IMPACT OF INSTITUTIONAL UNCERTAINTY ON PRIVATE INVESTMENT: AN EMPIRICAL STUDY IN SELECT EAST AND SOUTH ASIAN COUNTRIES

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Abstract

The study undertakes an empirical investigation to explore institutional uncertainty-private investment linkages in select East and South Asian countries, namely, Bangladesh, India, Pakistan, Sri Lanka, Indonesia, Republic of Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand. Within an analytical framework based on emerging *option theory* of investment, the study provides further empirical support to the impact of institutional uncertainty on private investment, using panel data over a period of 1982-95. The findings of the study suggest that gdp growth rate, availability of credit and complementary investment in the previous year- all have positive impact on private investment. On the other hand, government consumption and exchange rate fluctuation are negatively associated with private investment flow. Concurrently, enhanced bureaucratic quality and security to property rights are positively associated with investment performance, while lack of rule of law is found to deter investment stream. As such, the study suggests to improve the quality of institutions in South Asia, notably the quality of property rights and the quality of overall governance to promote private investment in the region.

Dedication

To the beloved members of my family

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INTRODUCTION

Prior to beginning of a new millenium, development profiles of the developing countries in Asia are marked with extremely varied outcomes. Embarking on growth journey during the 1950s with a more or less similar macroeconomic background, a number of East Asian countries recorded "miraculous" economic growth during the subsequent decades, graduating themselves into a "highly performing economy" status, while the South Asian countries are yet to rid from low income equilibrium trap. Among variant dimensions of the asymmetric development profiles between the East and South Asian countries, uneven private investment performance is unambiguously a major hallmark. Compared to a robust growth of private investment in most of the East Asian countries, it is yet to exhibit any sustained momentum in South Asia. Given the above, there seems to have a great deal of merit in studying the causal mechanics of differential private investment performance in the two developing regions in Asia within an appropriate analytical framework. The issue assumes enhanced cardinal importance due to a paradigmatic shift in development thesis of the South Asian Countries during the 1980s, marking a switch towards market economy based development regime from "state authoritarianism" in development governance. However, despite the past efforts within the standardized *Bretton-Woods* recipes, a desired private investment growth in South Asia is presumably deficient in some vital nutrients. In this order, the task of the development analysts of the region is to identify the deficiencies in current development efforts and explore proximate remedial measures.

On the other hand, recent development in both the theory and emperics of *Growth Economics* brought in some important fall-outs. Stepping beyond the strict neoclassical orthodoxy, a vibrant stream of studies is currently exploring institutions-economic growth causal nexus. In the current growth literature, there is a growing consensus that institutional factors are *sine qua non* for a dynamic spurt of private investment in developing countries, hence attaining a durable rapid economic growth. For example, in explaining varied private investment performance across developing countries, North (1990) argues that enforcement of property rights and contracts determines the incentives to invest in cumulative factors. Poorly enforced property rights create a wedge between the marginal product of capital and the rate of return that can be privately appropriated by the investors. Thus, two countries with the same marginal product of capital may have different investment rates if the appropriable returns differ. Consequently, differences in institutional quality could explain varied investment performance across developing nations.

A similar development is also evident in the emerging investment literature. Explicitly focusing on the irreversible property of fixed investment, the *option approach* of investment provides an alternative analytical framework to study the investment process in an uncertain business environment. Amidst pervasive institutional uncertainty in the developing countries, including South Asia, it provides a powerful analytical tool to study the "black-box" of private investment in these developing areas.

Against the backdrop, aim of the current study is to systematically explore institutional uncertainty – private investment linkages in the context of select East and South Asian countries within an *option theory* based analytical framework. Against the partial and deterministic framework of the prevailing studies on determinants of private investment in the South Asian region, the study attempts to provide a more complete analysis and empirical evidence in this order. For this purpose, it summarizes recent analytical discourses and empirical literature on institutional uncertainty and irreversible investment to explore proximate linkages between institutional uncertainty and private investment. Secondly, it attempts to gauge the empirics of institutional uncertainty and private investment link for East and South Asia. In this regard, compared to the tradition of cross-section analysis, the study provides empirical evidence on the current research topic based on panel data. Hopefully, the study would be able to provide some useful clues concerning the deficiencies in current efforts to promote private investment in South Asia.

The paper is organized as follows. Section I presents a brief overview of the theoretical literature on irreversible investment to formulate the analytical framework for the study purpose. Section II attempts for an exploratory search into the literature to explore linkages between institutional uncertainty and private investment. Section III focuses on the empirical link between institutional uncertainty and private investment in select East and South Asian countries, using panel data. The study concludes suggesting few policy implications.

I. THE EMERGING INVESTMENT THEORY: AN ANALYTICAL OVERVIEW OF UNCERTAINTY AND IRREVERSIBLE INVESTMENT

Over the past, orthodox investment analysis mainly rallied behind two dominating discourses. The neoclassical investment theory as standardized by Jorgenson (1973) known as the *user cost-of-capital* approach, maintains that the firm's desired stock of capital is determined by equating the marginal product and the user cost of capital, while the other leading stream, popularly known as the *Tobin's q* approach (introduced by James Tobin in 1969) focuses on the capitalized value of the marginal unit of capital relative to its replacement cost, a ratio known as the *Tobin's q.* In both the formulations, adjustment cost of capital is typically assumed to be convex which entails an otherwise static problem to a dynamic setting involving expectations about the future.

Despite their long dominance in the investment literature, the conventional discourses came under severe criticism both on theoretical as well as empirical grounds[1]. While the *Tobin's q* approach suffers from empirical nontestibility (Chirinco, 1993; Hasset and Hubbard, 1996; Caballero, 1997), and the Jorgenson's investment model has been rejected on the ground of its limited applicability in the developing countries due to technical as well as practical reasons (Khan and Blejer, 1990; Solimano, 1996). Particularly, the assumption of convex adjustment cost, cornerstone to both the formulations came under serious scrutiny due to its lack of realism. The emerging investment analysis identifies three critical pitfalls of the conventional analysis that

1. See Abel and Blanchard (1986).

eventually guided the subsequent analysis on the theory of investment (Dixit and Pindyck, 1994). First, unlike the traditional analysis, most fixed capital investments are partly or completely *irreversible*: the initial cost of investment is at least partially sunk which cannot be recovered completely by selling the capital once it has been put in use[2]. Second, investment decisions are subject to *uncertainty* about the future rewards, especially, in the face of imperfect capital market in the developing countries [3](Dixit and Pindyick, 1994). Given the uncertainties, the best investors can do is to attach probabilities to the possible outcomes. Third, investors can control the *timing* of investment by postponing investment decision to collect more information about the future.

Evolving on the above building blocks, the recent *option theory* of investment views an investment opportunity as an *option* to purchase an asset at different points in time. The optimal investment policy balances the value of waiting for new information with the cost of postponing the investment in terms of forgone returns. When a firm makes irreversible investment expenditure, it forgoes its option to wait for new information that might affect the desirability of investment. To take into account of this fact, the standard *net-present-value* investment rule requires some obvious modifications[4]. The anticipated return must *exceed* the purchase and installation cost by an amount equal to the value of keeping the option alive. The recent investment literature has shown that the option value of waiting can be considerable, especially, in a highly

2. Arrow (1968) first studied investment irreversibility in a deterministic context.
3. Uncertainty concerning future rewards can originate from numerous sources including the institutional uncertainty factors.
4. The precise way in which the "naï ve" *net present value* rule needs to be modified is discussed by Abel et. al. (1996).

uncertain environment. As a consequence, uncertainty can become a powerful deterrent even for risk-neutral investors.

While the above ideas may seem intuitive, the analysis of irreversible investment is far from being trivial. Thus, the following discussion is organized around a simple example to introduce the basic conceptual framework of the *option theory* of investment[5].

A. A Simple Dynamic Adjustment Model of Investment

For the sake of analytical simplicity, let us consider investment decision of a risk-neutral firm within a two-period dynamic adjustment model. Given the assumption that investment is partly irreversible, the firm has the option to decide whether to invest in an irreversible project whose purchase cost is P_k and whose future return is uncertain at present[6]. Further assume that if investment takes place now, the project will yield a known return R_0 at the end of the current year and an uncertain return R in each succeeding year. Given the information available today, the expected value of future return from the project is $E_0[R]$. Hence, the present value of the anticipated stream of cash flows can be written as follows:

$$V_0 = -P_k + \frac{1}{1+r} R_0 \left[\frac{1}{1+r}\right] \sum_{i=0}^{\infty} (1+r) E_0[R]$$

5. The interested reader is referred to the comprehensive discussion in Dixit and Pindyck (1994).
6. Presumably, due to uncertainty about the project' s output price, market demand, or other similar causes.

$$= -P_k + (1+r)[R_0 + (1/r)E_0[R]]$$

where r is the discount rate – or the real rate of return on the alternative asset.

Naï ve application of the net present value criterion would suggest undertaking the project if $Vo > O$, which can be conveniently rewritten as:

$$(R_0 - rP_k) + \frac{(E_0[R] - rP_k)}{r} > 0 \qquad (1)$$

The absent depreciation rP_k in equation (1) is Jorgenson' s (1963) user cost of capital. If investment were fully reversible, the optimal decision would be to invest now if and only if $R_0 > rP_k$ i.e., (current return exceeds the user cost of capital) – because the decision can always be undone in the next period in the event of any adverse outcome.

However, even if condition (1) holds *ex-ante*, the firm may regret its *ex-post* investment decision if there is a chance of $R < rP_k$, so that with some probability, the future return will fall short of the cost of capital. In such case, the firm would find it self committed to an unprofitable project. Given the probability of such outcome, the firm can defer its investment decision to learn more about the future return – perhaps by observing the trajectory of output prices or demand determinants --, the decision rule given by the condition (1) is incorrect. The reason is that it may pay to wait for more information before making an irreversible investment commitment.

As an extreme example, let us consider that uncertainty would completely disappear during the next period, so that the future return would remain constant forever at whatever value is realized in the next year. In such case, consider a strategy involving no action this year – and therefore no cash flows – and undertaking the project next year only if the return turns out to exceed the user cost of capital, but not otherwise. The anticipated stream of cash flows from this strategy is,

$$V_1 \equiv \Pr[R > rP_k]\{1/1+r(-P_k)+\left[\frac{1}{1+r}\right]\sum_{i=0}^{\infty}(1+r)E_0[R \mid R < rP_k\}$$

Notice that the entire above expression is multiplied by the probability *Pr* that the project's return will turn out to exceed the user cost of capital, since only then the investment would be taken in the next period. We can compare the two strategies by computing

$$V_1 - V_0 = \left(\frac{1}{1+r}\right)\left[\Pr[R < rP_k]\frac{E_0[rP_k - R \mid R < rP_k]}{r} - (R_0 - rP_k)\right] \tag{2}$$

It pays to invest immediately if this expression is negative, which is equivalent to the

$$(R_0 - rP_k) > \Pr[R < rP_k]\frac{E_0[rP_k - R \mid R < rP_k]}{r}$$

requirement

(3)

Condition (3) simply compares the cost of waiting – the current period net return ($R_0 - rP_k$) forgone by not investing – with the value of waiting, given by the irreversible mistake that would be revealed tomorrow should future project returns fall short of the

user cost of capital (i.e., $R < rP_k$). The expected present value of such mistake is measured by the right-hand side of (3): the mistake is made with probability $Pr[R<rP_k]$; its expected per-period size, given today's information, is $E_0[rP_k-R|R<rP_k]$; and since it accrues every period into the indefinite future, it has to be multiplied by $(1/r)$ to transform it to present value terms. It pays to invest immediately only if the first-period return exceeds the conventional user cost of capital by a margin large enough to compensate for the possible irreversible mistake – i.e., if the cost of waiting outweighs the value of waiting.

