21.49	5.09	-10.96
	(1.09)	(6.90)	(1.37)	(3.47)
Ln (I_{t-1})	0.72**	0.16	0.56**	-0.04
	(0.10)	(0.21)	(0.12)	(0.14)
Ln(GDP_{t-1})		2.84		1.66**
		(0.83)		(0.31)
rir_t	-3.91E-05**	-2.2E-03	-2.14E-06	-4.6E-03
	(1.12E-05)	(1.3E-03)	(2.59E-06)	(5.5E-03)
$\sigma_t(rer_t)$	-1.21**	-3.36**	-1.27**	-2.86**
	(0.36)	(1.64)	(0.53)	(0.02)
D73				-1.81**
				(0.33)
D80			0.30**	
			(0.10)	
D98		0.60**		
		(0.21)		
R^2	0.83	0.93	0.77	0.93
S.E. of Regr.	0.15	0.18	0.09	0.28
Durbin-Watson	1.56	1.74	1.66	1.32
Akaike criterion	-1.79	-0.33	-1.75	0.48
Jaque-Bera	0.87	1.39	0.33	1.58
	(0.64)	(0.50)	(0.84)	(0.45)
DWH test	0.99	0.29	053	0.15
Cusum test	+		+	+
Cusum Square	+		+	+

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
Jaque-Bera is a normality test for the residuals and the p-value is in parentheses.
DWH is a simultaneity test among variables and the p-value is reported.
Cusum and Cusum Square are Stability Tests: a + sign means are inside the boundaries.
σ_t measured by the conditional variance from GARCH (1,1) estimates.

Table 3.2 Private Investment and Relative Price Uncertainty: Colombia, Mexico, Peru and Venezuela (dependent variable: log of real fixed private investment)

	Colombia	Mexico	Peru	Venezuela
Constant	0.69	-0.65	-12.28	2.15
	(2.36)	(0.93)	(5.0)	(1.30)
$Ln(I_{t-1})$	0.56**	0.88**	0.16	0.82**
	(0.14)	(0.13)	(0.23)	(0.12)
$Ln(GDP_{t-1})$	0.36*	0.16	1.77**	
	(0.18)	(0.15)	(0.40)	
rir_t	-4.89E-03	-8.63E-04	-3.76E-05	-1.22E-03
	(4.39E-03)	(1.13E-03)	(2.77E-05)	(1.7E-03)
$\sigma_t(rer_t)$	-3.41*	-0.97**	-0.95**	-2.90**
	(1.84)	(0.46)	(0.40)	(1.17)
D83		-0.31**		
		(0.09)		
D84				0.78**
				(0.24)
D8385			-0.45**	
			(0.12)	
D90			0.37*	
			(0.20)	
D9394	0.41**			
	(0.09)			
D9495			0.36**	
			(0.12)	
D95		-0.41**		
		(0.09)		
D99	-0.53**			
	(-0.12)			
R^2	0.93	0.95	0.89	0.71
S.E. of Regr.	0.10	0.08	0.15	0.20
Durbin-Watson	2.52	1.91	1.55	1.47
Akaike criterion	-1.54	-1.85	-0.72	-0.20
Jaque-Bera	0.90	0.40	1.53	1.84
	(0.63)	(0.81)	(0.46)	(0.39)
DWH test	0.65	0.59	0.19	0.70
Cusum test	+	+	+	+
Cusum Square	+	+	-	+

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.

Table 3.3 Private Investment and Relative Price Uncertainty: Panel Analysis
(dependent variable: difference of real fixed private investment)

Variable	(1)
Δ Ln (I_{t-1})	0.14 (0.20)
Δ Ln(GDP_{t-1})	0.88* (0.46)
Δ rir_t	-3.97E-06* (2.37E-06)
Δ $\sigma_t(rer_t)$	-1.63** (0.72)
Δ D83	(-0.20)** (0.07)

Notes:
All right-hand side variables are expressed in first differences.
GMM standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
σ_t measured by the conditional variance from GARCH (1,1) estimates.

