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Investment and Capital Flows under Uncertainty and Capital Market Imperfection in Oil Producing Countries

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INVESTMENT AND CAPITAL FLOWS UNDER UNCERTAINTY AND CAPITAL MARKET IMPERFECTION IN OIL PRODUCING COUNTRIES

by

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Mohamed Gaber Hassan Elsayed

TABLE OF CONTENTS

CHAPTER

CHAPTER

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Investment is the vehicle of economic growth and growing importance of capital flows, especially foreign direct investment, and its observable role in achieving high growth rates in many countries give rise to examine the relationship between capital flows and domestic investment. The class of models of investment in developing countries extends the previous work in the theoretical literature on investment in developed countries. However, applying these models to developing countries has been difficult due to many market distortions, such as capital market imperfection, economic and political uncertainty. Oil producing countries share most of the common characteristics of developing counties. The tremendous political and economic uncertainty in these countries create a "hit and run" or "wait and see" attitude of the investors, which in turn delays investment, simply because there may be a gain to be achieved by waiting in an uncertain environment and this implies a reduction in aggregate investment. Also, the assumption of a perfect financial market is far from justified due to information asymmetries and poorly financial market infrastructure. In addition, most of capital flows to these countries, especially FDI, are directed to oil investment. Both, this type of FDI and domestic investment in this stage of development are always associated with high fixed cost, which makes most of these investments irreversible. This specificity combined with uncertainty deters both domestic investment and foreign investment.

Though there are many studies examined the relationship between investment and uncertainty, there is no theoretical or empirical study we aware of that considers the specificity of oil producing countries in this relationship. In addition, there is no single study that examines the dynamic interaction relationship between capital flows and domestic investment under uncertainty and capital market imperfection. This study endeavors to fill this gap with a new investment model specification considering the characteristics of oil producing countries.

In the first chapter, we discuss and analyze the recent development in the theory of investment under uncertainty, irreversibility, and capital market imperfections. In the context of developing economies, we examined different investment strategies under inflation and credit market imperfection. We discussed, using the real option theory, how the uncertainty and irreversibility make investors exercise the option to delay investment until they get more accurate information or until the uncertainty is resolved and this would lead to a fall in aggregate investment. The analysis of capital market imperfection with uncertainty has many implications. First, uncertainty combined with the imperfection will result in underinvestment. Second, uncertainty with the imperfection in credit market may cancel out the effect of interest rare on investment. We may expect a decrease in investment at the same time we see interest rate falling. Although these results are based on assumption that is more realistic, uncertainty and imperfect markets, they may underpin the neoclassical theory of investment in which financial factors are ignored. To test these results empirically we will consider a proxy for credit market imperfection and uncertainty

measures, inter alia, credit availability uncertainty in our investment model. In sum, this chapter proposes the most important variables considered in the investment model developed in the dissertation

In the second chapter, we distinguish between risk, volatility, and uncertainty. We constructs uncertainty measures for macroeconomic variables which have been chosen from the first chapter to estimate a model for how the uncertainty affects the interaction between domestic investment and capital inflows in a sample of oil producing countries and Middle East and North African countries (MENA). Through this work we explore the sources and the importance of uncertainty in those countries and then turn to discuss and examine empirically different approaches to measure uncertainty. Specifically, we construct GARCH models to estimate inflation, exchange rate, real interest rate, credit availability, and oil price uncertainty. In addition, we investigate the impact of different shocks to oil price on the short run and long run oil price uncertainty, the impact of Kuwait invasion in 1990, September 11, 2001, and Iraqi war in 2003.

In the third chapter, we examine the interaction relationships between capital flows and domestic investment under uncertainty and capital market imperfection in 12 oil producing countries from 1981 to 2003 periods. We pose two questions: (1) is there a dynamic interaction between capital flows and domestic investment, in other words, which one leads the other? (2) If there is, how is this interaction affected by uncertainty and capital market imperfection considering the specificity of oil producing countries? To address these questions, a four simultaneous equations model is

developed to capture the dynamic interaction between capital inflows and domestic investment. We employ Wooldridge's (1996) Generalized Method of Moments-three stage least square, (GMM- 3SLS) estimator, to estimate the simultaneous equations using different instrumental variables for each equation in a dynamic panel framework. The contribution of this chapter to the literature is threefold. Firstly, it combines the issue of the behavioral characteristics of different types of capital flows raised in the 1970-1990 periods and the more recent issue of their impact on domestic investment in the recipient countries. Secondly, the paper is different from previous empirical studies in the following aspects: (1) it considers the impact of uncertainty on investment, but distinguishes whether the uncertainty is persistent or not; (2) we consider that the imperfection of financial markets in these countries may lead investors to explore other channels to pass through capital inflows. So we focus on specific potential sources of credit market uncertainty: real interest rate uncertainty and uncertainty of credit availability; (3) we consider the possible different effect of each type of capital inflows on domestic investment to see how important the capital flows composition is. Thirdly, up to our knowledge, the subject of the study has been never addressed using GMM-3SLS technique. This technique accounts for a potential endogeneity of explanatory variables, controls for country-specific fixed effects, and enables the use of different instruments for each equation in the model.

Our findings show that bi-direction interactions between domestic investment, foreign investment, and foreign bank loans exist. However FDI induces domestic investment more than domestic investment does. FBL is the second most important

component in capital flows in stimulating domestic investment but its impact is much less than FDI. Also we find that the negative effect of credit uncertainty on investment dampens the positive effect of financial development and hence deter investment. The policy implications drawn from this study are essential for macroeconomic policy-makers given that increasing capital mobility weakens the macroeconomic autonomy via its potential effects on inflation, real exchange rate, and financial sector.

In the fourth chapter, we simulate the impacts of different policy responses on capital flows and domestic investment to propose strategic policy initiatives. For doing so, first: we discuss the macroeconomic problems, consequences, and policy issues that the capital inflows cause. Second, we apply the model estimated in Chapter III with the out-of-sample forecasts to examine the effects of different policy scenarios on the path of endogenous variable; domestic investment, FDI, FBL, and FPI to the Egyptian economy over the 2004- 2010 horizon. The results are: (1) sterilization policy is not recommended, (2) reducing short run and long run oil prices is favorable and has positive effects on both domestic investment and capital inflows, (3) a contractionary fiscal policy implemented by cutting government expenditure is more effective than increasing taxes in response to the "overheating" caused by the capital inflow, and (4) reducing uncertainty in all variables has a favorable effect in increasing domestic investment and FDI.