The notable property of (3) is the 'good news', represented by a future realization of R above rP_k, and is completely irrelevant for the investment threshold. This is the *bad news principle* first noted by Bernanke (1983): only the expected severity of future bad news matters for the decision whether to invest today; potential good news does not matter at all. The intuitive reason for this asymmetry is that the option to wait has no value in states in which adopting the investment would have been the right decision—it is only valuable in those states in which early investment would have been regretted. This option value of waiting equals the maximum of V_1-V_0 and 0. If $V_1 < V_0$ the option has no value, and the optimal decision is to proceed immediately with the investment.

Even with moderate amounts of uncertainly, however, the value of the option can be quite significant. This can be easily drawn by computing the premium above the user cost of capital that an irreversible project must offer for investors to give up option to wait. Consider a simple example of an irreversible project that with probability .10 will

"fail" —in the sense of yielding annual return 2 percentage points below the discount rate r – and with probability. 90 will "succeed". Lettering $P_k = 1$ and $r = .04$, we can ask: what immediate return R_0 must the project offer for a risk-neutral investor to undertake it ? Simple calculations using (3) above show that R_0 must be at least 9 percent —i.e., five percentage points above the cost of capital—for a rational investor to adopt it.

The key implication of the *bad news principle* is that any spread of the distribution of future returns, which increases downside uncertainty, raises the option value of waiting and therefore tends to depress investment.[7] In the preceding example, assume that we reduce the project's return in the adverse scenario by 1 percent, so that now it falls short of r by 3 percent. With all the parameters unchanged, R_0 now must be 11 percent! Two extra points of premium are now required, because the irreversible mistake has become larger.

B. Incremental Investment

The above discussion mainly addresses discrete investment decisions, i.e., the adoption of specific projects of given size. In reality, however, firms typically operate

7. However, some exceptions to this rule should be noted. If investment is at least partially reversible, and the cost of investing tomorrow is relatively high (i.e., P_k is rising over time), the asymmetry could be reversed into a "good news" principle, whereby only *upside* uncertainty would matter, and its effect would be to hasten investment (Abel et. al., 1996). Likewise, if the opportunity cost of waiting R_o is uncertain rather than known – as would be the case for investment projects are subject to completion lags – and the firm can abandon the project (at a cost) in the future, then again, higher uncertainty could hasten investment by making extreme favorable realizations of R_o more likely (extreme adverse realizations would also become more likely, but the firm could avoid their impact by shutting down the project) and thus raising the cost of waiting along with the value of waiting (see Bar-Ilan and Strange, 1996).

many projects, and their investment decisions can be better viewed in terms of determining the path of their total capital stock.

Bertola (1988) and Pindyck (1988) first analyzed the optimal irreversible investment policy of a firm facing uncertainty. They considered the case of a firm possessing a decreasing-returns technology and facing a downward-sloping demand schedule. Under such assumptions, successive marginal increments to the capital stock can be regarded as distinct "projects", each of which contributes its marginal product independently of the others. Hence, similarly to the above discussion, it is possible to find an investment threshold for each project, and then sum over the different projects to obtain the firm's desired capacity expansion. As before, the profitability threshold that must be reached for investment to take place exceeds the user cost of capital as conventionally computed, and rises with the degree of uncertainty faced by the firm.

The characterization of the investment threshold, and its relation with the existing degree of uncertainty, have been recently re-examined in a more general setting by Abel and Eberly (1994, 1995a). They provide a framework in which downward adjustment of the capital stock is possible, but more costly than upward adjustment, and allow also for the existence of convex adjustment costs to investment similar to those assumed by the conventional investment literature.[8] Hence, the standard *q investment model* can be viewed as a particular case of this general setting (Hayashi, 1982). In this framework, the

8. They also allow for "flow" fixed costs– i.e., costs whose magnitude is independent of the volume of investment but dependent on the length of the period over which investment takes place. This contrasts with "stock" fixed costs, which are independent of this latter factor as well. Stock fixed costs lead to "lumpy" investment, as analyzed by Caballero and Leahy (1996).

optimal investment strategy is a *two-trigger* policy that can be expressed in terms of *Tobin's marginal q* – defined as the addition to the value of the firm resulting from an additional unit of capital. If q exceeds a certain upper threshold q^+, positive gross investment occurs. In turn, if q falls below a lower threshold q^- , negative gross investment takes place – i.e., the firm sells part of its capital stock. Between q^+ and q^-, investment equals zero.

Figure 1

Investment with Costly Reversibility

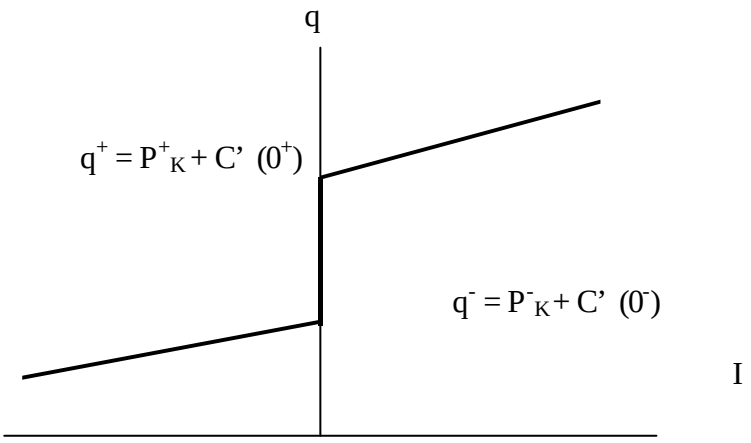
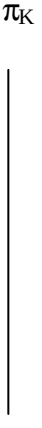
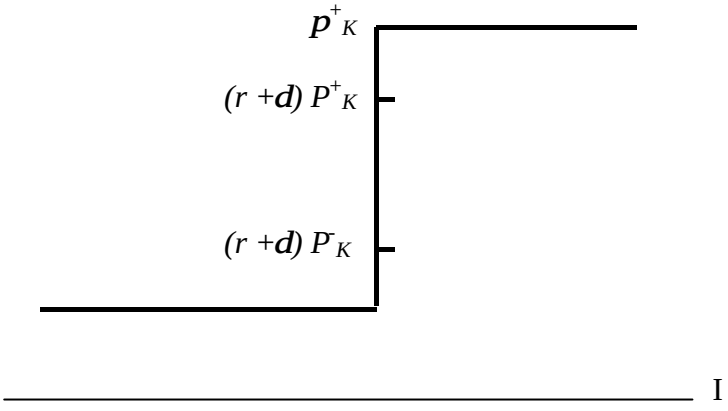


Figure 2

Investment with Linear Adjustment Costs





This optimal policy can be illustrated with the help of Figure 1, adapted from Dixit and Pindyck (1994), which shows the marginal cost of investment as a function of investment. In the absence of fixed costs, the total cost of investment (disinvestment) equals the capital purchase (sale) cost (revenue) plus the standard convex adjustment cost. In general, the slope of the latter may differ for positive and negative investment. In such framework, the upper threshold q^+ is equal to the purchase price of capital, denoted P_k^+, plus the marginal adjustment cost to positive investment evaluated at zero investment, denoted $C'(0)^+$. Likewise, the lower threshold q^- equals the sale price of capital P_k^- plus the marginal adjustment cost to disinvestment evaluated at zero, C' (0).

If the q is above q^+, investment is positive, and if q is below q^-, investment is negative. Between q^+ and q^- there is a range of inaction. Such range exists as long as (i) $P_k^+ > P_k^-$, so that capital can be sold only at a loss; or (ii) marginal adjustment costs are steeper for positive than for negative investment, i.e.,$C'(O^+) > C'(O^-)$; or (iii) there are fixed costs to investment (ignored in the figure). Moreover, investment is determined

exclusively by Tobin's (marginal) q, by P_k^+ and P_k^-, and by the parameters characterizing the adjustment cost function[9].

If convex adjustment costs are ruled out, investment occurs in episodic bursts. The firm's optimal policy involves purchasing or selling capital to keep its marginal revenue product between an upper and a lower bound, π_k^+ and π_k^- (Abel and Eberly, 1995a). When the marginal revenue product reaches either of these bounds, a burst of investment (positive or negative) occurs to equalize the actual and optimal capital stocks. In turn, if the marginal revenue product is between both bounds, no action is taken (see Figure 2). These bounds can be interpreted as the correctly measured user cost of capital relevant for investment and disinvestment, respectively. Specifically, π_k^+ (respectively, π_k^-) exceeds (falls short of) the conventionally defined user cost of capital, that would equal $(r+\delta)P_k^+$ (or $(r+\delta)P_k^-$ for disinvestments). Most importantly, higher uncertainty increases the wedge between the upper and lower bounds, and thus the range of inaction.

C. Uncertainty and Investment

[9]. If $C'(O^-) < O$ and/or fixed costs exist, it is possible that $q^- < O$, in which case negative investment will never be observed, as implied by the strict irreversibility hypothesis.

The models just described characterize the critical threshold that must be reached by the marginal profitability of capital in order for investment to occur. They predict that if volatility increases, the investment threshold will also rise – firms will be more reluctant to invest to avoid getting caught with too much capital, should the future turn out worse than expected. By contrast, if the future turns out better than expected, the firm can just add more capital as needed.

However, the models do not characterize the impact of volatility on investment. Such impact depends in addition on the effects of volatility on the marginal profitability of capital. For example, if the marginal revenue product of capital is a convex function of the variable whose evolution is uncertain (e.g., the output price or the real wage), then higher uncertainty raises expected profitability and, *ceteris paribus*, the desired capital stock (Hartman, 1972; Abel, 1983). This effect goes in opposite direction to the threshold effect above, and the net result is in general indeterminate. As shown by Caballero (1991), decreasing returns to scale and/or imperfect competition – either of which makes the marginal revenue product of capital a decreasing function of the capital stock – make it more likely that the threshold effect will dominate, so that higher uncertainty leads to lower investment.[10]

A second difficulty is that, even if the threshold effect dominates so that irreversibility and uncertainty reduce investments (or the desired capital stock) *ex-ante* in

10. In the special case of constant returns to scale and perfect competition, the opposite result obtains (Caballero, 1991). The reason is that the marginal revenue product of capital (whether current or future) does not depend on the capital stock, and therefore the firm is no more reluctant to invest under irreversibility than it would be with perfect reversibility. However, the effect of *aggregate* (as opposed to idiosyncratic) uncertainty on investment of a competitive *industry* can still be negative (Caballero and Pindyck, 1992).

the short run, little can be said on their long-run impact (Bertola and Caballero, 1994). Higher degrees of irreversibility and/or uncertainty make it more likely that firms will *ex-post* find themselves holding too much capital. This (Abel and Eberly, 1995b) tends to increase the long-run capital stock above the level that would have prevailed with less irreversibility or less uncertainty.[11]

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.

D. Aggregate Investment

The above discussion has been mainly preoccupied with the investment decision of a single firm. From the macroeconomic point of view, however, the question of primary interest is the impact of irreversibility and uncertainty on aggregate investment. Yet it is obvious that one cannot just translate mechanically the above microeconomic results to aggregate investment decision. In reality, we never observe the spells of zero aggregate investment that should arise if all firms in the economy faced the irreversibility

11. The lack of a more robust linkage between uncertainty and investment through irreversibility has led some researchers to look for alternative rationalizations. One example is the "disappointment aversion" analyzed by Aizenman and Marion (1995).

constraint – or were all at once in the range of inaction identified in microeconomic models. Instead, aggregate investment displays considerable smoothness and inertia.[12]

To assess the role for irreversibility in aggregate investment, it is therefore essential to take explicitly into consideration the heterogeneity of individual firms' investment decisions. Each firm adjusts its capital stock when profitability exceeds a firm-specific threshold, reflecting managerial abilities, output market conditions, and other idiosyncratic factors. At any given time, some firms may be close to their trigger points and others far from them. Firms may be subject to both aggregate shocks, which tend to push all firms above or below their investment trigger points, and specific shocks, which push different firms in different directions. Thus the response of aggregate investment to an aggregate shock may display substantial inertia, as different microeconomic units reach their investment thresholds at different times – even though each firm's policy may involve a discrete investment burst once its idiosyncratic threshold has been reached.