Table 3.4 Private Investment, Relative Price Uncertainty and Policy Reversal
(dependent variable: difference of real fixed private investment)

	(1)	(2)	(3)
Δ Ln(GDP_{t-1})	1.02**	0.84**	0.83**
	(0.33)	(0.27)	0.28
Δ rir_{t-1}	-2.97 E-06	-3.5 E-06**	-3.65 E-06**
	(2.25 E-06)	(2.10 E-06)	(2.15 E-06)
Δ $\sigma_t(rer_{t-1})$	-0.47**		-0.43**
	(0.25)		(0.24)
$INDIC_{t-1}$		-0.06**	-0.05**
		(0.03)	(0.04)
D83	-0.21**	-0.21**	-0.21**
	(0.07)	(0.06)	(0.06)
R^2	0.16	0.17	0.18
S.E. of Regr.	0.20	0.19	0.19

Notes:
All the economic variables in the right-hand side are expressed in first differences.
Standard errors are in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
σ_t measured by the conditional variance from GARCH (1,1) estimates.

CHAPTER IV
RELATIVE PRICE UNCERTAINTY, POLITICAL INSTABILITY AND PRIVATE INVESTMENT

The objectives of this chapter are 1) to measure political instability, 2) analyze the effect of relative price uncertainty and political instability on private investment, 3) describe the data and discuss the panel analysis, and 4) provide conclusions and recommendations for further research.

Measuring Political Instability and Relative Price Uncertainty

According to Alesina and Perotti (1996) political instability can be measured in two ways. The first one emphasizes executive instability. For example, Cukierman et. al (1992) defined political instability as the probability of a government change as perceived by the current government. Edwards and Tabellini (1991) constructed an index that measured the instability of the political system by capturing changes in the political leadership from the governing party to an opposition party.

The second approach to measure political instability is based upon indicators of social unrest and political violence. There are a number of empirical studies that have used several indices of socio-political instability as an explanatory variable in various regressions in which the dependent variable is growth, savings or investment. For example Alesina, and Perotti (1996), and Hibb (1973), used the method of principal components to construct such index. Venieris and Gupta (1986) constructed a socio-political index by using discriminant analysis.

In this study I am viewing political instability based on the second approach. In addition, instead of directly constructing an index I want to determine if the information captured in an index contains more or less information than using the individual variables

separately. The main argument of using socio political variables instead than an index is that the coefficient of the individual variables is interpretable while the coefficient of the index is not. For a detailed description of the socio-political variables see table 4.1.

Applying the method of principal components to ASSAS, STRIKE, WAR, GOV, PUR, RIOT, and REV leads to the following index of socio-political instability and using the factor loadings of the first principal component:

$$SPI = 0.29\ ASSAS + 0.14 STRIKE + 0.47\ WAR + 0.10\ GOV + 0.75\ PUR + 0.31\ REV \quad (4.1)$$

where SPI represents the socio-political index. Table 4.2 presents the results of principal components analysis and by examining them I can point out the following conclusions: first, the first principal component explains only 37% of the variance, and the first two principal components together explain 61% of the variance. This means it will be necessary to include more than two principal components in order to explain most of the original variation of the variables and that beats the whole purpose of using the method of principal components; and second, the loadings of the first principal component are all of the same sign but of different size. This means that the influence of the original variables on the first principal component varies dramatically. Examining the loadings of the first principal component we can say that assassinations, guerilla warfare, purges and riots weighted most heavily. These variables contain most of the information captured in the SPI. Consequently, why use an index instead than the individual variables separately? The main argument is that if the SPI does not provide additional information than the individual variables; therefore, I should use the individual variables because their

coefficients are interpretable and will be useful for policy implications. Later on, I present evidence that individual variables should be used instead of an index.

Relative price uncertainty will be represented by the "uncertainty measure" which is mainly the implied volatility of the exchange rate that I estimated in chapter 3.

Model Specification

My hypotheses that political instability and relative price uncertainty have a negative effect on private investment can be explained by the following reasoning: first, social unrest causes disruption of productive activities, and therefore a decrease in productivity of capital and labor; and second, political instability and relative price uncertainty create a hostile environment for investment inducing investors to postpone projects, invest abroad (capital flights) or simply consume more. Therefore, high levels of social and political unrest as well as high levels of relative price uncertainty will hamper private investment. When social unrest is widespread, the probability of the government being overthrown is higher, making the course of future economic policy and even protection of property rights more uncertain.