CHAPTER I
RECENT DEVELOPMENTS IN THE THEORY OF INVESTMENT UNDER UNCERTAINTY AND IMPERFECT CAPITAL MARKET

Investment is the vehicle of economic growth and the hope of future prosperity. Previous studies have explored the determinants of economic growth and the majority of these studies conclude that the most robust effect is the positive relationship between investment and the growth rate of output (Levine and Renelt, 1992). Indeed, the new growth theory further emphasizes the role of investment in the growth process (Romer 1986, 1987; Lucas, 1988). More specific, demand for investment -with the supply of savings- determine how much of an economy's output is invested and how the standard of living behaves over the long run. In addition, Changes in investment spending are the driving force behind the business cycle. They played a powerful role in every single recession and boom.

The framework of studying investment in developing countries is an extension of previous work in the theoretical literature on investment. Therefore, the studying of well-defined class of models of accelerator, cash flows, new classical theory, Tobin's q ...etc. forms the solid ground to develop investment models specified to developing countries. However, applying these models to developing countries has been difficult due to many markets distortions, such as credit market imperfection, and little reliable data (Blejer and Khan 1984). In addition, these models do not consider the specific characteristics of developing countries such as low saving rates, the need for foreign finance, and political and economic uncertainty. The flow of bank credit and capital

flows are the most important sources to expand financial saving and hence, increase investment. The way of allocating these resources is also important. The assumption of a perfect financial market is far from justified in developing countries due to information asymmetries, and poorly financial market infrastructure. It has been known that the absence of functioning financial market and uncertainty make investors less eager to invest.

A relatively recent theoretical literature has focused on the role played by uncertainty in shaping the investment decisions (Dixit and Pindyck, 1994). It is well known that the combination of the typically irreversible nature of investment, uncertainty about the future benefits and costs of the investment project, and some flexibility about investment timing, may have a substantial impact on the investment behavior. The uncertain macroeconomic environment in developing countries creates a "hit and run" or "wait and see" attitude of the investors, which in turn delays investment, simply because there may be a gain to be achieved by waiting in an uncertain environment and this implies a reduction in aggregate investment.

The growing importance of capital flows; especially foreign direct investment, and its observable role in achieving high growth rates in many developing countries give rise to examine the relationship between capital flows and domestic investment. Investment is the most effective channel through which capital flows affect growth. Of course, much has been written about investment and many surveys and surveys of surveys already exist. Instead of surveying, the goal of this chapter is to discuss the relatively new theories in investment focusing on the effect of uncertainty and

irreversibility on investment decision. What I plan to discuss and analyze is the fundamental relationships between domestic investment and capital flows under uncertainty. We use this analysis as a basis for developing an appropriate model of the interaction between investment and capital flows in Chapter III.

The rest of the chapter is a follows, in section two we review the testable hypotheses in investment theories. Section three discuses the modern theory of investment under uncertainty and we focus on the real option theory. Section four analyzes the role of credit and market imperfection and uncertainty in deterring investment. Section five explores the interaction relationships between capital flows and domestic investment. Section six sheds light on the role of government.

1- Investment Theories (Brief Survey)

1.1 The Accelerator Model

One of the earliest empirical models of aggregate investment behavior is the accelerator model, which was put forward by J. M. Clark in 1917 as a possible reason to rationalize the volatility of investment expenditures. The accelerator model is based on the assumption of a fixed capital/output ratio. There are many well-known versions of the accelerator model. The naïve accelerator simply asserts that not only does the optimal capital stock ($K^*_t = \alpha Y_t$) bear a fixed factor α (capital-output ratio) of proportionality to output Y_t, but also the capital stock is always optimally adjusted instantaneously in each time period, implying that $K^*_t = K_t$ and therefore the net investment is

$$NI_t = K_t - K_{t-1} = \alpha(Y_t - Y_{t-1})$$

This naïve accelerator model has not fared well in empirical analysis, due in part to the restrictive instantaneous adjustment assumption. It is also unable to account for the serial correlation of investment beyond that of output growth. The flexible accelerator model was introduced to overcome these problems. The adjustment of capital stock to its optimal level is assumed to be a constant proportion ϕ of the gap between K^* and K. i.e. $I_t = \phi\ (K_t^* - K_{t-1})$. Since $K^*_t = \alpha Y_t$ then the flexible accelerator can be written as:

$$NI_t = K_t - K_{t-1} = \phi(K_t^* - K_{t-1}) = \alpha\phi Y_t - \phi K_{t-1}$$

Without details of derivations, we can identify many versions of the flexible accelerator model. For example,

$$NI_t = K_t - K_{t-1} = \alpha[\phi(Y_t - Y_{t-1}) + \alpha(1-\phi)(Y_{t-1} - Y_{t-2}) + \alpha(1-\phi)^2(Y_{t-2} - Y_{t-3}) + ...] \quad ..(1)$$

Equation (1) shows two things. First, the net investment (the change in capital stock) depends on current and lagged changes in output. Second the effect of output changes on investment is distributed over an infinite number of future time periods. Another version of accelerator model is to add replacement investment to get gross investment (GI).

$$GI_t = \alpha\phi Y_t + (\delta - \phi)K_{t-1} \qquad (2)$$

Where δ is a constant and represents a depreciation rate. Avoiding the difficulties in obtaining a reliable measure of capital stock, we can estimate the following equation.

$$GI_t = \alpha\phi Y_t - (1-\delta)\alpha\phi Y_{t-1} + (1-\alpha) GI_{t-1} \qquad (3)$$

Equation (3) is called "Koyck transformation". This equation can be estimated without employing any capital stock data and δ can be estimated instead of assuming it. The main advantage of the accelerator model is its simplicity. It says that the investment is a function only of current and lagged output and lagged capital stock. The economic rational behind that is the current output is a signal to think about investment in the current period and the lagged output terms represent the gradual response of investment to changes in final demand including gestation lags. The lagged capital stock, which bears the coefficient (δ-ϕ), is the base for calculating replacement investment and is to adjust the gap between desired and actual capital stock since the capital output ratio is constant by assumption. The absence of prices, wages, and taxes, (the cost of capital in particular) from the accelerator model has earned it disrespect despite its empirical success.

1.2 The Neoclassical Model

This theory intended to remedy the absence of capital cost and the substitution possibilities between capital and labor, which was ignored by assuming constant capital, output ratio in accelerator model. Jorgenson (1963, 1971) started from the optimization problem that relates the desired capital stock to interest rate, capital prices, and tax policies. The pioneering studies by Jorgenson and his associates are widely used until this day. Consider a model of a perfectly competitive firm facing no adjustment costs, myopic expectations, and two inputs. Profits function can be written as:

$$\pi_t \equiv P_t Y_t - \omega_t L_t - c_t K_t$$

Where P is the price of output (Y), ω is the wage rate. L is the hours of labor services; c is the user cost of capital, and K is the quantity of capital services. In Jorgenson specification, the firm chooses time paths of inputs and output to maximize the present value of the profit subject to Cobb-Douglas production function. The durability of capital goods involves uncertainties about lifetime of capital goods, future prices, of inputs and output, and future output demands. Also, long-lived equipments means that the firms might not be able to dispose of unwanted capital goods, this problem called irreversibility of investment. Both problems make the present value optimization problem very complex. To avoid this problem Jorgenson assumed the existence of a perfect market for used capital goods. This means that the firm can sell its capital goods at price equals to the present value of the expected service in the remaining lifetimes.