However, aggregation of individual firm's investment policies is not easy because as we saw above, under irreversibility, such policies are nonlinear. Thus, the impact of a given economy-wide shock on aggregate investment depends, for example, on how many individual firms are within their inaction ranges, how far they are from their trigger points, and how important are idiosyncratic shocks relative to aggregate shocks.

12. Indeed, the original rationale behind the standard convex adjustment-cost approach to investment was precisely to replicate these two empirical facts.

Bertola and Caballero (1994) have recently explored the implications of irreversibility for aggregate investment in a model in which individual firms' investment proceeds in discontinuous bursts. Individual investments are not synchronized, and firms are subject to idiosyncratic uncertainty in addition to aggregate uncertainty. As a result, aggregate investment shows smoothness. A favorable aggregate disturbance (e.g., a fall in the price of capital goods) may have a very small effect on aggregate investment if many firms are far below their threshold for positive investment, and may take a long time to develop its full impact, which depends on initial conditions – i.e., on firms' original situation relative to their respective investment thresholds.

E. Empirical Application of the Uncertainty and Irreversible Investment Theory

Despite its rapid development at the theoretical front, progress of irreversible investment theses lagged far behind at the empirical level. The main reason is of course the analytical complexity of irreversible investment models, which typically involve nonlinear investment rules, whose empirical estimation is computationally cumbersome. As a result, most of the existing empirical studies of the impact of irreversibility adopt a reduced-form approach.

Nevertheless, there are some exceptions. At the microeconomic level, an important recent study by Caballero, Engel and Haltiwanger (1995), using a large sample of U.S. plant-level data, uncovers strong evidence of irreversibility. Using a simple structural model of irreversible investment, the authors find that adjustment of the capital stock to its optimal level is highly nonlinear, and typically much faster for upward than for downward movements in the capital stock – as should be the case if retiring capital is more costly than acquiring it.

Leahy and Whited (1995) use the same type of data in a reduced-form empirical approach. They note that in most models of irreversible investment, the effect of uncertainty on investment operates through *Tobin's* (marginal) q. If such models are an accurate description of reality, uncertainty should have a negative impact on q but no independent impact on investment, once q has been controlled for[13]. Their empirical results using U.S. data provide support to this view. Likewise, recent empirical work by Nilsen and Schiantarelli (1996) using Norwegian plant-level data in a reduced-form framework also uncovers evidence of irreversibility and lumpiness in investment.

At the aggregate level, Bertola and Caballero (1994) have developed a structural modal that follows explicitly from the aggregation of individual firms' irreversible investment rules. The resulting specification of aggregate investment is able to capture

13. Strictly speaking, this is true as long as investment does not involve (stock) fixed costs. In the opposite case, investment is lumpy, and bears no monotonic relation to marginal q. See Caballero and Leahy (1996).

the key features of the U. S. data[14]. Caballero (1993) applies a similar approach to developing country data, with equally promising results.

A different approach is followed by Pindyck and Solimano (1993) to test for the effects of uncertainty on aggregate (and also sectoral) investment. It is to be noted that the long-run impact of uncertainty on investment is ambiguous on theoretical grounds, but its impact on the profitability threshold above which firms will invest is unambiguous. Thus, a test of the importance of irreversibility can be performed by investigating the dependence of that threshold on measures of uncertainty. Using panel data for industrial and developing countries, such empirical exercise reveals a moderate impact of the variability of the marginal profitability of capital on the investment threshold.

II. INSTITUTIONAL UNCERTAINTY AND PRIVATE INVESTMENT

14. See also Caballero and Pindyck (1992).

LINKAGES: AN EXPLORATORY SEARCH INTO THE EXISTING LITERATURE

The theoretical formulations of the irreversible investment thesis as overviewed in the earlier section mainly emphasize on output demand and/or prices as the basic sources of uncertainty. However, it would be clear from the current discussion that uncertainty arising from other sources could have exactly the same effect on irreversible investment decisions, as an expanding literature has underscored numerous forms of institutional uncertainty and private investment linkages.

Given the above, an exploratory search is made in the current section to comprehend various transmission links through which institutional uncertainty can impact upon private investment. It would help understand the theoretical underpinnings of the current subject and guide to build up an appropriate analytical framework for the study purpose. It would also be useful to comprehend an integrated domain of institutional uncertainty as opposed to any partial perception.

A number of analytical as well as empirical studies have recently emerged to study institutional uncertainty-private investment nexus within the *option theory* of investment. While the largest part of empirical literature evolved around macroeconomic policy induced institutional uncertainty, and the second strand examines the effects of lack of property rights and socio-political uncertainty on private investment. These studies focus on the role of government instability, unstable incentive regime, social

unrest, and fundamental uncertainties about property rights. Although the earlier studies sought to identify institutional uncertainty-private investment linkage in the realm of different forms of macroeconomic volatility originating from the failure of desired macroeconomic governance, a growing stream of discussion within a broader institutional domain is exploring the given issue incorporating more direct institutional uncertainty measures. Given the above, it would be reasonable to review the two major streams separately as the same.

A. Macroeconomic Policy Uncertainty and Private Investment Behavior

Bulk of the prevailing studies on the current subject suggest that investment uncertainty in the developing countries predominantly originates from suboptimal macroeconomic regime that results in policy uncertainty and ultimately impairs private investment. Inappropriate policy design, non-credible macroeconomic governance, distributive politics of both monetary and fiscal regimes---all breed various forms of macroeconomic instability leading to a pervasive response of private investment. Particularly, macroeconomic instability in tandem with socio-political instability and poor state of property rights can culminate into a sluggish private investment performance.

Credibility, Policy Reversal, Uncertainty and Irreversible Investment

From the policy viewpoint, an extremely important form of uncertainty faced by investors is the imperfect credibility of policy regimes. Investment-friendly reforms typically raise expected returns, but may also increase uncertainty if investors believe that the reform measures could be reversed. In such context, investors' perceptions about the probability of policy reversal become a key determinant to the investment response. The possibility of policy reversal creates a value of waiting for investors facing irreversible projects. Thus, lack of confidence can be reflected in a weak and delayed investment response, as it may take time for investors to become convinced that the reforms will be sustained. This pattern is in fact consistent with the "investment pause" often observed in the aftermath of adjustment programs in developing countries.

One of the earlier studies on the current subject is undertaken by Blejer and Ize (1989) which stresses on endogenous uncertainty of policy adjustment rather than "state-of-the-world uncertainty" in the event of any internal/external shock. It formalizes the existence of self-fulfilling pessimistic equilibria from: i) the limited ability of political systems to support the political and social costs of adjustment while carrying through on a stable and predictable basis, ii) the strong sensitivity of investment to the prospects of a protracted and uncertain adjustment, particularly when waiting becomes an attractive alternative. The political uncertainty attached to the strength of the political system is thus accompanied by "coordination" uncertainty, which arises when multiple equilibria exist and agents can not predict which equilibria will guide other agent's expectations and behavior. The study describes the condition under which one type of uncertainty or

the other dominates in which investment is not guided by the availability of savings, rather by the investor's own subjective assessment of credibility content of the policy regime and associated adjustment costs

Explicitly, based on the uncertainty-option theory of investment, Fischer (1991) provides an analytical model of alternative transmission links through which macroeconomic instability can detriment private investment. The study combines the irreversibility and timing dimensions of investment with major macroeconomic instability measures originating from suboptimal macroeconomic governance. The study suggests that in a situation of macroeconomic instability in tandem with irreversible nature of investment, a risk-neutral investor requires a premium to make an investment, which has the same second period expected return as his alternative investment opportunity. The reason is that with waiting an even higher return can be achieved, once uncertainty is resolved (or narrowed down). The premium required for immediate investment is higher the larger is the probability of bad macroeconomic state and the larger the discrepancy between foreign rate of return that prevailing in the adverse state. The crucial aspect of sluggish investment response is the lack of credibility of macroeconomic regime that directly affects private investment.

The study of Rodrik (1989) which derives its tools from the literature of hyteresis provides a similar analytical exposition of private investment and policy uncertainty. His model provides a "simple formula" that relates the size of the implicit tax to the subjective probability that policy reforms will collapse and to magnify the irreversibility

in the investment process. It stresses the trade-off between stability and reform, under reasonable conditions, may be quite steep, in the sense that even a subjective probability of reform collapse may render harmful than otherwise sensible reforms pertaining to private sector investment. The study also discusses various ways in which probability of reform collapse can be determined endogenously, which leads to the possibility of multiple equilibria wherein pessimistic expectations can be entirely self-fulfilling. The central equation of the study links the entrepreneur's response to the magnitude of reform, the *ex-ante* probability of sustainability and the magnitude of capital irreversibility (entry and exist cost). It also shows that potential policy uncertainty, including the probability of policy reversal, acts as a tax to investors which can be endogenously determined under alternative assumptions. Consequently, unless policy reform is sufficiently large, significant compensation to the investors is necessary to avoid *hyteresis effect* on capital. The analytical framework also sheds light on an important trade-off between reform and stability. When a policy reform is introduced, it is almost inevitable that the private sector will view it as less than one hundred percent sustainable. At one level, there will be the expectation of the political economy configuration that supported earlier policies. At another, since new policies take the economy into uncharted terrain, there will be the legitimate fear that unexpected consequences will lead to reversal. Hence, with the possibilities of policy reversal, *hyteresis effect* on capital becomes well evident. As earlier mentioned, the study provides an analytical framework which endogenizes the probability of policy reversal through three transmission links, i) political economy and creating entrenched interests; ii) through effects on external balance and reserves; and iii)

through effects on fiscal balance. Although the study provides a neat analytical exposition, nevertheless it refrains from any further empirical investigation.

A later study by the same author (Rodrik, 1991) shows that a reform favorable to capital, but regarded as less than fully credible, will fail to trigger off an investment response unless the return on capital becomes high enough to compensate investors for the losses they would incur should the reversal take place. Van Wijnbergen (1985), who considers the case of a trade reform suspected to be only temporary, reaches similar qualitative conclusions. He shows that the result can be a decline in investment in both the traded and non-traded goods sectors, as investors wait for additional information and thus avoid irreversible commitment to any particular industry.

Thus, the perception that reforms may be unsustainable can have a very adverse impact on investment. However, it is important to recognize that the sustainability of reform is ultimately endogenous, and depends largely on the response of the private sector. Lack of a sufficient investment response can delay growth, increase social hardship, and ultimately force the reversal of the reforms, confirming investors' initial skepticism.

Laban (1991) formally investigates this endogeneity in a model in which investors can repatriate capital flight following a stabilization that lacks full credibility. Investors face a choice between irreversible fixed investment and liquid assets, and the latter have

an option value, due to the lack of confidence in the permanence of the stabilization. At the same time, however, the sustainability of the program depends on its ability to generate sufficient fixed investment – a mechanism ignored by the individual investor. The study shows that in these circumstances, the outcome of the stabilization is generally indeterminate, as investors' expectations can become self-fulfilling: pessimism leads to insufficient fixed investment and thus to collapse of the stabilization program, while optimism leads to the opposite result. The underlying reason is that the combination of investment irreversibility and strategic complementarity of investors' decisions create an externality that drives a wedge between the social and private returns to investment.