I examine the association between political instability and relative price uncertainty with private investment by estimating the following empirical equation:

$$I_{it} = \beta_{i0} + \beta_1 Y_{i,t-1} + \beta_2 r_{i,t-1} + \beta_3 \sigma_{i,t-1} + \beta_4' x_{i,t-1} + \beta_5 CONS_{i,t-1} + \beta_6 D83_{i,t-1} + \varepsilon_{it} \qquad (4.2)$$

where I_{it} represents the logarithm of private investment, $Y_{i,t-1}$ represents the logarithm of lagged Gross Domestic Product, $r_{i,t-1}$ represents the lagged real interest rate measuring the cost of capital, $\sigma_{i,t-1}$ is the "uncertainty measure", $x_{i,t-1}$ is a vector of socio-political variables, $CONS_{i,t-1}$ represents major constitutional changes and $D83_{i,t-1}$ is used to

capture the sharp decline in private investment growth due to capital flight in 1983 as a consequence of the debt crisis that erupted in 1982. The residual ε_{it} is assumed to have standard regression properties. Equation (4.2) is estimated using GLS with fixed effects and Cross Section Weights. The variable WAR is insignificant in explaining private investment when entered in the equation; therefore, it has been deleted from all the equations.

Data

This project was completed using data compiled yearly between 1970-1996 from eight Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. All data was gathered from the World Bank. The economic variables were collected from the World Development Indicators database. Real private Investment is at constant prices; the nominal interest rate is represented by the lending rate (presented as the average for the year); other series include the Real Gross Domestic Product at constant prices, the real exchange rate index (1990=100), and inflation (the annual percentage change in the consumer price index). Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. The real interest rate is calculated by subtracting the concurrent inflation from the nominal interest rate.

The socio-political variables were collected from the Arthur S. Banks Cross-National Time-Series Data Archive. For the purpose of this study I classify these variables in two categories. First, variables that capture social unrest: ASSAS, the number of politically motivated assassinations, STRIKE, the number of strikes, WAR,

the number of guerilla warfare, PUR, the number of purges, RIOT, the number of riots, REV, the number of revolutions. In periods of social unrest both the supply of investment capital by savers and the demand for capital by investors will decrease. Social unrest puts investors' decisions to invest their money on physical capital on hold, and motives them to consume more or send their money abroad. Second, variables that capture instability of the current regime and measure executive instability: GOV, the number of major government crises, and CONS, the number of major constitutional changes. According to Alesina and Perroti (1996) a high propensity of executive changes is associated with policy uncertainty which can lead to a decrease in private investment. A more detailed definition of the variables used in this paper is in Table 4.1 Also, SPI will represent an index obtained by applying the method of principal components to the following variables: ASSAS, STRIKE, WAR, GOV, PUR, RIOT, and REV.

A number of empirical studies have also used several of the variables that are included in this paper. Barro (1991) captures political instability by using three variables: revolutions, coups and assassinations of politicians. Venieris and Gupta (1986) constructed a socio-political index using the following variables: protest demonstrations, deaths, and regime type for the year for which data on income distribution is available, respectively. The index was created by using discriminant analysis. Alesina and Perotti (1996) construct a socio-political index by applying the method of principal components to assassinations, death, coups, and democracies.

There is a set of other studies that measure political instability emphasizing on executive instability. Cukiermna, Edwards and Tabellini (1992) constructed an index using a probit model that measured political instability using the following variables:

regular and irregular government transfers, unsuccessful coup attempts, executive adjustments, and other political events. Edwards and Tabelini (1991) constructed 2 proxies for political instability: 1) the actual frequency of transfers of power in the period 1971-82, and 2) the estimated probability of power transfer obtained from a probit regression on pooled cross-country time series. Feng (2001) measured political instability by the variability of political freedom.

Table 4.3 reports the summary statistics for the socio-political variables and tables 4.4 and 4.5 indicate the sample correlations between them. For my analysis I am interested in determining which individual variables will best represent social unrest and executive instability.