Using the traditional Lagrangian multiplier and solving for the level of K^* such that the marginal physical product of capital equals the real user cost of capital, Jorgenson obtained

$$K^* = K = \beta Y \;/ c_k \qquad (4)$$

Where, β is the share of capital in Cobb-Douglas production function. Equation (4) implies that K is decreasing in c. To apply this equation interest rate, capital gains/losses, depreciation rate, and tax rate are included in the user cost of capital (c). Specifying constant returns to scale Cobb-Douglas production technology with some mathematical manipulation, the net investment function can be written as:

$$NI_t = \sum_{j=0}^{\infty} \beta \gamma_j (P \cdot Y / c)_{t-j} \qquad (5)$$

Where γ_i is constant over time and j is the periods that the order (investment) takes to be delivered. Equation (5) relates current net investment NI_t to a distributed lag function of current and previous investment, to current and previous changes in the optimal capital stock, and finally to current lagged output and real user cost. Adding the replacement investment δK_t, we obtain the gross investment.

In sum, the neoclassical investment model is attractive on theoretical grounds because it gives the optimal capital stock in a rigorous framework; it is the net present value rule (NPV). The marginal approach suggests that firms keep on investing until the value of an incremental value of the capitals equals to its cost, without regard to what they expect future marginal revenue products or user costs to be (Berndt, 1996). However, the foundations of neoclassical investment model have been criticized on the grounds that: the assumptions of perfect competition, zero adjustment cost, and exogenously given output are inconsistent; the assumption of static expectations about future prices, output, and interest rates is inappropriate, since investment is essentially forward-looking. In addition, the neoclassical model is for optimal capital stock not optimal investment so the choice of the lags (in decision making and delivery) are introduced ad hoc rather than based on optimization theory. Finally, by assuming the existence of perfect competitive secondhand market for used capital goods, the model considered that all investment is reversible which is not realistic.

1.3 Tobin's q Model

In practice expectation about demand and costs are central to investment decisions. Firms expand when they expect their sales to be growing and their cost to be low and vice versa. Thus it is costly for a firm to increase or decrease its capital stock. This adjustment cost was assumed to equal zero in neoclassical model. Tobin (1969) introduced a model of investment with adjustment cost, known as *q* theory of investment. Under price-taking setting and constant returns to scale production function, the firm's real profits are proportional to firm's capital stock (k) and decreasing in the industry-wide capital stock (K). We assume that the real interest rate (r) is constant; the purchase price of capital is constant and equal 1 so that the firm has only internal adjustment costs, and no depreciation. The key assumption of the model is that the adjustment costs are a convex function of the rate of change of the firm's capital stock. This assumption implies that the marginal adjustment cost is increasing in the size of the adjustment.

In a discrete-time version, the firm maximizes the present value of profits $\pi(K_t)k_t - I_t - C(I_t)$ subject to $k_{t+1} = k_t + I_t$. where I is the firm's investment, C(I) is the adjustment cost. For brevity, we will not carry out the mathematical derivations, which can be found in any textbook, see for example (Romer, 2001). Instead, we will focus on the intuition and implications. The first order condition of the profits maximizing problem in period t is given by equation (6).

$$q_t = 1 + c'(I_t) \qquad (6)$$

Where $q_t = (1+r)^t \lambda_t$ shows the value to the firm as a result of an additional unit of capital at time t+1 in time-t value and λ_t is the Lagrange multiplier. Equation (6) simply shows that the firm invests to the point where the cost of acquiring capital (purchase price plus marginal cost of adjustment) equals the value of the capital. The idea is that an increase in capital by one unit will increase the present value of the firm by q. Hence, q is the market value of a unit of capital. If the ownership is traded in the stock market, q will distinguish any firm with one more unit of capital from the other. Since the purchase price (replacement cost) is fixed at 1, then q is the ratio of market value of a unit of capital to its replacement cost. . However, if the investment ownership is not traded in the stock market, we can compute the value as an expected increase in the present value of profits as a result of installing an additional unit of capital and its replacement cost.

All information about the future that is relevant to the firm's investment decision with adjustment costs is summarized in q. The uncertainty about future price, demand, costs, taxes, and other factors affecting future profitability are explicitly included in the investment decision. When the increase in the firm's market value exceeds (or less than) the replacement cost, firms will desire to increase (or decrease) their capital stock. The investment decision is made when q is equal or greater than 1. The investment is an increasing function of marginal q in the presence of convex adjustment costs.

However, it is not easy to measure marginal q. Hayashi (1982) proved that, under perfect competition and constant returns to scale marginal q is equal to average

q, which is the ratio of the market value of the entire existing capital stock to its replacement cost. He point also to the problems in using average q. If firms enjoy economies of scale or market power, or if they cannot sell all they want, marginal q will be different from average q. Moreover, the assumption of increasing marginal installation costs underlying the q theory is dubious. The cost of additions to an individual firm's capital stock is likely to be proportional or even less proportional to the volume of investment because of the lumpy nature of many investment projects. More important, disinvestment, if feasible, is more costly than positive investment because capital goods often are firm specific and have a low resale value.

In contrast to these complicated theoretical studies, large number of recent empirical researches report that investment is not obviously related to q as expected. The recent literature has involved in solving this ambiguous relationship by focusing on three issues: uncertainty, irreversibility, and the option to wait and delay investment.

2- Modern Theory of Investment Under Uncertainty

The modern theory of investment under uncertainty is based on the interaction among three characteristics of investment, which were ignored totally or partially in previous theories. These three characteristics are uncertainty, irreversibility, and "wait and see" attitude in making investment decisions. The new literature, known as the real option theory of investment, is led by (McDonald and Siegel, 1986; Ingersol and Ross, 1992; Pindyck, 1993; Dixit and Pindyck, 1994). Although most of this literature focuses on models of firm behavior, there are many implications for aggregate

investment. In this section, I will explain the importance of uncertainty in investment decision, how previous theories addressed it, the real option theory and its new implications for investment decision, and finally the relationship between investment and different sources of uncertainty.

2.1 The Importance of Uncertainty to Investment

Investors necessarily look into the future before undertaking any investments. Therefore, investment behavior will be responsive to the degree of investor uncertainty about future prices, rates of return, and economic conditions. Indeed, Keynes (1936) was the first who pointed out that the animal spirits of private investors would be the main driving force in investment volatility since any rational assessment of the return on investment was bounded to be uncertain. In the early investment models, accelerator models and adjustment costs hereafter, the role of uncertainty—embodied in the backward looking expectations formation—was implicitly introduced through the inclusion of lagged variables. These attempts to capture the uncertainty effect had been criticized according to its ad hoc approach. The neoclassical theory did not pay much attention to the roles of expectations and uncertainty; it just assumed static expectation about future prices. Indeed, while the neoclassical model considered static expectations about future, the role of future expectations was made explicit in *q*-models of investment (Tobin, 1969) when agents' expectations about future conditions are included in the corporate stock valuation.