A relatively recent study by Aizenman and Marion (1995) investigates the correlation between macroeconomic volatility and private investment using the disappointment-aversion expected utility model first expounded by Gul (1991). The central implication of their disappointment-aversion utility framework is that when private investors are disappointment-averse they put more weight on "bad" outcomes and less weight on "good" outcomes than in the standard case. The asymmetric weighting of outcomes introduces additional concavity into the utility function and causes volatility to have significant, negative effects on economic performance. The large, negative effects of increased volatility continue to hold even with the coefficient of relative risk aversion is zero[15].

15. That is, even if the marginal utility of income is constant so that, agents are risk-neutral in the conventional sense.

A recent empirical study by Ibarra (1995) also focuses on the effects of credibility. He explores the case of the Mexican trade liberalization of the late 1980s, which was accompanied by a substantial private investment slump. Drawing from cross-country evidence, he estimates empirically the path of the probability of reform reversal, and shows that it can contribute to explain a substantial portion of the observed investment slowdown.

Empirical Aspects of Macroeconomic Uncertainty and Private Investment

A central issue related to the current research topic is how to quantify the quality of macroeconomic regime for systematically analyzing the private investment response. A convincing answer to the question depends upon finding good proxies for policy-induced macroeconomic instability. The relevant literature in this order suggests that there are several dimensions to this type of policy induced instability. Given the nominal interest rate, the present value of an investment project depends on such factors as expected future demand, the expected future price level and on expected relative prices. Fiscal policy, monetary policy, debt management and exchange rate policy can all have a significant impact on these variables. Where the supply of inputs are rationed to some degree by the government, expectations about allocations of key resources are of key significance. Even the pricing policy imposed on public utilities is potentially important. In this order, what is important to know about some measures that can capture how well governments have managed their fiscal and monetary affairs. Poor fiscal management creates temptation to resort to the inflation tax, and inflation is liable to create relative

price distortions as well as uncertainty about the general price level. The external monetary dimension is also critical. Poor exchange rate management may generate volatility in the real exchange rate, and hence in internal relative prices.

A majority of the empirical studies on the current subject suggest that private investment responds strongly to changes in output and income. Investment in developing countries is no exception, and most econometric studies conclude that fluctuations in output are one of the most important determinants of private investment (Blejer and Kahn, 1984; Faini and de Melo, 1990; Greene and Villanueva, 1991; Solimano, 1997). The initial downturn in economic activity often associated with macroeconomic adjustment may affect investment through its effect on expectations. A current recession could produce "pessimistic" expectations that lead investors to postpone investment until the recovery arrives; this phenomenon in turn may prevent the take-off of investment (particularly in projects with short gestation lags) and delay the recovery itself, and the economy could get stuck in a low investment equilibrium because of insufficient investment as a result of a self-fulfilling pessimism.

One of the direct measures of unstable monetary policy is the volatility of money supply as hypothesized by Barro (1976, 1980). Likewise, Kormendi and Meguire (1985) found negative association between monetary variance and private investment response. Also, Aizenman and Marion (1995) observed similar negative impact of nominal money growth volatility on private investment in a cross-section of developing nations.

Inflation is one of the grand routes of investment uncertainty that very often is triggered by policy failures[16]. Nevertheless, one is confronted with two opposing views at analytical front as regards the inflation-private investment linkage. While the *Mundel-Tobin effect* implies that an increase in expected inflation increases capital accumulation, a variety of other mechanisms produces the opposite correlation. The negative effect of inflation on the efficiency of the exchange mechanism suggests that higher inflation reduce private investment via multiple effects. Higher inflation can reduce investment capacity by reducing income level[17]. Inflation can result in distortionary "signal effect" to a private investor by distorting the relative price level. Besides, it ultimately appears as a capital tax to the investor (Fischer, 1991). Also as Fischer (1991) argues, inflation is an important indicator of overall ability of the government to manage the economy. A failure of combating inflation can generate expectational pervasiveness coupled with eroding credibility of the policy regime relating to private investment.

As noted earlier, most of the empirical studies incorporated inflation as one of the determinants of private investment in their empirical analysis. Pindyck and Solimano (1993) maintain that inflation appears to be a major cause of macroeconomic volatility and it is negatively related to investment performance. Recently, Yeyati (1996) proposed a reinterpretation of this result in the context of a structural model of irreversibility that highlights the role of current inflation as predictor of the future price volatility faced by investors. He offers some empirical evidence in support of this view. Likewise, a number of studies overwhelmingly testify a negative linkage between inflation and private

16. Vulnerability to inflation can also result from structural rigidities in the developing countries coupled with numerous institutional pervasiveness such as distributive politics of the fiscal regime.

investment (Aizenman and Marion, 1995; Barro, 1989; 1991, 1996 and 1998; Bleaney, 1996; Fischer, 1991; Kormendi and Meguire, 1985; and Serven and Solimano, 1992; Solimano, 1997). Finally, a recent work by Ghosal and Loungani (1996) focuses on the impact of price uncertainty on investment using panel data for U.S. manufacturing industries. For those subsectors with a high degree of product market competition, they find a large negative and significant effect of price volatility on sectoral investment. Along these lines, Serven and Solimano (1993b) find a significant negative impact of inflation and real exchange rate volatility on private investment using panel data for developing countries.

Another well-documented transmission link of macroeconomic instability is related to fiscal imbalance. As some studies suggest, chronic budget deficit might be associated with crowding out of private investment. A chronic fiscal deficit can exert various tax and non-tax pressures against the private investors. Also, it could lead to severe credit rationing. Besides, it might reduce investment friendly public investments, like investment in infrastructure and investment in R &D. Concurrently, an inefficient mode of deficit management is thought to engender investment uncertainty. Based on the above hypotheses, several studies attempted to explore linkages between fiscal imbalance and private investment. For example, Woi and Wong (1982) record a strong negative correlation between fiscal deficit and private investment. Similar result is evident from

17. Extensively documented by Fischer (1991) and Barro (1989, 1991, 1996, 1998).

later studies, namely by Kormendi and Meguire (1985), Fischer (1991), Levine and Renelt (1992), Aizenman and Marion (1995) and Bleaney (1996)[18].

The case of uncertain tax policy is addressed by Hassett and Metcalf (1994). They show that an increase in the volatility of taxes (specifically, an investment tax credit) has the usual effect of raising the hurdle rate required by investors to undertake irreversible projects. However, they also conclude that the overall impact on investment generally depends on the specific form taken by tax uncertainty.

Complementary to the above is the relation of private investment with public spending and public investment. The most popular hypothesis concerning public spending is its potential crowding out impact on private investment. Several regression analysis of Barro (1989, 1991, 1996) report a systematically negative impact of public spending as measured by government consumption/gdp ratio on investment across a cross-section of developing nations. However, considerations should be taken into account concerning the nature of public spending. Lack of adequate public spending on social sectors can act against the promotion of private investment. Similar mixed analysis can be found concerning the potential impact of public investment. The popular belief suggests various counterproductive impacts of public investment on the desired growth of private investment, although the causal relationship is not intrinsic in nature[19]. In broad terms, public sector investment can crowd out private investment if it utilizes scarce

18. However, Solimano (1997) records positive association between fiscal deficit and private investment across developing countries.

physical and financial resources that would otherwise be available to the private sector, or if it produces marketable output that competes with private output. Furthermore, the financing of public sector investment—whether through taxes, the issuance of debt, or inflation—will lower the resources available to the private sector and depress private investment activity. Yet public investment that is related to various forms of infrastructure coupled with the provision of public goods and investment in institutional capacity building can enhance the possibilities for private investment and raise the productivity of capital, increase the demand for private output through increased input demand and ancillary services, and augment overall resource availability by expanding aggregate output and savings (Khan and Blejer, 1990). Consequently, the overall effect of public investment on private investment will, therefore, depend on the relative strength of these various effects, and there seems to be no *a priori* reason to believe that they are necessarily substitutes or complements.

In the empirical analysis, one can note that the way public investment is introduced into the model significantly influences the measured statistical correlation. Bulk of the studies concentrate on crowding out aspect (Galbis, 1979; Goldbrough et al., 1996; Heller, 1975; Wai and Wong, 1982; Sundarajan and Thakur, 1980; Ozler and Rodrik, 1992), while few studies (Greene and Villanueva, 1989; Khan and Blejer, 1990) report a positive association between public investment and private investment response[20].

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19. The extreme version of crowding out exposition conceives an increase of public investment is matched by an immediate and equal decline in desired rate of private investment (David and Scadding, 1974).

20. Most of the above-cited studies represent cross-section analysis against a handful of time series

Importantly, the study of Khan and Blejer (1990) found that public investment related to infrastructure is positively related with private investment, while the nonifrastraucture component of public investment crowds out the private investment. Musalem (1989) found evidence of complementarity between private and public investment in a time-series study of investment in Mexico. However, Balassa (1988) reported cross-section estimates showing that public and private investment are negatively related, with an increase in public investment leading to a decline in private investment.[21]

In the 1980s, many developing countries undertook sharp real depreciation as part of their adjustment to the debt crisis. A real depreciation affects investment through three main channels: the real cost of capital goods; the real interest rate; and real output.[22]

First, a real depreciation tends to raise the real cost of capital goods relative to domestic goods. The reason is that in most developing countries capital has a high import content (mainly machinery and equipment), whose relative price is increased by a real devaluation). As argued by Buffie (1986) and Branson (1986), this situation tends, *ceteris paribus*, to depress investment in non-tradable activities. However, the opposite happens

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studies. Cardoso (1990) presents regression of panel data for six Latin American countries. Changes in terms of trade, variability of GDP growth, and the share of public investment are all significantly correlated with private investment.

21. Khan and Reinhart (1990) reexamined the issue of the differentials in productivity between private and public investment for a sample of 24 developing countries and found that the marginal productivity of public sector capital was negative, although not significantly so, while that of private investment was significantly positive.

22. A real depreciation may also have potentially important effects on the timing of investment, depending on the degree of financial openness in the economy and on the import content of capital goods.

in the traded goods sector: the real cost of new capital goods in terms of final goods falls and investment rises. The result for aggregate investment is therefore uncertain. Despite this theoretical ambiguity, most empirical studies conclude that in the short run a real depreciation has an adverse impact on investment through this cost-of-capital-goods effect (although its long-run effect may be positive).[23] In general, a high dependence on imported capital and intermediate goods and a relatively low share of the traded goods sector in total investment would make the contractionary result hold.[24]

A second channel through which devaluation affects the profitability of investment is the real interest rate. Devaluation raises the price level through its impact on the cost of imported intermediate inputs and wages under indexation; if monetary policy does not fully accommodate the increase in the price level, real money balances fall, pushing up the real interest rate for a given rate of (anticipated) inflation. Hence, the cost of capital to the user rises and investment falls. On the other hand, if the devaluation is anticipated and if it succeeds in eliminating the expectations of a devaluation, then it may result in an expansion of investment since the required return on capital would tend to fall, a reflection of the reduction in the anticipated rate of depreciation.[25]

The third channel through which devaluation may affect investment is through its impact on aggregate demand. If the devaluation reduces aggregate demand *ex ante,* then

23. Musalem (1989) found that in Mexico, the devaluation had an adverse investment effect. Faini and de Melo (1990) arrived at similar results using data for 24 developing countries. Solimano (1989), on the basis of an empirical simultaneous equation model for Chile derived from an extended *Tobin's q* approach, also concluded that a real depreciation reduced investment in the short run.