Examining table 4.3 I can note that the number of incidents on the variables ASSAS, STRIKE, WAR and RIOT are higher than the other variables. Also, the standard deviation of the above variables is also larger than the other socio-political variables. Therefore, for my analysis I take ASSAS, STRIKE, WAR and RIOT to represent social unrest.

Table 4.4 summarizes the correlations among indicators of social and political unrest. The general message from this table is that these variables are all positively correlated with each other and that the magnitude of association between each other differs. Interestingly, WAR and RIOT seem to have a strong linear relationship with ASSAS. This implies that an increase in the number of guerilla warfare and the number of revolutions are associated, on average, with an increase in the number of politically motivated assassinations, and vice-versa. Also, RIOT is strongly related with all the other variables in the sample. By contrast, WAR seems particularly strongly associated

with only two variables: PUR and GOV. Thus, I should consider ASSAS, RIOT and WAR in my empirical model.

In summary, the descriptive statistics and correlations of various socio-political variables are on the whole strongly supportive that ASSAS, STRIKE, WAR and RIOT be used as indicators of social unrest and political violence in my analysis.

Lastly, table 4.5 presents two key correlations: first, private investment and SPI; and second, private investment and "uncertainty measure". The two correlations are -0.04, and -0.27. The negative sign of these correlations are consistent with our hypotheses that socio-political instability and relative price uncertainty are negatively related with private investment. However, these correlations differ in magnitude. Interestingly, relative price uncertainty seems to be the most closely associated with private investment, while the opposite is true for the measure of social unrest and political violence.

Results

I used GLS estimation to test several models involving political and economic variables. The results are reported on Tables 4.6, 4.7 and 4.8. Because heteroscedasticity could be important across countries, the standard errors for the coefficients are based on White's (1980) heteroscedasticity-consistent covariance matrix. All the tables follow the same format. Those coefficients marked with an asterisk are significantly different from zero at 10 percent level of significance and those with two asterisks are significantly different from zero at 5 percent level of significance; standard errors are in parenthesis.

Examining the results, it can be seen that models using political variables do not explain aggregate private investment as well as economic models. Among the

political variables in Table 4.6, column (1), only ASSAS and CONS are statistically significant at the 5% level. All the variables have the expected negative signs, indicating they have an adverse effect on private investment. In addition, the results of column (2) in table 4.6 show that the SPI is insignificant and does not have the expected sign. Based on these results we can conclude that individual socio-political variables have a statistical significant effect on private investment while the SPI does not.

In contrast, the economic model has more explanatory power than the socio-political model. Table 4.7 shows the regression results focusing on economic variables. It can be seen that most of the coefficients are statistically significant at the 5% level and all the variables have the expected sign. Specifically, relative price uncertainty has a statistically significant negative effect on private investment.

The economic and political model improves the estimation of private investment. Table 4.8 presents the results of using both political and economic variables. All the economic variables as well as the political variables are significant at the 5% level and have the expected sign in column (4) and (5). The main results can be summarized as follows. First, the relative price uncertainty measure has a negative and statistically significant impact on private investment. This means the failure of investment to pick up in Latin American countries could be a consequence of investor's lack of confidence on government to sustain exchange rate policies.

Second, output has a positive significant effect on private investment. Intuitively this means that a recession, for instance, could lead investors to postpone investing until the economy is recovered. Third, the real interest rate has a negative significant impact

on aggregate private investment. A high level of interest rates raises the real cost of capital, and therefore dampens private investment.

Fourth, the number of politically motivated assassinations has a negative impact on private investment. One can argue that a relatively rare event such as the assassination of a politician disrupts the social and political climate of a country creating a hostile environment for investment. Fifth, the number of strikes has an adverse influence on private investment. Intuitively, strikes cause disruption of productive activities and therefore a decrease in the productivity of capital and labor. Sixth, the number of riots has an adverse effect on private investment. Intuitively, manifestations of mass violence create social costs that have a negative impact on the formation and accumulation of private physical capital. Finally, CONS has a positive effect on private investment meaning that major constitutional changes in the previous period are favorable for private investment.