Before analyzing the effects of real option theory and its application to the relationship between investment and uncertainty, it is worth citing the theoretical

directional relationship between investment and uncertainty. Nickell (1978) noted that uncertainty reduces investment in the presence of adjustment costs, or in Tobin's q. However, Hartman (1972) and Abel and Eberly (1995) explained that increased uncertainty might raise investment because it can raise the marginal profitability of capital, and hence increase investment. In the theory, the two different expected signs of the relationship between investment and uncertainty depend on the shape of the marginal revenue product of capital (MRP_k) as a function of the shock. The shock here is any change in mean preserving in the variance of an uncertain variable of interest. If the function is convex, then a mean-preserving increase in the variance of an uncertain variable will increase investment and the opposite for concave function. The flexibility of labor-capital ratio is the important assumption made to produce convex function in Abel (1983), and hence positive relation between uncertainty and investment. For example, assume a firm with a fixed labor-capital ratio faces a price shock. The MRP_k function will be linear because the firm cannot adjust to such a shock. On the other hand, if labor can be adjusted, then the change in MRP_k will be more than the change in price i.e., convex MRP_k (Leahy and Whited 1996).

Models that predict concave MRP_k function are the class of models with irreversible investment. Partially or totally irreversibilities generate asymmetry in investment return. When the outlook is worse than expected, MRP_k falls and the investors will be locked in with low return. In contrast, if the outlooks improve and there is incentive to invest more, the rise in MRP_k will be limited. This asymmetry or hysteresis generates concave MRP_k function. Therefore, greater uncertainty makes

investment undesirable. Irreversibility means that the sunk cost involved in investment expenditures cannot be recovered because it is a firm or an industry specific. Irreversibility may also arise because of the absence of well functioning secondary market for capital in most countries.

There are economic rationales behind translating uncertainty on the firm level into aggregate level. It has been discussed that if firm or industry fluctuations in uncertainty are not coincident, then these fluctuations will simply cancel each other out at the aggregate level. However, Bernanke (1983) discusses two possible reasons why the effects of uncertainty may not average out at the aggregate level. Firstly, macroeconomic factors, such as uncertainty about future interest, exchange and inflation rates or shocks in fiscal or monetary policy, affect on the micro level decision-making. Secondly, aggregate uncertainty may be generated or propagated by individual decision makers. If an individual firm is uncertain about whether an aggregate demand shock is transitory or permanent, then the decision to invest may be delayed in order to learn about its degree of permanence. Bernanke (1983) argues that the irreversibility of investment is one of such propagating mechanism. Similarly, if firms are uncertain about the impact of an aggregate demand shock on their individual demand levels, they may delay decisions (Carruth et al, 2000).

Bertola and Caballero (1994) investigate the properties of aggregate investment under irreversibility. They argue that microeconomic irreversibilities in the presence of idiosyncratic uncertainty are also relevant to aggregate investment dynamics. Their theoretical analysis demonstrates that, in complete reversibility and

uncertainty, the rate of investment for a revenue-maximizing firm at any point in time will depend on the capital stock and the user cost of capital, augmented by terms to capture the stochastic effects of uncertainty on revenue. They construct a hypothetical desired aggregate investment-capital stock ratio under the assumption of reversible investment and compare this to the observed investment ratio using the following relationship:

$$\left(\frac{I}{K}\right)_t^* = \frac{1}{1-\xi}(\Delta \ln y_t - \Delta \ln c_t) - \frac{\xi}{1-\xi}\left(\frac{I}{K}\right)_T + \frac{1}{1-\xi}\delta \qquad (7)$$

where $\left(\frac{I}{K}\right)_t^*$ and $\left(\frac{I}{K}\right)_T$ are the reversible and actual investment rates respectively, Y is revenue (proportional to GNP), c is a neoclassical user cost of capital series, δ is the depreciation rate and ξ is a parameter capturing the elasticity of output with respect to capital. Bertola and Caballero show that for reasonable values of α and σ, the calculated rate of reversible investment displays much greater cyclical volatility than does the actual series. Moreover, the actual series displays much greater first order serial correlation than the reversible investment series.

Evidence for the aggregate investment-uncertainty relationship has been found using a variety of empirical approaches, and the broad conclusion is that the negative "option" effect outweighs the positive "Hartman-Abel" effect of uncertainty on the marginal value of capital. The results of the various aggregate empirical studies that attempt to correlate investment with alternative methods for proxying uncertainty show that the relationship is negative. By contrast, the results of the smaller number of disaggregated studies are far less conclusive (Carruth et. al, 2000).

2.2 Real Option Theory and Investment Under Uncertainty

The new theories of investment start from the observation of that the NPV rule, which is the basis in the neoclassical model, ignores three important issues in investment decision, which are irreversibility, uncertainty and the possibility to delay investment (option to wait). The possibility to delay means that the investment decision is no longer "now-or-never" decision as assumed is neoclassical model. Waiting for more accurate information or solving the uncertainty surrounding the investment decision is valuable and its value should be compared with the opportunity cost of not to invest now. The option to delay irreversible investment can alter the decision to invest. In this case, the NPV is not applicable. Moreover, it undermines the theoretical foundation of neoclassical investment model (Dixit and Pindyck 1994). In brief, projects that have negative NPVs may have positive NPVs once the value options purchased are included. The new theory of investment has been developed on the idea of that, an investment today buys options to invest later, and the analysis of such an investment must account for the value of these options. In addition, an option-driven strategy assumes that an investment today may derive its value from the future choices it makes possible (Kogut and Kulatilaka, 1985).

The book of Dixit and Pindyck (1994) on the effect of uncertainty provides a valuable survey of advances in this literature. They presented an option-based model of irreversible investment in conditions of uncertainty. In their model, the ability to delay an irreversible investment decision is similar to a financial call option. The possibility of postponing an investment has a cost as well as a benefit. The benefits resulting from

the arrival of new information might outweigh the cost under conditions of uncertainty. By waiting, the firm incurs a loss in the expected profits; however, new information under uncertainty is so valuable that it might lead to higher profits in the future. This suggests a critical threshold above which investment is undertaken. That is, investment takes place at the point where net present value of the investment project is positive such that it is greater than the value of postponing the project to the investor.