24. See Lizondo and Montiel (1989) for a detailed analysis on this issue.

ex-post investment is likely to fall. Moreover, if investment has a significant import content, then an expansion in output is likely to be a necessary (but not sufficient) condition for investment not to fall *ex-post* (Serven, 1990). The literature on contractionary devaluation (Krugman and Taylor, 1978; Wijnbergen, 1985; Solimano, 1986; Edwards, 1986; Lizondo and Montiel, 1989) emphasizes on how slowly the substitution effects of a devaluation emerge; hence, in the short run the impact of a real devaluation on aggregate demand is dominated by its adverse effects on income: it generates transfers of real income abroad (because of the likely initial external imbalance) from wage earners (low savers) to profit recipients (high savers) —a pattern that tends to reduce aggregate demand.[26] If the net effect of a currency devaluation is contractionary, then the slump in economic activity is likely to form the basis for investors to cut investment spending. However, with sufficiently strong substitution effects (for example, a large impact of devaluation on net exports), greater output and investment could result —an expansionary outcome that becomes more likely as time passes and the substitution effects gradually come into play.[27]

A major influence on the relative profitability of various activities is the real exchange rate. In the debate about external trade orientation and growth, several researchers have attempted to assess whether real exchange rate misalignment exerts any dampening impact on private investment. Various cross section studies incorporating

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25. In fact, whether this shift takes place will depend on the degree of capital mobility and import content of investment; see Serven (1990).

26. A real depreciation may also have adverse supply-side effects that lead to a contraction in output, such as the increased real cost (in terms of domestic goods) of imported inputs and the rise in the costs of working capital (because of higher interest rates).

27. See Solimano (1986) for an evaluation of these *J curve*-type effects of devaluation on output in Chile.

different forms of exchange rate distortionary proxies report a consistently negative impact of exchange rate distortion on private investment growth (Caballero and Corbo, 1988; Celasun and Rodrik, 1989; Cardoso, 1990; Cottani, et al., 1990; Fischer, 1991; Solimano, 1990; Dollar, 1992; Ghura and Grennes, 1993; Aizenman and Marion, 1995; Bleaney, 1996). More recently, Greene and Villanueva (1991), using a panel of 23 developing countries, found complementarity between exchange rate policy and private investment. Particularly, the study of Fischer (1991) provides an excellent analytical exposition of how foreign exchange black market premium can detriment incentive structure of private investment through numerous transmissions channels. Both Fischer (1991) and Serven (1996) report negative impact of black market premium on private investment. Also in similar vein, using the panel data, Lopez and Edwards (1989) record a negative impact of real exchange rate variability on private investment. Likewise, Dixit (1989), and Baldwin and Krugman (1989) focused on real exchange rate uncertainty. They showed that sunk costs of entry might discourage firms from moving into export activities that would appear profitable in the light of current real exchange rate levels.

Another stream of researchers more directly focused on trade policy uncertainty and its impact on private investment. Lopez (1989), using the trade policy indicators as developed by Haveli (1988) report negative impact of unstable trade policies on private investment. Also, Blejer and Ize (1989) analyze the confidence-eroding phenomenon of inconsistent trade policy within an integrated confidence gap and adjustment cost framework. A recent study by Goldsbrough et al. (1996) found dampening effect of unstable and "distortionary" trade policy on private investment in select eight developing

countries. A complementary research area is the impact of instability of export on private investment. Several studies, namely by Glezakos (1973), Voivodas (1974), and Ozler and Harrigan (1988), found negative association between export instability and private investment in the developing countries. Serven (1996) tests instability indicators in a sample of African countries and reports a significant negative association between investment and terms-of-trade variability. Aizenman and Marion (1995) also report negative impact of terms of trade volatility on private investment. Hausman and Gavin (1996) present similar result for the Latin American countries.

Another major policy-induced investment uncertainty encompasses financing aspect of private investment. The restrictive monetary and credit policies usually included in stabilization packages tend to raise the cost of capital to users by raising the real cost of bank credit, a major source of investment financing in developing countries, and by increasing the opportunity cost of retained earnings. The result is a decline in investment through both mechanisms. The empirical relevance of this effect has been confirmed in a number of studies (for example, de Melo and Tybout, 1990; Greene and Villanueva, 1990; Solimano, 1989), but others have not found a significant effect of interest rates on investment demand. The reason is that in the repressed financial markets that characterize many developing countries, credit policy affects investment directly through stock of credit available to firms with access to preferential interest rates, rather than through the indirect channel of interest rates –although the latter will also operate for firms that borrow in the unofficial money market (Wijnbergen, 1983). Besides, the perverse political economy of credit allocation can hamper desired rate of private investment. The

rates of return on investment in the developing countries typically tend to be high, whereas real rates on loanable funds are kept low due to a variety of reasons. In such circumstances, the investor cannot be expected to equate the current marginal product of capital to its service cost (Blejer and Khan, 1990). Indeed, because the total amount of financing is limited and price mechanism is not allowed to operate smoothly, it would seem legitimate to hypothesize that the available bank financing restricts the private investor in a developing country. Any effect exerted by the rate of interest on private investment is not direct within this rationing framework, but, rather, occurs via channel of financial savings[28]. Particularly, the rudimentary nature of capital markets in the developing countries limits the financing of private investment to the use of retained profits, bank credits and foreign borrowing. Of these, the flow of bank credit to the private sector would perhaps tend to be quantitatively the most important. An increase in real credit to the private sector will encourage real private investment, and rolling over bank loans can sufficiently lengthen the maturity of debt.

The role of foreign capital flows in the domestic private investment has been documented by Weisskopf (1972), Stillson (1976) and Wai and Wong (1982). The effects of foreign financing are broadly similar to the effects of variations in bank credit--both tend to increase investable fund. Since the control of the total bank credit usually is the principal instrument of monetary policy in developing countries[29], through varying the composition of credit between the public and private sectors, the government can affect

28. Galbis (1979) and Fry (1980, 1982) provide excellent discussion on the effects of interest rate on private investment.
29. Other tools of monetary policy, such as open-market operations, have a limited role where capital and bond markets remain relatively underdeveloped.

the speed and ability of private investors to respond to achieve their desired levels of investment. Monetary policy thus can have a direct as well as potent influence on the rate of private investment. Consequently, distortions and uncertainties concerning credit allocation can negatively contribute private investment. At the empirical level, a number of studies found a close association of credit uncertainty and negative response of private investment in the developing countries (Wai and Wong, 1982; Khan and Blejer, 1990; Greene and Villanueva, 1990; Fischer, 1991; Goldbrough et.al., 1996; Bleaney, 1996).

Also, the distributive politics of credit rationing often found to act as disincentive to the majority private investors (Rama, 1990; Khan and Blejer, 1990; Goldbrough et.al., 1996). Many empirical studies note this direct role of credit availability (for example, Wijnbergen, 1982; Blejer and Kahn, 1984; Lim, 1987; Dailami, 1990). Hence, the institutional set-up of the financial markets in developing countries is an important ingredient in the transmission mechanisms of monetary and credit policy with respect to investment. However, Ingersoll and Ross (1992) examine the consequences of interest rate uncertainty in a context in which future investment returns are known. They show that interest rate uncertainty creates a value of waiting; moreover, a decline in interest rates accompanied by an increase in their volatility can actually reduce investment (see also Tornell, 1990). Thus, to promote investment, the stability of interest rates might be more important than their levels.

From the above discussion, it is evident that institutional uncertainty pertaining to both quality and predictability of macroeconomic policy can affect private investment

performance. Especially, prevalence of numerous market imperfections and structural rigidities in the developing countries assigns more weight on quality of policy regime for steering the trend of private investment. It is also found that there are some agreed measures among the researchers on how to quantify uncertainty of policy regime for any systematic analysis purpose.

B. Socio-Political Instability, Quality of Property Rights and Private Investment Behavior

The current discussion attempts to explore the institutional uncertainty-private investment linkage from a broader perspective, incorporating the socio-political milieus of institutional uncertainty, uncertainties stemming from quality of governance, and property rights in developing nations. Similar to the earlier discussion, it would undertake an exploratory search into the existing literature in order to identify different forms of institutional uncertainties, contesting hypotheses, and how they are incorporated into empirical exercise. Nevertheless, institutional uncertainty encompasses a vast domain with multifaceted dimensions. Besides, overlapping characteristics of institutional factors make it almost impossible for any additively separate analysis and discussion. However, on the basis of the current inventory of the studies, one could classify the studies into two major categories. They are: i) uncertainties originating from various forms of socio-political instabilities; and ii) uncertainties associated with fragile property rights and enforcement. Although, poor quality of property rights might be

partly due to socio-political instability[30], they are treated separately by most of the studies due to their individual gravity of importance in the context of private investment.

Impact of Socio-Political Instability on Private Investment

There is unanimous consensus among the development analysts that political stability is an essential prerequisite for fostering private investment. Particularly, political instability amidst numerous socio-economic structural rigidities in the developing countries can endanger the property rights system. Political instability can exert negative effects on investor's behavior leading to "too little interpersonal exchange" and "too little intertemporal exchange"[31]. One strong theoretical argument underlying the negative relationship between political uncertainty and private investment is based upon the effects of uncertainty on productive decisions encompassing investment, production, or labor supply. A higher incidence of political instability is associated with increasing policy uncertainty, particularly, in the event of frequent government changes. In such events, risk-averse economic agents may hesitate to take economic initiatives or may "exit" the economy by investing abroad. Conversely, foreign investors prefer a stable political environment, with less policy uncertainty and less insecurity about property rights[32]. Alesina and Tabellini (1990), Tabellini and Alesina (1990), Cukierman, Edwards and Tabellini (1992), Ozler and Tabellini (1991) present several models in which a government is uncertain about its survival, and as a result engages in suboptimal

30. However, one might also consider the reverse causation that political instability is due to the lack of property rights.
31. Both the effects tend to result in short run bias in decision making and preferences and prefer consumption against investment. For a detailed explanation, see North (1990).

policies in order to "worsen" the state of the world inherited by its successor. Actually, one can conceive of endless cobweb transmission links between political instability and private investment uncertainty, which is beyond the scope of the current study. For the study purpose, it only recognizes the well-documented hypothesis that political instability can generate perverse forms of instability, particularly in the exchange system that dissuades private investment (Barro, 1991, 1996, 1998; Rodrik, 1989, 1998; Rodrik and Ozler, 1992; Alesina and Perotti, 1993).

In a recent study, Svensson (1998) provides an analytical model that addresses the question why investment rates differ so markedly across countries. The model is laid out explaining why governments in unstable and polarized societies may not have sufficient incentives to undertake legal reform so as to fully protect property rights, and how this may hold back private investment. The model also yields some testable predictions regarding the link from political instability to the quality of property rights, as well as the link from property rights to investment. These predictions hold up when confronted with cross-country data for about 100 countries. In particular, once the quality of property rights is controlled for, the different measures of political instability and polarization employed have no direct effect on private investment. Thus, a possible link between political instability and investment is identified. Results of a similar study by Poirson (1998) provide further empirical support to the view that enhanced economic security fosters private investment and growth in the developing nations.

32. Goodrich (1992) finds that foreign direct investment have been negatively affected by a high degree of political instability in a large sample of LDCs.

One of the central issues in this regard is how to define and measure socio-political instabilities for any empirical estimation purpose. In the relevant literature, political instability has been identified broadly in two ways. The first one emphasizes executive instability. The second one is based upon indicators of social unrest and political violence. The first approach defines political instability as the "propensity to observe government changes". These changes can be "constitutional" i.e. take place within the law, or "unconstitutional", i.e. they can be *coups d' etat*. The basic idea is that a high propensity to executive changes is associated with policy uncertainty and, in some cases, with threats to property rights. It is to be noted that the "propensity" to executive changes is distinct from the actual frequency of changes, and can be measured by probit regressions in which the probability of a change in the executive is related to several economic, socio-political and institutional variables. For example Cukierman, Edwards, and Tabellini (1992), and Edwards and Tabellini, (1991) adopt this definition of instability in their work on inflation. Alesina, et al. (1992) develop a structurally linked analytical model where political instability is endogenized by a probability index of government change. In their estimated two-equation system: one equation is a probit regression, which estimates the propensity to government changes, while the other is regression for investment growth. The key results of the study are: i) in countries and time periods with high propensity of government collapses, growth and investment significantly lower than otherwise[33]; ii) they have found no evidence that growth and investment is significantly different between authoritarian regimes compared to democracies; and iii) lack of political stability (defined as frequent government collapses)

33. Unlike Barro (1991), Scully (1988) and Kormendi and Meguire (1985) avoided the joint endogeneity problem between economic growth and political instability measures.

increases the probability of additional collapses. Londegran and Poole (1990, 1991), and Block Bomberg (1992), taking into the account of joint-endogeneity, applies the same probit regression approach.