Examining the coefficients of the socio-political variables column (4) and (5) in table 4.8 we note the following. First, the magnitude of the coefficients of ASSAS, STRIKE, and RIOT is small: -0.018, -0.02, and -0.02 respectively. Second, the magnitude of the SPI, -0.05, is larger than the coefficients of ASSAS, STRIKE, and RIOT. Third, the aggregate value of the coefficients of the socio-political variables ASSAS, STRIKE, and RIOT is equal to the value of the SPI coefficient. I can conclude based on these three facts that the information of some of the individual variables used to construct the index overlap; therefore, for policy implications we will use the individual variables because their coefficient is interpretable while the coefficient of the SPI is not.

Table 4.9 presents the elasticities for the economic and political model presented in table 4.8. I used the coefficients of column (4) and (5) for the construction of these elasticities. We decided to calculate elasticites for 2 reasons: first, to determine the degree of impact of the economic as well as political variables on private investment; and second, to compare the magnitude of impact of the economic variables and socio-political variables on private investment. Examining column (4a) in table 4.9 I conclude that the economic variables have a higher impact on private investment than the political variables. Among the economic variables real gross domestic product has a very strong effect on private investment. The effect of relative price uncertainty on private investment is higher than the effect of all the individual socio-political variables. For policy implications this is important because the government should pay very close attention to the macroeconomic climate in order to attract investment. Analyzing column (5a) in table 4.9 we can say once again that the economic variables have a bigger impact on private investment. Also, we can point out as in the previous case that relative price uncertainty has a bigger impact than the SPI on private investment.

Table 4.10 analyzes the relationship between political instability and relative price uncertainty[7]. PUG and RIOT are significant at the 5% level and have the expected sign. This means that a high number of purges and riots will increase relative price uncertainty. Intuitively, the political system needs to have good-will among different social groups and political parties, so that in the aftermath of a shock, there will no be problems of hostility and mistrust. Policy makers need to have safety nets as complements of

[7] Tables 4.10a, 4.10b, 4.10c and 4.10d analyze the relationship between political instability and the other measures of uncertainty. The SPI has a negative and statistically significant effect only on implied volatility of the inflation rate and interest rate.

adjustment programs and/or structural reforms in order to keep a stable environment for investment; where investors will feel confident to allocate their resources in the accumulation of physical capital. In addition, SPI has the expected sign but it is not statistically significant. Intuitively this means that political instability and relative price uncertainty are not strongly related. Once again this supports the idea that policy makers have to take into consideration both issues, relative price uncertainty and socio-political instability at the same time in order to attract private investment.

Finally, in all the equations regardless the model, D83 is statistically significant at the 5 percent level and has the expected sign. This means that the external debt and credit rationing due to the external debt may have played relatively important roles in the slowdown in investment.

Overall, these results show a robust negative impact of relative price uncertainty on private investment, and a weaker effect of the socio-political variables. Also, an increase in ASSAS, STRIKE, RIOT will create a threat to property rights and therefore private investment will decrease because investors will prefer to wait and see, consume more or send their money elsewhere.

Conclusions

This study has important implications for the design of growth enhancing macroeconomic adjustment programs. Macroeconomic stability and socio-political stability are key ingredients for the achievement of a strong investment response. With high macroeconomic uncertainty, the reaction of investment to changes in incentives is likely to be very limited. The same will happen if policy sustainability is threatened by social and political unrest. In such circumstances, investors will prefer to wait and see

before committing resources to irreversible fixed investments. These results can be generalized to developing countries that share similar culture, common macroeconomic problems as well as common socio-political unrest.

Political instability strongly discourages private investment, and thus economic growth. This highlights the need to develop the state and build a civil society in which citizens can participate in decision-making and express consent or disagreement without generating social turmoil. For this purpose, it is important to build free and fair electoral systems, develop participatory forms of government with an adequate delegation of authority to the local level, and ensure that police and judiciary systems enforce equal treatment under the law.