To explain how irreversibility and uncertainty affect the investment, consider the following example. Assume a monopolist who faces sunk cost (I) to start a project whose present value is V. under the NPV rule, if V-I ≥ o, the investor will go ahead and invest. Now if V is variable over time and evolves according to geometric Brownian motion:

$$dV = \alpha V dt + \sigma V dz \qquad (8)$$

Where *dz* is the increment of a Wiener process, α is the mean of *dV* and σ is the standard deviation of *dV*. Equation (8) implies that the current value of the project is known but the future value is lognormally distributed with expected value $E\ (V_t) = V_{t=0}\ exp\ (\alpha t)$ and a variance growing linearly with the time horizon t. Since V evolves when information arrives, the future value of the investment is always uncertain. The firm will maximize the expected present value of the investment opportunity, given by $F\ (V) = max\ E\ [(V_T - I)\ exp\ (-\rho T)]$. The solution to this problem is given by equation (9).

$$V^* = \frac{\beta}{\beta - 1} I \qquad (9)$$

Where $\beta = \frac{1}{2} - \alpha / \sigma^2 + \sqrt{(\alpha / \sigma^2 - \frac{1}{2})^2 + 2\rho / \sigma^2}$

Equation (9) defines the wedge $\beta / (\beta - 1)$ between the payoff needed to induce the investor to exercise the option to invest V^* and the present value of the cost of the investment I. given that $\beta > 1$, the wedge is always greater than 1, and hence $V^* > I$. The size of the wedge is positively related to uncertainty about future returns σ, discount rate ρ, and the drift term in the evolution process of the expected rate of return α. The wedge converges to unity when β increases and in this case NPV and real option rules coincide.

According to the preceding analysis, the higher the level of uncertainty and the greater the irreversibility investment, the greater the opportunity cost of undertaking the investment in the current time. Investors will require a higher rate of return in order to compensate for the opportunity cost of exercising the option to invest rather than waiting. When the rate of returns are constrained by the availability of investment opportunities, the productive capacity of these investments, and the efficiency in allocating resources, then under the conditions of real option theory investors will choose the option to delay investment and this would lead to a fall in aggregate investment. The model of irreversible investment under uncertainty identifies the conditions under which the investment should be undertaken, rather than giving a structural model of investment. However, the predictions of this approach are quite clear in the sense that uncertainty plays an important role in determining private investment although the analytical studies present different results on the sign of the effect of uncertainty (Serven, 1998).

2.3 Inflation, Inflation Uncertainty, and Investment

Intuitively, inflation uncertainty is the degree to which the future inflation rate is unknown in the sense of not being predictable, given past performance (Golob 1993). Similarly, long-run price-level uncertainty is the extent to which the longer-term path of the price level is unpredictable. Since these concepts seemed to be closely linked, however they are still distinct. Then, a high level of long-term inflation uncertainty would still imply a high level of price-level uncertainty. The connection between inflation uncertainty and investment can be through uncertainty about real wages, output price, and /or real profit.

A typical mechanism through which inflation uncertainty affects business investment is through the discount rate that is used to calculate the expected net present value, that is, its effect on the cost of capital. Increased uncertainty clearly raises the cost of capital through its effect on the discount rate used to calculate the expected net present value. If the firm cannot diversify the uncertainty about real future payoffs, increased uncertainty will deter a firm from undertaking capital expenditure (Huizinga, 1993). The mechanisms through which changes in inflation uncertainty may affect longer-term real economic performance can also be found in the recent theoretical literature on investment and irreversibility. The implications of the assumption of irreversibility for investment decision-making are likely to be even more important in situations of high levels of aggregate- or industry-wide uncertainty (non-diversified uncertainty).

In contrast, the theoretical work by Abel (1983) shows that the benefits of having a high capital stock when the price-cost-ratio is high outweigh the costs of having a high capital stock when price-ratio is low. This suggests that increased uncertainty about a firm's ratio of output price to variable cost should increase capital stock. However, in the context of real option theory, when the firm decides to invest, it ignores an option and this option becomes more valuable with higher inflation uncertainty leading new firms to be reluctant to invest, given the assumption of irreversibility. For a new firm, higher uncertainty would lower the optimal capital stock.

As well, if the economic environment in the future is perceived to be more uncertain than at present, then the required level of profitability on new investment projects will rise, leading to a clear reduction in investment (Caballero et al 1997). Moreover, the objective of the promotion of aggregate capital spending is likely to be better achieved by stable and credible macroeconomic policies than by frequent changes in tax rates or interest rates (Pindyck 1991). In particular, a significant increase in uncertainty regarding future economic policies would likely raise the value to many firms of waiting for more information, and lead them to reduce investment expenditures substantially, at least in the short run. The analysis of economic behavior in models with incomplete market implies that an increase in uncertainty regarding future incomes, part of which might reflect higher long-run inflation uncertainty, would lead households to reduce current consumption, while firms would postpone selected irreversible investment projects (Drèze 1999).

In financial investment, if there is a substantial rise in uncertainty regarding the future path of aggregate prices, then it becomes much riskier for agents to hold un-indexed longer-term nominal assets. The recent theoretical literature focusing on asymmetric information in credit market shows how higher rates of inflation can impair the effective functioning of the financial market. An increase in the rate of inflation lowers the real rate of return on all financial assets, thereby increasing the level of frictions in credit markets and consequently reducing investment spending (Huybens and Smith 1999). In addition, it seems likely that financial markets would perform less effectively if inflation and long-run inflation uncertainty rose. The various effects on financial markets arising from greater long-term inflation uncertainty have adverse effects on investment and economic growth.

Focusing on the source of uncertainty, short versus long run effect, Chadha and Sarno (2002) found evidence of a clear link between uncertainty in the price level and investment. Moreover, they found that short-run uncertainty is more important in determining real activity than long-run uncertainty. Ball and Cecchetti (1990) when considering the impact of uncertainty in inflation on the level of inflation itself also raised this point.

2.4 Exchange Rate, Exchange Rate Uncertainty, and Investment

Exchange rate changes and uncertainty surrounding it affect domestic investment through three forces: (I) Sectoral profitability effect, (II) Location Effect, and (III) portfolio and Wealth effect (Goldberg 1990). Sectoral profitability is affected by both Exchange rate changes and exchange rate uncertainty. Depreciation

(appreciation) changes relative-price, which increase (decrease) demands for exports and import-competing goods. Increased (decreased) profitability of domestic producers caused by depreciation (appreciation) would lead firms to expand (contract) investment in capacity and new plant and equipment. In addition, the real income-reducing (increasing) effect of depreciation (appreciation) may lead to a contraction (expansion) in domestic demand, which exceed corresponding increases (decreases) in foreign demand for domestic goods. Furthermore, in the absence of domestic substitutes for imported intermediate inputs, the depreciation (appreciation) increase (decrease) the marginal costs of production and hence appears to be negative/positive supply shock. The net effects of the exchange rate changes on foreign demand for domestic goods have determinate effect on prices but not quantity. This suggests that the expected effect of exchange rates on investment is ambiguous.