The second approach to measuring political instability does not focus directly on executive changes. Socio-political instability is measured by constructing an index, which summarizes various variables capturing phenomena of social unrest. An important reference on this point is Hibbs (1973), who uses the method of principal components to construct such index. More recently, Venieris and Gupta (1986, 1989), Gupta (1990), Barro (1991, 1996, 1998), Ozler and Tabellini (1991), Benhabib and Spiegel (1992), and Mauro (1993) have used several indices of socio-political instability as an explanatory variable in various regressions in which dependent variable is growth/investment.

Which of the two approaches to measuring political instability described above is preferable is not clear *a priori* and may depend upon the specific issue under consideration. For instance, one may argue that for a given level of expected government turn over, phenomena of social unrest do not have any direct impact on policy uncertainty, and therefore on economic decisions. This might be strong but useful "identifying" assumption: policy changes relevant for economic decisions can occur only governments' change. On the other hand, one may argue that particularly when it reaches very high levels, social unrest disrupts market activities and increases economic uncertainty above and beyond its direct effects on executive instability. Mass violence, civil wars, socio-political disorder, and physical threats to workers and entrepreneurs engaged in

productive activities can have direct effects on productivity and therefore on return on productivity.

As political uncertainty can be construed from different dimensions, several authors used various indicators related to political instability in their regression equations. For example, Barro, (1989, 1991, 1996, 1998) uses a set of "objective" political instability variables namely, assassination, revolution, political executions, and war casualties into the directly specified regression equations[34]. In all the studies, Barro found a systematically negative lnkage between political instability and investment in the developing nations. The pioneering study of Barro inspired a number of further studies in the same direction (Alesina, Ozler, Roubini and Swagel, 1992; Block-Bomberg, 1992; Mauro, 1993; Easterly and Rebelo, 1993; Hausman and Gavin, 1996; Serven, 1996; Bleaney, 1996).

In the similar vein, a group of researchers use various subjectively constructed[35] political instability measures in their empirical exercise. Venieris and Gupta (1983) develop a "sociopolitical instability" index consisting of a set of sociopolitical instability indicators[36]. According to the study, sociopolitical instability is deeply entrenched with deprivation of the populace, state of alienation and the consequent violent reaction of people. The sociopolitical index is intertwined with an aggregate "frustration index" of

34. One notable hypothesis in this regard is coined is coined Gossman (1991) which says that in countries where rulers are weak i.e. more easily overthrown, the probability of revolutions is higher and the citizens have higher incentives to engage in revolutionary activities rather than productive market activities. Nevertheless, the hypothesis has many theoretical rivals.

35. Primarily based on the *Delphi* method.

36. The variables are: riots, political demonstration, and political strikes, armed attack events and deaths from political violence.

the economic agents, which in turn is dependent on a number of observable economic variables and the government "coercion index". The study reports a negative impact of sociopolitical instability on the private investment. Interestingly, it found that lower income countries are more vulnerable to sociopolitical maladies compared to the higher income nations. Using a different set of subjective measures, Knack and Keefer (1995) report similar negative result. Incorporating a comprehensive set of measures of sociopolitical instability, a recent study by Brunetti and Weder (1997) report similar result.

One important aspect associated with socio-political instability is the nature of the governance regime and magnitude of civil liberty. Although, it is generally conceived that democracy and civil liberty are conducive to economic prosperity, however, the rationale is contested both on theoretical and empirical fronts[37]. As regards civil liberty, the study of Kormandi and Meguire (1985) estimates negative effect of lack of civil liberty on private investment using the "Gastil Index" for civil liberty over a period of 1950-77. Interestingly, in their estimated investment equation, inclusion of civil liberty variable "virtually eliminates the effects of all the other variables in explaining investment-income ratio" [38]. In the similar vein, Veneries and Gupta (1983) report negative impact of lack of civil liberty as proxied by an index of government coercion. Scully (1988), on the other hand, separates political liberty from the civil liberty[39]. Using

37. Sirowy and Inkeles (1990) and Przeworski and Limongi (1993) provide extensive survey on the current discussion.

38. Civil liberty alone explains 45 percent variation of investment ratio.

39. The political liberty connotes to the degree to which individuals in a state have control over those who govern. The civil liberty purport to measure the rights of the individual relative to the state (like the independence of the judiciary, freedom of press, etc.).

a data for 1960-1980, the study found statistically significant positive relation between civil liberty and private investment. A growing number of studies report similar result (Barro, 1991, 1998; Serven, 1996; Hausman and Gavin, 1996; Brunetti and Weder, 1997).

Concerning the effects of democracy on private investment, the results are not unambiguous. Scully (1988) reports that politically more open states with more inclination towards free market regime tend to grow faster and invest more than the politically closed countries. Exclusively focusing on democracy and private investment in select Latin American countries for the period of 1970-86, Pastor and Hilt (1993) found significantly positive impact of democracy variables on private investment. Similarly, recent studies of Barro (1996, 1998) report positive impact of democratic governance on private investment up to certain ceiling level of lower income, implying a nonlinear correspondence.

One major source of political instability is the unequal income distribution. The rich literature on income inequality and economic growth suggests numerous adversaries of inequality on economic growth. As for explaining private investment behavior, one can notice over the recent years, the contribution of a number of commendable studies from different analytical perspectives with powerful insights (Ozler and Rodrik, 1992; Alesina and Perotti, 1993; Benhabib and Rustichini, 1996; Tornell and Lane, 1996, 1998). In development literature, one can find two opposing views pertaining to the "direct links" between income inequality and investment. The first is a Kaldorian view (Kaldor, 1956), which holds that more inequality favors more accumulation, because rich save

more than the poor do. The second view rests on the effects of inequality on the demand for fiscal redistribution. This argument implies an inverse relation between inequality and investment in physical capital (Alesina and Rodrik, 1991; Bertola, 1991; Pearson and Tabellini, 1991)[40]. At the empirical level, the results are not unambiguous. Sometimes, it is observed that the two opposing direct effects may cancel out each other (Alesina and Perotti, 1993).

However, there are several indirect "channels" through which income inequality may dissuade private investment. A number of researchers, namely, Alesina and Perotti (1993), and Ozler and Rodrik (1992) postulate "political transmission process" through which income inequality impacts upon private investment. The former study investigates the validity of two propositions, first, "more unequal societies are more politically unstable: in particular, political stability can be enhanced by the presence of a wealthy middle class, and secondly, "political instability has adverse effect on growth and investment". In other words, impact of inequality on private investment is explored via

40. Tornell and Lane (1996, 1998) recently coined a "voracity model of growth" where redistributive fiscal conflicts among the powerful multiple interest groups within a brittle institutional environment, spawn voracity effect on growth and eventually undermines investment.

the political instability channel. In this order, they construct an index of sociopolitical instability as suggested by Hibbs (1973). Further, the index is structurally linked with a number of economic variables and the income share of the middle class. The estimated results of the regression equation evidently confirm their main propositions.

The latter study (Ozler and Rodrik, 1992) focuses on the distributive struggle between labor and capital in the urban, manufacturing sector[41]. The investment climate of the country is considered to be partly determined by the distributive politics between labor and capital. They formalize the relationship between labor and capital as a "non-cooperative game" in which each side has one "weapon": workers have politics on their side, and have the ability to enlarge their share of the pie by taxing capital; capitalists have economics on their side, and can withdraw investment (and engage in capital flight) as domestic tax increases. The equilibrium of the game determines the tax on capital and the level of domestic investment as functions of exogenous variables. Also, the external shocks are formalized into the system, namely through global interest rate shock, or reduction in capital inflow to the public sector, which hit the system at different points. While the interest shock affects private investment demand, the net resource transfer affects the government budget. In both the cases, the shocks interact with the distributive struggle to affect the equilibrium level of tax on capital. Also, the political transmission mechanism could either dampen or magnify the fall in investment. The dampening scenario is more likely when the initial redistributive politics is low, while the magnification scenario is more likely when redistributive activity is initially high. The

41. It is a similar sort of study to Pazarbasioglu (1991), who studies the distributive politics between labor and capital in the context of the developing economies.

analytical model has three building blocks: i) a policy reaction function, ii) specified investment behavior; and iii) determination of worker's activity. Taking a cross-section data for 1975-85 including 32 developing countries, their main conclusions are: i) urbanization has a statistically significant impact on private investment (as it caters more intense distributive politics) and an interest shock in private investment is larger in more urbanized societies; ii) political rights variable has a statistically significant negative parameter estimate implying that effect of an external shock on investment is larger in countries with more restricted political systems.

In an attempt to explain why poor countries have tended to invest and accumulate at rates lower than the rich countries, Benhabib and Rustichini (1996) provide a game-theoretic model of conflict between social groups over distribution of income. The study emphasizes the relationship between levels of wealth, social and political conflict, and incentives for accumulation[42]. In this political economy model, returns to investment are appropriable by the other groups. This framework transforms the accumulation problem into the "commons" problem that may lead to underinvestment equilibria. It focuses on second-best subgame perfect equlibria to show that growth rate can be indeed wealth dependent. Poor countries may indeed accumulate at lower rates because even for the best sustainable equilibria, the incentives for appropriation can be much stronger at low level of wealth than at high ones, and therefore the momentary advantages of defection can be overcome only with high consumption and low investment rate. Although, the

42. The study is indirectly related to the studies done by Pearson and Tabellini (1994), Alesina and Rodrik (1994), Grossman (1991), Tornell and Velasco (1992), Lane and Tornell (1996, 1998).

study provides a new insight on linkage between income inequality and private investment, its empirical validity is yet to be tested.

Impact of Quality of Property Rights on Private Investment

In the emerging literature of *New Institutional Economics* (NIE*),* fragile institutions, particularly poor quality of property rights are identified as the key peril of path dependent lower level private investment trap in the developing countries (Olsen, 1982; North, 1990). Lack of well assigned as well as well enforced property rights arrangement can devastate private investment flow through various channels. An interesting analytical model, propounded by Tornell and Velasco (1992), formalizes a differential game among a group of conflicting interest groups over an appropriable "commons" that eventually leads to capital flight as the preferred option, thus reducing domestic private investment[43].

One major dimension of the quality issue boils down to the country' s legal system concerning the property rights. Here, the central theme is whether the property rights are well assigned. Another major dimension of the quality issue relates to enforcement of property rights system. Well-assigned property rights can collapse due to lack of proper enforcement. Evidently, the facet involves a country' s quality of governance, particularly,

43. External effects and strategic complementarities may play an important role in determining institutional efficiency. Putnam (1993) argues that a *tragedy of the commons* may explain the institutional failure in both developed and underdeveloped areas. Andvig and Moene (1990), Sah (1991), Tirole (1993) derive models with multiple equlibria with corruption. Murphy, Shleifer and Vishny (1993) derive a model of multiple equilibria in corruption and economic growth.

quality of bureaucracy and quality of judiciary system. Although theoretical development concerning property rights system has a long tradition, the empirical analysis of property rights system in connection to economic growth and investment got momentum only during the recent past.