Within this framework of participatory democracy, it is essential to work toward a wide-ranging consensus on economic strategy, so that changes in government will not imply radical reversals of the policy framework. The political system needs to have good-will among different social groups and political parties, so that in the aftermath of a shock, there will not be problems of hostility and mistrust. Toward this end, governments should develop the necessary instruments to ensure that adjustment is not only efficient, but also shared in a socially acceptable manner. This highlights the importance of social safety nets and a progressive and flexible tax system to balance equity and efficiency.

In addition, relative price uncertainty measured by the variability of the exchange rate has a negative effect on private investment. This suggests that countries attempting structural change through relative-price adjustment, such as depreciations of the exchange rate, should take into account not only the positive efficiency gains anticipated

through the relative price-adjustments; but also the losses in private investment and the impact on future economic growth due to the increased uncertainty. Nevertheless, using relative prices as a tool to promote the export sector can still occur, but the structural policies need to be taken along in order to eliminate excess volatility in price movements in order to provide an appropriate environment for investment.

It has been seen that the external debt as well as credit rationing had an important impact on private investment in Latin America. It will be interesting in future studies to include these variables in the investment equation. Another extension of this project could be to use the "propensity of executive changes" as a measure of political instability. And finally, examine the effect of certain fiscal policies on private investment. However, for this analysis we will need more detailed data that is not available yet.

Table 4.1 Definition of Socio-Political Variables

Variable	Definition	Explanation
ASSAS	Assassinations	The number of any politically motivated murder or attempted murder of a high government official or politician.
STRIKE	General strikes	The number of any strike of 1,000 or more industrial or service workers that involves more than one employer and that is aimed at national government policies or authority.
WAR	Guerilla warfare	The number of any armed activity, sabotage, or bombings carried on by independent bands of citizens or irregular forces and aimed at the overthrow of the present regime.
GOV	Major Government Crises	The number of any rapidly developing situation that threatens to bring the downfall of the present regime - excluding situations of revolt aimed at such overthrow.
PUR	Purges	The number of any violent demonstration or clash of more than 100 citizens involving the use of ranks of the regime or the opposition.
RIOT	Riots	The number of any violent demonstration or clash of more than 100 citizens involving the use of physical force.
REV	Revolutions	The number of any illegal or forced change in the top governmental elite, any attempt at such a change, or any successful or unsuccessful armed rebellion whose aim is independence from the central government.
CONS	Major Constitutional Changes	The number of basic alterations in a state's constitutional structure, the extreme case being the adoption of a new constitution that significantly alter the prerogatives of the various branches of government. Examples of the latter might be the sub-situation of presidential for parliamentary government or the replacement of monarchical by republican rule. Constitutional amendments which do not have significant impact on the political system are not counted.

Source: Banks, A.S. 1996. Cross-National Time Series Data. Binghamton, N.Y.: SUNY Binghamton.

Table 4.2 Summary of Principal Components Analysis

Country	C1	C2	C3	C4	C5	C6	C7
s.d.	2.37	1.87	1.63	1.13	0.93	0.86	0.47
Var	0.38	0.61	0.79	0.88	0.94	0.98	1.00
Fac	0.29 * ASSAS + 0.14 * STRIKE + 0.47 * WAR + 0.10 * GOV + 0.75 * PUR + 0.31 * RIOT						

Note:
s.d. = Standard Deviation of Each Component
var = Cummulative Variance Explained
fac = Factor Loading of First Component

Table 4.3 Summary of Descriptive Statistics of the Social and Political Variables

Country	ASSAS	STRIKE	WAR	GOV	PUR	RIOT	REV	CONS
Sum	191	155	182	131	115	244	76	28
Mean	0.60	0.48	0.57	0.41	0.36	0.76	0.24	0.09
s.d.	1.82	1.14	1.45	0.88	2.1	1.66	0.62	0.29

Note:
Sum = the sum across years
Mean = the mean across years
s.d. = the standard deviation across years

Table 4.4 Correlation between Indicators of Social Unrest

	ASSAS	STRIKE	WAR	GOV	PUR	RIOT	REV
ASSAS	1.0000						
STRIKE	0.1189	1.0000					
WAR	0.2538	0.2874	1.0000				
GOV	0.0857	0.1520	0.2569	1.0000			
PUR	0.0568	0.0323	0.5413	0.1185	1.0000		
RIOT	0.1477	0.4021	0.2339	0.2127	0.1408	1.0000	
REV	0.1271	0.0722	0.1183	0.5233	0.1486	0.1957	1.0000