On the other hand, exchange rate uncertainty affects the sectoral profitability via its impact on expected costs of production and revenues from international sales. The sign of this relationship depends on the balance of three factors: (1) the negative effects from risk aversion of investors, (2) the negative effects of investment irreversibilities, (3) the positive effects from convexity in prices, and (4) the negative effects from a profit and price uncertainty relationship that is possible under imperfect competition (Goldberg 1993).

The "location effect" refers to the entry and exit of firms from the market in response to exchange rate changes and exchange rate uncertainty (Goldberg 1990). These effects depend on the barriers to entry, the sunk cost of exiting. The location

channel for the impact of exchange rate uncertainty on investment depends on the exposure of both domestic and foreign producers to foreign exchange rate changes. High exchange rate uncertainty causes more reluctance to enter or exit industries. Thus, the elasticity of investment to exchange rate changes will be affected in high uncertainty periods. The "portfolio and wealth effect" of exchange rate changes refers to the redistribution of wealth across international investors via risk aversion and home assets preferences. For example, if the dollar depreciates against the euro, the Europeans gain wealth relative to Americans. This redistribution of wealth may shift aggregate portfolio and direct investment demands. Nevertheless, if the Europeans have strong home assets preferences, the wealth distribution may reduce overall investment in the U.S.

Based on these results we can say the sign of the impact of exchange rate uncertainty on investment is an empirical matter. In developing countries, the view may be different. The substitutability between traded and non-traded goods is very weak or may not exist because the traded good sectors in most of developing countries are exporting primary goods, raw material and oil. In addition, these countries do not have a well-diversified manufacturing base. Therefore, if demand for traded goods rises due to depreciation, resources may not be reallocated toward this sector and away from the production of non-traded goods. Another contractionary effect of exchange rate depreciation originates on the supply side. The increased demand for factor inputs by tradables sector raises the cost of nontradables.

Furthermore, the cost of intermediate goods required in producing non-traded goods will increase due to depreciation.

Under exchange rate changes, uncertain economic environment and costly reallocation of resources across sectors, we expect that the response of resource transfer and investment to exchange rate changes is weak. Foreign direct investment is operating indifferent currency units, therefore the firms' profit and firms' decisions as where to produce may be affected by exchange rate movements and exchange rate uncertainty. So exchange rate uncertainty not only can create a problem of managing the risk inherent in its volatility but also present the opportunity of moving production to lower cost facilities. Sung and Lapan (2000) and Goldberg and Kolstad (1995) studied the effect of exchange rate risk on FDI. Their model assumes constant marginal cost and the production decisions are made before resolving the uncertainty. They showed that increased exchange rate uncertainty led a risk-averse firm to alter its FDI in order to reduce risk. On the other hand, some empirical studies show that positive and significant correlation between increases in exchange rate risk and FDI flows (Cushman 1985).

In Developing Countries, Serven (2003) found that real exchange rate uncertainty has a highly significant impact on investment. The impact was larger at higher levels of uncertainty. Moreover, the investment effect of real exchange rate uncertainty was shaped by the degree of trade openness and financial development: higher openness and weaker financial systems are associated with a more significantly negative uncertainty- investment link. Recent studies on exchange rate uncertainty and

investment such as Nucci and Pozzolo (2001) and Baum et al. (2001) have extended looking for the source of uncertainty. These studies reported that permanent changes in the exchange rate are important for the level of investment whilst changes in the transitory component are not.

2.5 Credit Availability, Credit Uncertainty, and Investment

The neoclassical model of investment predicts that investment is negatively related to the cost of capital. Empirically, this prediction has not been fully supported in both developing and industrial countries (Chirinko, 1993). The analytical and empirical studies of developing countries in particular have attributed this result to the institutional and structural characteristics of these countries. Private investment in developing countries is constrained mainly by the availability of external funds rather than the cost. Credit constraint is likely to be more important partly because the relative scarcity of financial resources in developing countries. Moreover, controls over interest rates and credit rationing in the financial markets in most developing countries highlight the importance of credit availability and reduce the role of the cost of capital (proxied by the interest rate). Adding the credit availability to the model instead of the cost of capital, empirical studies found that the availability of credits to private sector positively affects private investment (Blejer and Khan, 1984 for a panel of developing countries and Ramirez, 1994 for Mexico). Therefore, they suggested that credit availability exerts a binding constraint on private investment that makes the cost of financing less important in explaining private investment in developing countries (Erden, 2000). There is, however, another theoretical explanation provided

in the literature of irreversibility approach to modeling investment behavior. Pindyck, 1991; Caballero, 1991; Dixit and Pindyck, 1994; Abel and Eberly, 1994, 1995 argued that uncertainty surrounding the costs of credit may have a more substantial impact on private investment than the level of costs.

Accordingly, there may be another reason why the cost of capital (often proxied by real interest rate) does not show up as a statistically significant determinant of private investment. For example, private firms/investors may not respond to the changes in real interest rate because of uncertainty surrounding the real cost of capital. Given the preceding discussion, we will investigate the effect of credit availability and credit uncertainty on investment in our model

3- Investment and Credit Market Imperfection

There is a huge literature about the role of capital market imperfection in investment decisions. Surveying this literature is beyond this chapter (Fazzari et al 1988). However, I will explain the idea and relate it to uncertainty. The basic idea about the role of capital market imperfection and investment is that Firms usually choose between "internal funds" (retained profits, cash flows, etc…) or "external funds" (borrowing from financial institutions such as banks) to finance their investments. Under complete markets, the firm should be indifferent to choose one of these sources. However, under imperfect capital market, due to asymmetric information, external funds may not be available or available at a prohibitive price. Since internal funds are partially exhausted and external funds are costly, firms in this

situation are called financially constrained firms because they are presumed to underinvest and cannot take advantage of their investment opportunities.

The problem of imperfect capital markets has macro-aspects and micro-aspects. Frictions arising from capital market imperfection affect the expected future profitability and user costs of capital and can play a major role in propagating relatively small shocks. Macroeconomists noticed that cyclical movements in investment could be largely explained by financial factors; therefore, they identified them in investment models. In this context, the term "financial accelerator" has been used to refer to the magnification of initial shocks by capital market imperfections (Bernanke, Gertler, and Gilchrist 1994).

The gap between the cost of internal and external funds is explained by asymmetric information between borrowers and lenders. The micro-aspects of capital market imperfection explain the reasons and impacts of such asymmetric information on credit markets. Imperfect information produces adverse selection and moral hazard problem, which in turn generate frictions in capital markets. Adverse selection in credit market means that the market of bad quality borrowers (or more risky) drives out the good ones. A higher return is required to compensate external providers of funds for monitoring and screening cost and the potential moral hazards associated with managers' control over the allocation of investment funds. These problems drive the gap between the cost of external fund (including "Lemons" premium) and internal funds.