Looking into the emerging literature, one can identify various stylized measures that have evolved to capture quality of property rights. Some widely used measures include quality of judiciary, efficiency of bureaucracy, corruption, rent-seeking, enforcement and repudiation of contracts, credibility of government and rule of law. All the above factors are considered as prerequisites for an efficient property rights system in a market economy regime. Consequently, deficiency of these factors detriment spontaneous development of private investment.

One of the pioneering works in the current subject is provided by Scully (1988), who incorporates an index of civil rights (proxied for independence of judiciary) into the regression equation. The study reveals remarkably high positive association between property rights and growth and investment within market based allocation system. Societies with a market based allocation system coupled with well assigned political, civil and property arrangements significantly grow faster and invest more compared to the institutional have-nots. In their widely known study, Knack and Keefer (1995) exclusively focus on various aspects of property rights. Using the *International Country Risk Guide* (ICRG) data, the study incorporates various institutional measures namely, expropriation risk, rule of law, repudiation of contracts by government, corruption,

quality of bureaucracy and contract enforceability into their regression equation. The statistical estimates of the relevant parameters unambiguously support the earlier hypotheses.

Following the same path, a number of studies have recently emerged using more comprehensive institutional indicators. One study by Brunetti et al. (1997) develops a "credibility of rules index" collecting primary data from a worldwide survey. Incorporating the credibility index with other familiar institutional and macroeconomic policy uncertainty variables together into the regression equation, their study documents a statistically significant correlation between private investment and credibility as well as predictability of the rule of law. A later study by the same authors (1997) systematically focuses on institutional uncertainty and investment response in the developing countries. Taking almost all the institutional measures used by the earlier studies, they attempt to integrate macroeconomic policy uncertainty and nonpolicy aspects of institutional uncertainty into a single calculus. In this order, they classify four sets of variables, namely, i) government instability; ii) political violence; iii) policy uncertainty; and iv) enforcement instability. Constructing three indices for the nonpolicy institutional uncertainty, their regression estimates confirm statistically significant negative correlation between institutional insecurity and private investment in the developing nations.

Corruption is one very important aspect of governance issue in the context of private investment. The debate on the effects of corruption is particularly fervent.

Beginning with Left (1964) and Huntington (1968), some authors have suggested that corruption might raise growth and investment through types of mechanisms. First, corrupt practices such as "speed money" would enable individuals to avoid bureaucratic delay. Second, government employees who are allowed to levy bribes would work harder, especially in the case where bribe acts as a piece rate. While the first mechanism would increase the likelihood that corruption can be beneficial to private investment only in countries where bureaucratic regulations are cumbersome, the second would operate regardless of the level of red tape. In contrast, Shlefier and Vishny (1993) argue that corruption would tend to lower investment and Rose and Ackerman (1978), warn about the difficulty of limiting corruption to areas in which it might be economically desirable. Murphy, Shleifer and Vishny (1991) provide evidence that countries where talented people are allocated to rent-seeking activities tend to grow more slowly.

Considering corruption as the prime explanatory variable, Mauro (1995) provides a neat analytical model for determining the impacts of corruption along with other stylized institutional variables on growth and investment in developing countries. In this order, he constructs two institutional indices, political stability index and bureaucratic efficiency index. The political stability index includes political change within institutional framework, political stability, probability of opposition takeover, stability of labor, relationship with neighboring countries, and terrorism. While the bureaucratic efficiency index includes, judiciary, magnitude of red tape and intensity of corruption. To address the endogeneity problem, he introduces a "Ethno-linguistic Fragmentation Index" as an instrumental variable in 2SLS regression. Both OLS and 2SLS estimates confirm a

negative and significant association between corruption and investment rate[44]. The magnitudes of slope coefficients measuring the association between corruption and investment are far from being significantly different in low-red tape and high red-tape samples of countries which evidently rejects the hypotheses of Left (1964) and Huntington (1968). The efficiency of bureaucracy also has a statistically significant coefficient with the expected sign[45]. The estimated results also show that in addition to affecting investment through political instability and bureaucratic inefficiency, ethno-linguistic fractionalization imparts a direct link in dissuading private investment.

Corruption and rent seeking are organically interwoven. However, it is agreed upon that both maladies are stemmed from imperfect institutional arrangement. The vast literature of rent seeking evidently confirms that a higher incidence of rent seeking is associated with higher dead-weight loss and lower private investment. A recent study by Rama (1993) provides an endogenous growth model where unequal distribution coupled with bureaucratic failures proliferate lower growth and reduced private investment

44. The magnitude of the effect is considerable. A one-standard deviation increase (an improvement) in the corruption index is associated with 2.9 percent of GDP.

45. A one-standard deviation increase (improvement) in the bureaucratic efficiency increases the investment rate by 4.75 percent of GDP. In fact its significance level increases when controlled by ELF instrument.

III. AN EMPIRICAL ANALYSIS ON THE IMPACT OF INSTITUTIONAL UNCERTAINTY ON PRIVATE INVESTMENT IN SELECT EAST AND SOUTH ASIAN COUNTRIES

The current section provides an empirical analysis on impact of institutional uncertainty on private investment in select 11 South and East Asian countries over a period of 1982-1995. The countries included in the study are: Bangladesh, India, Pakistan, Sri Lanka, Indonesia, Republic of Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand. Since the study covers only 11 countries for a period of 14 years, a pooled cross-section time series analysis seems appropriate for empirical exercise. Under certain conditions and specifications, pooling provides more efficient estimation, inference, and possibly, prediction (Vinod and Ullah, 1981; Jayaraman, 1996). A generalized least square (GLS) estimation procedure is adopted for correcting three different sources of error correlations: (i) heteroskedastcity among cross-sectional data for the eleven countries, ii) time series autocorrelation among each cross-section, and iii) contemporaneous correlation on cross-sectional dependence.

Model Specification

Following the conventional practice in the empirical literature, a reduced form approach is adopted in the present study to cardinally test proximate linkages between institutional uncertainly and private investment. Among a long list of potential

explanatory variables in the empirical literature, the study includes the most commonly used institutional uncertainty regressors. Also, nonavailability of a comprehensive institutional data set prevented the study to include other institutional variables.

For the empirical analysis, the panel specification is as follows:

$$PRI_{it} = \alpha_0 + \alpha_1 GDP_{i\,t-1} + \alpha_2 PCR_{i\,t} + \alpha_3 PRIV_{i\,t} + \alpha_4 INF_{i\,t-1} + \alpha_5 EXR_{i.\,t-1} + \alpha_6 GCON_{i\,t} + \alpha_7 RULE_{i\,t-1} + \alpha_8 BRQ_{i\,t-1} + \alpha_9 SECU_{i\,t-1} + \alpha_{10} RDUMY + \varepsilon_{it}$$

where the subscript i denotes a given country, while t refers to the year of observation. PRI is private investment/gdp ratio, GDP denotes annual gdp growth rate, PCR refers to private credit/gdp ratio, PRIV stands for private investment in the previous year, GCON is annual government consumption/gdp ratio, INF is annual inflation rate, EXR refers to exchange rate fluctuation measured by standard deviation, "RULE" is proxied for law and order situation, "SECU" is an index of security of property rights (defined as lower order of expropriation risk and government repudiation of contract), BRQ is an index of quality of bureaucracy (defined as bureaucratic efficiency and progress in corruption), RDUMY is a regional dummy (0 value for South Asia and 1 for East Asia) and ε_{it} is the stochastic noise term.

It should be noted that under the *option approach* of investment analysis, given the option of waiting, there is expected to have a delayed response of uncertainty on *ex-post* private investment. Given the assumption, one year time lag is introduced in both

macroeconomic and direct institutional explanatory variables in the above regression equation. The contesting hypotheses associated with the explanatory variables in the current model have been discussed in detail in the earlier section.

Following the earlier studies, inflation and exchange rate can be considered to be exclusively macroeconomic policy induced uncertainty indicators. Real gdp growth in the previous year is a standard regreesor of private investment, quite extensively used in the empirical literature (Barro, 1990; Solimano, 1990, 1996, 1997). Also from the discussion in the previous section, it seems quite reasonable to consider availability of credit to the private sector as an explanatory variable, instead of the interest rate for the current research purpose. Also, it is quite logical to assume a complementary relation between private investment in current year and private investment in the previous year. Apart from its direct impacts, investment in the previous year can also have some external effects on investment in the current year. Given the irreversible property of investment, there is likely to be more complementarity between current year and previous year's investment than the conventional analytical framework. Government consumption is introduced to test the crowding out hypothesis of government expenditure.

Given the hypotheses in the empirical literature, the expected signs of the explanatory variables in the current model are pretty unambiguous. Coefficients of gdp growth, private credit and private investment in the previous year-all are expected to have positive association with private investment. Coefficients of macroeconomic uncertainty variables, namely inflation and exchange rate are hypothesized to be negatively

correlated with private investment. Given its potential crowding out impact, government consumption is also likely to be negatively associated with private investment. As regards the institutional variables, since they are measured at a positive scale (higher score refers to better quality), higher security to property rights (SECU) and higher quality of the bureaucracy (BRQ) are expected to have positive signs. On the other hand, a lower state of "rule of law" is expected to have negative coefficient.

Data Source

The study uses a uniform data source for the select 11 countries. Data on macroeconomic indicators have been collected from the *Annual Yearbook of International Financial Statistics* and the data for institutional indicators have been taken from the *International Country Risk Guide (*ICRG). The two indices, security to property rights and quality of bureaucracy, have been constructed following the method as suggested by Brunetti et al. (1997). The index of security to property rights is constructed from two ICRG indicators, namely "repudiation of government contract" and "expropriation risk", while bureaucratic quality index is formulated from two other ICRG indicators, namely, "bureaucratic efficiency" and "corruption".

Results of Pooled Cross-Section Time Series Analysis

Prior to the regression analysis, a proximate linkage between private investment and the explanatory variables used in the current model could be explored by studying a

correlation matrix, reported in Table 1. It shows simple correlation coefficients at two-tailed significance level. Besides, it also presents cross-correlations between the different indicators.

A cursory look at Table 1 confirms strong association of private investment with select regressors in the current model. Also, signs of the correlation coefficients with private investment overwhelmingly support the *a priori* hypotheses. They all support earlier findings in the empirical literature. For instance, strong positive association is found between private investment and gdp growth, private investment in the previous year, and private credit. On the other hand, negative correlation could be seen with private investment and macroeconomic policy uncertainty variables, namely inflation and exchange rate fluctuation. Concurrently, strong positive association is evident between private investment and institutional quality variables.

Summary statistics of pooled cross-section time series analysis are provided in Table 2. The overall goodness-of-fit measure, as measured by adjusted R^2 which is the coefficient for estimating the equation by GLS for a cross-section time series model, is high at 0.955. Thus, about 96 percent variation in the dependent variable is explained by the interaction of all the select explanatory variables. Further, the *Durbin-Watson* statistic at 1.62 rejects the presence of serial correlation[46]. In the estimated equation, all the parametric coefficients of select independent variables except for inflation, emerged with

46. Although, collinearity diagnostic statistics are not reported in the summary table, but they confirm absence of any strong muti-collinearity bias.

high degrees of statistical significance, signified by high two-tailed "t" ratios which are greater than their respective values at acceptable significance level.