Table 4.5 Correlation between Private Investment and Selected Indicators

	LPFI	Uncertainty	SPFI
LPFI	1.00		
Uncertainty	-0.27	1.00	
SPFI	-0.04	0.22	1.00

Table 4.6 The Political Model of Private Investment
(dependent variable: log of real private investment)

Variable	(1)	(2)
ASSAS	-0.014**	
	(0.005)	
STRIKE	-0.011	
	(0.016)	
RIOT	-0.013	
	(0.019)	
CONS	0.08 **	0.09 **
	(0.031)	(0.027)
SPI		0.007
		(0.01)
D83	-0.22**	0.007
	(0.043)	(0.011)
S.E.	0.27	0.27

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
S.E. = standard error of regression

Table 4.7 The Economic Model of Private Investment
(dependent variable: log of private investment)

Variable	(3)
Log RGD(-1)	1.38 ** (0.17)
RIR(-1)	-4.84 E-06 (1.98E-06)
RER uncertainty (-1)	-0.85 ** (0.26)
D83	-0.27 ** (0.06)
S.E.	0.19

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
S.E. = standard error of regression

Table 4.8 Socio-Political and Economic Model
(dependent variable: log of private investment)

Variable	(4)	(5)
Log RGDP(-1)	1.28 ** (0.159)	1.31 ** (0.164)
RIR(-1)	-3.99E-06** (1.63E-06)	-3.76E-06 ** (1.50E-06)
RER uncertainty	-0.62 ** (0.258)	-0.66 ** (0.295)
SPI		-0.05 ** (0.013)
ASSAS(-1)	-0.018 ** (0.005)	
STRIKE(-1)	-0.02 (0.016)	
RIOT(-1)	-0.029 ** (0.011)	
CONS(-1)	0.096 ** (0.039)	0.11 ** (0.034)
D83	-0.29 ** (0.055)	-0.26 ** (0.059)
S.E.	0.18	0.19

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
S.E. = standard error of regression

Table 4.9 Elasticities of the Socio-Political and Economic Model
(dependent variable: log of private investment)

Variable	(4a)	(5a)
Log RGDP(-1)	1.42	1.18
RIR(-1)	-1.11 E-06	-1.05 E-06
RER uncertainty	-1.28 E-04	-1.37 E-04
SPI		-6.48 E-07
ASSAS(-1)	-1.40 E-05	
STRIKE(-1)	-1.24 E-05	
RIOT(-1)	-2.85 E-05	
CONS(-1)	9.95 E-06	

Table 4.10 Model of Relative Price Uncertainty
(dependent variable: relative price uncertainty)

Variable	(6)
PUR	0.01 ** (0.004)
RIOT	0.002 ** (0.001)
SPI	0.001 (0.25)
AR (1)	0.87 ** (0.03)
S.E.	0.04

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
S.E. = standard error of regression.

Table 4.10a Model of Inflation Uncertainty
(dependent variable: inflation uncertainty)

Variable	(6)
PUR	-6.40 (21.88)
RIOT	0.36 (0.16)
SPI	-0.13* (0.07)
AR (1)	0.49** (0.06)
S.E.	360.4

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
S.E. = standard error of regression

Table 4.10b Real GDP Growth Uncertainty
(dependent variable: real GDP growth uncertainty)

Variable	(6)
PUR	-0.06 (0.15)
RIOT	-0.01 (0.04)
SPI	0.01 (0.05)
AR (1)	0.67 ** (0.05)
S.E.	0.90

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
S.E. = standard error of regression

Table 4.10c Model of Real Interest Rate Uncertainty
(dependent variable: real interest rate uncertainty)

Variable	(6)
PUR	-0.78 (3.99)
RIOT	0.001 (0.02)
SPI	-0.02* (0.008)
AR (1)	0.29** (0.07)
S.E.	759.86

Notes:
Standard errors in parentheses.
* Coefficients significant at 10 percent level.
** Coefficients significant at 5 percent level.
S.E. = standard error of regression

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