We can modify the graphical illustration given in (Hubbard 1994, 1998) to simplify the discussion about the effects of asymmetric information in credit market on investment and to consider the effect of uncertainty. In his paper, Hubbard assumed the following in figure (1-1): (D) is the firms' demand for capital. Its location is determined by factors affect the firm's investment opportunities. (S) is the supply curve of funds; it consists of two parts. The first is the horizontal line at real interest rate (r^*) up to the level of funds that the investor has (W_0) i.e. initial internal fund. In this range, there are no agency costs and the external funds providers (lenders) charge rate of return equal the real interest rate as assumed in neoclassical investment model. The second part is upward sloping to reflect the increasing information costs needed to compensate the risk of opportunistic behavior of the borrower as he/she engaged in uncollateralized loans. Of course, an increase in the internal funds (W_1), will shift the curve to right because the increase in W will reduce the borrower's incentive to misallocate funds reducing the informational cost and subsequently the cost of borrowing decreases. Finally, the positive slope portion of S curve will be steeper as marginal cost of information increases and vice versa. Under frictionless setting (no information cost), K^* is the best capital stock where investors are indifferent to finance their investment by internal or external funds. Now in the presence of imperfection (positive friction i.e. information cost), the actual level of capital stock K_0 be determined by the intersection of D1 and S (W_0). This level is under the best level. That is, there is underinvestment due to capital market imperfection.

Now let us discuss the effects of Introducing uncertainty in the presence of capital market imperfection. First, the S (W_0) curve will be steeper as the cost of information gets higher. This effect by itself will reduce investment to K_1. If we assume that the investment opportunities will decrease under uncertainty, then the D_1 curve will shift left causing further decrease in investment. This discussion has two important implications. First, uncertainty combined with the imperfection will result in underinvestment. Second, uncertainty with the imperfection in credit market may cancel out the effect of interest rare on investment. We may expect a decrease in investment at the same time we see interest rate falling. Although these results are based on assumption that is more realistic, uncertainty and imperfect markets, they may underpin the neoclassical theory of investment in which financial factors are ignored. To test these results empirically we will consider a proxy for credit market imperfection (credit flow/GDP ratio) and uncertainty measures, inter alia, credit availability uncertainty in our investment model.

Finally, having the complementarities between capital inflows and domestic credit, then the surge in capital flows would increase credit as follows: capital flows will Increase the asset prices (land, real state) and in imperfect credit market, debt capacity is limited and then agents are credit-constrained within the value of collateral holdings. This value will increase due to the increase in asset prices. The increase of collateral holdings will increase the debt capacity of credit-constrained agents, which subsequently increases credit. The adverse shock to international capital market will

cause persistent contractionary effect in the presence of credit market imperfection. (Kubo, 2002)

4- Capital Flows and Domestic Investment

In the theory, the reallocation of capital from industrial countries to developing countries, where the marginal productivity of capital is relatively high, can improve living standards by mobilizing global saving to finance investment opportunities in developing countries. It has been observed that private capital flows have been associated with a rise in domestic investment in developing countries. However, it is not clear whether the capital flows has a direct effect on domestic investment or indirect effect by just financing the investment that would have occurred in any event (World Bank, 2001). The relationship between capital flows, especially FDI, and growth has been widely discussed in economic literature, but the precise nature of the relationship and the mechanism through which it promotes growth remain unexplored. I shall focus first on the impact of foreign investment on economic performance via domestic investment, and then I will discuss the determinants of FDI and the role of capital flows in economic growth.

Theoretically, at least FDI may affect private and public investment in the host country through two distinct channels. First, FDI can raise the profitability of domestic investment by involving in providing infrastructure, supplying scarce inputs, creating demand for local inputs and labor, spreading positive externalities, and increasing tax revenue that may be used in public goods. On the other hand, FDI may reduce profitability of domestic investment by possessing large market share, worsening terms

of trade, stifling domestic competition, and spreading negative externalities if it is tariff-jumping FDI type. Second, FDI could increase domestic investment by providing facilities, to acquire and merge with domestic firms, such as additional funding and efficient marketing network. When FDI firm owns domestic investment in the process of privatization, the total investment will not change but the ownership structure will change. The change in ownership structure of total investment will have a negative effect on domestically financed investments, given the financial market constraints (McMillan, 2001).

Now we turn to discuss how domestic investment stimulates capital flows. The country's absorptive capacity plays a major role in magnifying the positive effect of capital flows on domestic investment. It includes not just the macroeconomic policy framework but also political stability, the depth of financial system, the well-educated labor force, the quality of infrastructure, and the degree of corruption. More specifically, Capital flows are more strongly associated with domestic investment in countries where financial markets are deeper. Diamond (1984) shows that specializing in financial services will reduce the costs of acquiring information and diversify risks by pooling the funds of depositor, hence increase liquidity and facilitate investment in the long run. Moreover, financial sector development is significantly associated with faster growth (Beck et al 2000). It has been discussed that foreign capital often brings new financial instruments, accounting and financial disclosure practices. These benefits enhance the standard of local capital markets by acquiring more quality of information and transparency. Capital flows and financial development can reinforce each other.

Portfolio flows and bank lending can increase financial sector development, and hence increase the efficiency of capital allocation (Hechet et al 2002). However, an inflow of capital does not guarantee improvement in financial sector especially when capital flows are volatile.

Besides, the importance of domestic conditions' role in attracting capital flows, domestic conditions affect the composition of capital flows. Razin et al. (1998) explain that the information asymmetry problem affects on the composition of capital flows to developing countries. They suggest that FDI is the most preferred type of capital flows because it overcomes the informational barriers. The next in the ranking is the debt flows, FBL while the equity (FPI) will be issued as a last resort when information asymmetries are the least. Hull and Tesar (2000), show that, for small countries that integrate into the global capital markets with firms that have relatively high risk and lower credit rating, international capital flows will be dominated by FDI and FPI as opposed to FBL.

Dunning (1988) put forward general framework in which we can determine the variables likely to affect on FDI activity. This framework consists of three potential advantages for FDI in a foreign country: ownership, location and internalization (OLI). First, ownership advantages (firm specific advantage) include any monopoly power that the MNC may practice and allows it to overcome the costs of operating in a foreign country, for example, proprietary technological know-how, R&D capacity, trademarks and known brand names, and workers and managers with industry specific human capital. The firm specific advantages such as product differentiation or

economies of scale serve as entry barriers at home and as a way to subdue the obstacles of competing in foreign markets, hence, make the FDI a preferable mode of entry. Second, internalization advantages achieved via coordinating production hierarchies versus markets, increase efficiency and reduce costs of transactions. These advantages enable large firms to accomplish goals more cheaply within the single firm than can be accomplished in a market setting among separate corporations. If there is no market or the market functions poorly, transaction costs can be kept in check by internalization. For example, internal economies of production, advantage of intra-firm trade, economies of scale in overhead operations (marketing, finance, purchasing). These advantages make the firm's choice is to own the foreign assets directly rather than to use other mode to obtain the rents from foreign production. Third, location advantages (country specific advantage) which are factors that favor production either at home or abroad. For example, prices of internationally immobile inputs, differences in quality of infrastructure (public; educational; commercial and legal), transportation costs, economies of marketing when production is located near the market (Gray, 1999).