The estimated results are quite comparable to the observations made by earlier studies in the empirical literature. Like Barro (1996, 1997), Solimano (1993, 1997), and the others, the estimated result reports a moderately positive statistically significant relationship between gdp growth rate lagged by one year and current year private investment. Similar to Khan and Blejer (1990), and other representative studies, the estimated result perfectly agrees to a statistically significant positive association between availability of credit to the private sector and private investment. Conforming to our earlier stated hypothesis, a strong positive association is evident between previous year's investment and investment in the current year. The emergence of the previous year's investment as statistically the strongest regressor in the estimates could be interpreted by the reasoning that promotion of investment is a path-dependent dynamic process (North, 1990), and a disruption in current investment flow due to any reason would impair future investment stream, given the option of waiting to the investors. The regression result supports crowding out effect of government consumption on private investment in the developing countries. Like Barro (1996, 1997), and Alesina (1998), it records a statistically significant negative association between private investment and government consumption.

As regards the macroeconomic uncertainty variables, the results are mixed. Although the inflation coefficient has an expected negative sign, however it appears to be

statistically insignificant. On the other hand, exchange rate fluctuation records a significant negative impact on private investment.

The estimates of the direct institutional variables are quite unambiguous. Higher quality of bureaucracy (defined as lower corruption coupled with higher efficiency) has a significant positive impact on private investment. Similarly, a higher scale of security to property rights (defined as lower expropriation risk and lower level of government repudiation of contract) has a significantly positive link with private investment. Also, statistically significant negative coefficient of rule of law variable could be due to difference in law and order situation between East and South Asia. Concomitantly, significant positive coefficient of the regional dummy hints about some missing factors in the current analysis that might have positively contributed higher private investment performance in East Asia[47]. This observation is similar to the recent findings by the representative studies (Alesina, 1998; Rodrik, 1998; Solimano, 1998) in the empirical literature.

The above results are admittedly quite preliminary and due to their reduced form framework, can not be strictly viewed as postulating the causation (rather than simpler association) between the variables. Nevertheless, the estimates do indicate that higher income growth, availability of credit, complementary investments in the previous year are significantly associated with positive private investment performance, while

47. They could b educational performance, better infrastructure, or the socio-cultural factors.

government consumption and exchange rate fluctuation are involved with a lower investment flow. Concurrently, higher quality of bureaucracy, security to property rights and higher state of rule of law- all are positively linked with private investment. Thus, on the whole, the multivariate regression results appear consistent with bivariate correlations examined earlier.

D. A Comparative Analysis of Private Investment between East and South Asia

Although the econometric results in the previous section do not refer to any causality, the findings in tandem with available data on the trends of the select explanatory indicators could be fairly useful for a comparative analysis of private investment between the two developmentally varied performing regions.

Both in terms of level and sustainability of private investment, the East Asian region, particularly the *Newly Industrialized Countries* (NICs; except for Taiwan) are "super-performers" compared to other developing regions. On the other hand, the South Asia appears to be laggard in this score. This is quite evident from Figure 3, which shows average private investment trend in the select two regions during the study period (1982-95). The disaggregate scenarios (Figure 4 and Figure 5) show that Bangladesh and Pakistan in South Asia, while Philippines and Indonesia in the East Asian region are poor performers compared to their neighbors in the respective regions. Given this stylized fact, a closer look at trends of the explanatory variables in conjecture with the empirical

findings in the previous section, would suggest that the poor performance in the above countries are not at all accidental.

In our estimated equation, higher income growth appears as a significant regressor. Given the fact, one can notice a remarkably varied performance in gdp growth between the two regions (Figure 6). It should be noted that due to strong negative growth (7.30 percent in two consecutive years) in Philippines, it shows a sudden drop in the East Asian average growth rate during 1984-85. The disaggregate trends (Figure 7 and Figure 8) show that the countries with poor income growth in both the regions have lower level of private investment, and vice versa (except for Taiwan).

Likewise, given the significant positive association between private credit and private investment, one can readily visualize an increasing trend of credit availability in East Asia as opposing to its stagnant trend at a lower level in South Asia (Figure 9). At intra-regional level, countries with higher private credit are better performers in private investment, while the "regional-poors" in private investment, namely Bangladesh and Philippines in their respective regions have a precarious level of private credit share (Figure 10 and Figure 11).

Given the crowding out phenomenon of public consumption, one can notice a declining trend of public consumption in East Asia as opposed to its increasing trend in South Asia (Figure 12). Decreasing trend of private consumption in East Asia is also confirmed at the disaggregate level, except for Philippines and Indonesia. While in South

Asia, the most notable feature is an ever-increasing trend of public consumption in Bangladesh throughout the entire study period.

Turning to the institutional indicators (Figure 20 to Figure 34), one can note a significant disparity among the two regions. While the institutional quality is far better in East Asia at every front compared to that of South Asia. However, at the aggregate level, there are some signs of improvement in South Asia starting from the 1990s. At the country level, not surprisingly the countries with poor quality of institutions in both the regions are also poor performers in private investment. So, it could be inferred that a relatively higher state of institutional certainty coupled with rapid income growth might have positively contributed higher private investment in East Asia, while a lower level of institutional certainty in tandem with lower income growth could have some proximate causal linkage to the poor performance of private investment in South Asia.

Table 1. Correlation Coefficient Table

Correlation Coefficients

	PRI	GDP	PRIV	PCR	INF	EXR	GCON	RULE	SECU	BRQ
PRI	1.0000	.4273	.9698	.8360	-.2682	-.2959	-.1974	.5202	.6433	.5976
	P= .	P= .000	P= .000	P= .000	P= .001	P= .000	P= .014	P= .000	P= .000	P= .000
GDP	.4273	1.0000	.3688	.4016	-.4561	-.2427	.0605	.3515	.4649	.1873
	P= .000	P= .	P= .000	P= .000	P= .000	P= .002	P= .456	P= .000	P= .000	P= .020
PRIV	.9698	.3688	1.0000	.8322	-.2279	-.2369	-.1768	.5377	.6363	.6247
	P= .000	P= .000	P= .	P= .000	P= .004	P= .003	P= .028	P= .000	P= .000	P= .000
PCR	.8360	.4016	.8322	1.0000	-.4642	-.3620	.0617	.6718	.6516	.6078
	P= .000	P= .000	P= .000	P= .	P= .000	P= .000	P= .447	P= .000	P= .000	P= .000
INF	-.2682	-.4561	-.2279	-.4642	1.0000	.3978	-.3457	-.4927	-.4026	-.3070
	P= .001	P= .000	P= .004	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000
EXR	-.2959	-.2427	-.2369	-.3620	.3978	1.0000	-.2231	-.4048	-.4343	-.3478
	P= .000	P= .002	P= .003	P= .000	P= .000	P= .000	P= .005	P= .000	P= .000	P= .000
GCON	-.1974	.0605	-.1768	.0617	-.3457	-.2231	1.0000	.4100	.2507	.3453
	P= .014	P= .456	P= .028	P= .447	P= .000	P= .005	P= .000	P= .000	P= .002	P= .000
RULE	.5202	.3515	.5377	.6718	-.4927	-.4048	.4100	1.0000	.7898	.7603
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .	P= .000	P= .000
SECU	.6433	.4649	.6363	.6516	-.4026	-.4343	.2507	.7898	1.0000	.6712
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .002	P= .000	P= .	P= .000
BRQ	.5976	.1873	.6247	.6078	-.3070	-.3478	.3453	.7603	.6712	1.0000
	P= .000	P= .020	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .

(Coefficient / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

Table 2. Results of Cross-Section Time Series Analysis

Number of countries =	11
Number of observations for each country =	14
Total number of observations =	154
Adjusted R^2 =	.955
F-ratio =	327.47
D-W statistic =	1.62

(Dependent Variable: Private Investment/GDP; PRI)

Regressors	Coefficient	t-ratio	Significance
Constant	2.774	2.666	*
GDP growth in last year (GDP)	.178	3.420	*
Private investment in last year (PRIV)	.745	14.311	***
Credit to private sector (PCR)	.048	3.489	**
Government consumption (GCON)	-.272	-3.753	**
Inflation (INF)	-.013	-.409	**
Exchange rate fluctuation (EXR)	-.036	-2.624	*
Rule of law (RULE)	-.647	-3.317	**
Private property security (SECU)	.266	2.035	**
Quality of bureaucracy (BQR)	.442	2.282	**
Regional dummy (RDUMY)	1.161	2.792	**

*** = at 1 percent level; ** = at 5 percent level; * = at 10 percent level

CONCLUSION

This paper has reviewed the emerging investment literature that focuses the option value of waiting in the investment process. In the event of uncertainty originating through any transmission channel coupled with irreversibility of investment, waiting can become a rational choice to avoid costly mistakes. The recent discourses on investment suggest that value of waiting can be extremely high even with moderate uncertainty. Thus, the latter becomes a powerful investment deterrent even under strict risk-neutrality. The key implication is that, to encourage private investment, *stability* and *predictability* of the incentive framework – relative prices, demand, interest rate, exchange rate, taxes – may be much more important than the *level* of the incentives themselves. To put it differently, huge incentives may be necessary for investors to give up their option to wait and commit themselves to irreversible investment in an uncertain business environment.

The central implication for macroeconomic policy is that, to encourage investment and facilitate its response to incentive changes, governments should attach top priority to correction of unsustainable macroeconomic pitfalls – such as high inflation, growing government consumption leading to widening public deficits and exchange rate overvaluation – which are a primary cause of macroeconomic instability and uncertainty about future policies. Concurrently, institutional reforms to establish rule of law, security of property rights and higher quality of bureaucracy can also go a long way to facilitate a positive response of investment to incentive changes.

The paper has also examined the practical relevance of the uncertainty-investment link for select developing countries in East and South Asian region. The statistical evidence reveals that institutional uncertainty proxies as used in the current study are quite tightly associated with *ex-post* private investment performance in the select countries. The tight correlation of private investment with select institutional uncertainty indicators lends support to the growing consensus in the emerging growth literature that quality of institutions is very crucial in explaining varied performance of economic growth and private investment among the nations. Also, it provides credence to the strengthening recognition onto a broader dimension of institutional uncertainty encompassing both economic as well as noneconomic parameters as opposed to a deterministic perception. There is a growing support both at theoretical as well as empirical fronts that uncertainty breeding from institutional variables like socio-political instability, absence of rule of law, less secured property right arrangements can also toll against private investment within a market economy regime just like the conventional macroeconomic uncertainty parameters.

Although the study does not provide any causal analysis to the varied performance in private investment between the two select developing regions, however, it provides some useful clues in this direction. The available data amply show that South Asian countries are still far behind in terms of quality of their institutions compared to their development partners in the East Asian region. Also, it is evident that the investment "poors" in both the regions are faltered with lower quality of institutions. The implication

is that South Asian countries may have much to gain from progress in reducing economic and political instability and improving the quality of their institutions.

In concluding, while the *irreversibility approach* brings out a number of relevant policy implications, it is important to be aware also of its limitations. Three of them are worth mentioning here. First, on theoretical grounds irreversibility cannot explain the negative *long-term* association between instability (whether economic or political) and investment performance found by a number of empirical studies. While such relation might arise under particular conditions, it is by no means a general consequence of investment irreversibility, and likely reflects the simultaneous action of other factors, such as investor risk aversion and limited access to risk diversification.

Second, from an analytical perspective, irreversible investment is only one of the factors that can render investment decisions insensitive to changes in incentives. Other reasons, such as liquidity constraints (Hubbard, 1994) or fixed costs (Caballero and Leahy, 1996) can likewise create a "range of inaction" for investment, in which firms fail to tune their investment decisions to changing profitability conditions.

Third, and most important, the irreversibility approach only describes investors' decisions about when (or whether) to adopt profitable investment projects (or exercise their investment ""options"). At least equally important from the policy viewpoint is the question of how these profitable investment opportunities arise in the first place. Specifically, in the context of South Asia, the question that may merit attention is: what

are the key policies that would help generate valuable investment options? The right answer surely varies across countries, but investment in human resources, adequate infrastructure provision and effective institutions for fostering property rights and social consensus would undoubtedly be at the top of the priority order.

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