The OLI framework suggests that countries tend to go through five main stages of development and these stages can be classified according to the propensity of those countries to be outward and/or inward direct investors. In turn, this propensity will depend on the extent and pattern of the OLI advantages. The country's path in these stages is determined by three variables. First is the size and structure of resources. Second is the economic development strategy, that is, the orientation of an

economy to be export oriented or import substitute regime. Third is the role of government (Dunning and Narula, 1996).

The relation between capital flows and economic growth can be discussed in the context of endogenous growth model. In the endogenous growth theory, increasing returns to scale, imperfect competition, human capital accumulation or spillovers effects could avoid the decline in the marginal physical product of capital. The most influential endogenous model presented by Romer (1990), has many interesting implications for international economic integration. According to the model, the higher the interest rate, the lower the present value of the profits the machine monopolist will earn, and the less she will bid at auction for the design to which it relates. A lower price of new designs means less income for inventors. It, therefore, means fewer inventors, and so fewer inventions, slower expansion in producing capital goods and, therefore, a slower rate of economic growth. This negative growth-interest relationship with the positive growth-interest relation, derived from consumer optimization, determine the long-run equilibrium of interest and growth. Romer's model concentrates on the steady state, where the ratio of consumption to income is constant. That means that higher interest implies faster income growth, since income and consumption have to grow at a common speed at the steady state. Romer concludes that access to the stock of foreign knowledge leads to a doubling in the rate of invention causing the both growth rate and interest rate to increase. The new growth theory views FDI as a composite bundle of capital, know-how and technology. Its contribution to growth is through technology transfer and

technology and skill diffusion in the countries importing FDI. As has been cited in the literature, the two greatest benefits for a recipient country from FDI are the technology transfer and the externalities, measured in terms of spillovers generated by the FDI.

Empirically, a number of studies have analyzed the impacts of capital flow on domestic investment. Feldstein (1994) find that the relationship between capital flows and domestic investment tends to be one to one. A one dollar increase in capital flows will raise domestic investment by one dollar. In the same line Borensztein et al. (1998) find that the impact of an increase in FDI by one dollar on domestic investment is greater than one dollar, but only in a setting with sufficiently high level of human capital. Bosworth and Collins (1999) analyze the relationship between various types of private capital flows and both investment and saving, focusing on the variation over time within countries rather than the variation across countries. They find that FDI and FBL have a strong impact on domestic investment while FPI has positive but insignificant effect on investment. World Bank (2002) replicates Bosworth and Collins study using a data set with broader country coverage and a longer period. The study concludes the same results that private capital flows (long-run plus short-run) are seen to have close one to one relationship with domestic investment and the capital flows are associated with a broader stimulation of demand that implies that not all private capital flows are invested.

In sum, we can say the interactions between capital flows and domestic investment depends on first, the nature of capital flows (short run versus long run) and

its composition (the magnitude of each type i.e. FDI, FBL, and FPI) second, to what extent the domestic economies are globally integrated, third, the domestic investment climate.

5- Private Investment and Government Expenditure

The relationship between private investment and public expenditure should be considered in designing any macroeconomic policy. In general, traditional investment models do not offer a consistent theoretical rationale for having government expenditure as a determinant factor in capital formation. However, various empirical studies have included it in investment studies to test the "crowding-out" hypothesis (Aschauer 1989 and Looney et al, 1997). These studies argued that the influence of public investment should be considered since public capital may compete or may complement private capital.

The literature identifies two channels through which the public expenditure and private investment may compete resulting in "crowding out" or may complement resulting in "crowding in". Given the relative scarcity in domestic finance, if the public investments depend on borrowing, this will lead to an increase in the market interest rate (the price of these resources) and thus the cost of capital for private investor. The result will be a decrease in private investment. Hence, the public investment is crowding out private investment. On the other hand, public investment may be beneficial for encouraging and developing private investment public investment in infrastructure may enhance the productivity of private capital and, hence, increase private investment. Hence, the public investment is crowding in private investment. In

addition, the government investment that is used as a counter-cyclical economic policy tool to harness business cycle may stimulate aggregate demand and revitalize private investment at least in the short run. The two channels may operate in opposite direction, so the net effect will be for the dominant one.

Empirically, the relationship between public spending and private sector's productivity was examined in (Barro, 1981 and Aschauer, 1989). The empirical analysis of Aschauer (1989) is based on the neoclassical model in which private non-residential investment was assumed to be a function of government investment, government consumption and the rate of return on private non-financial corporate capital. It was shown that government investment "crowded-out" private investment while increasing marginal productivity of private capital by a factor of one to one. He argued that while both channels appear to be operating, the latter comes to dominate, so the net effect of a rise in public investment expenditure is likely to raise private investment. This means that government investment had a positive effect on private investment and caused a "crowding-in" rather than a "crowding-out." Karras (1996) discussed that the small size of government is a catalyst in the interaction. It increases the productivity since the marginal productivity of the government services is negatively related to government size.

It is worth noting that the crowding out arguments is based on the assumption that the economy has well developed and efficiently functioning financial markets. These conditions are dubious in the context of developing countries. Hence, the public investment may not necessarily compete with private sector for the scarce resources.

Also in certain cases, capital market imperfection may imply that firms are rationed in their access to external funds. Thus, credit may be available but banks may not provide it because the limited liability of firms and agency costs associated with informational asymmetries and costly contract enforceability. As a result, the private sector and overall economy may benefit from public investments.

CHAPTER II
MEASURING UNCERTAINTY OF MACROECONOMIC VARIABLES IN OIL PRODUCING COUNTRIES

This chapter constructs uncertainty measures for some of macroeconomic variables that have been chosen from the first chapter to estimate a model for how the uncertainty affects the interaction between domestic investment and capital inflows in a sample of oil producing countries and Middle East and North African countries (MENA). Through this work we explore the sources and the importance of uncertainty in those countries and then turn to discuss and examine empirically different approaches to measure uncertainty. Specifically, we measure uncertainty proxies for inflation, exchange rate, real interest rate- as a proxy for real cost of capital, credit availability, and oil price using ARCH model originated by Engle (1982) and GARCH model developed by Bollerslev (1986). Since the specific source of uncertainty, short lives versus long lived, has important implications in analyzing the impact of uncertainty on investment behavior, we will apply the recent work in GARCH literature, component GARCH, developed by (Engle and Lee, 1999). The chapter will focus on decomposing uncertainty into its component using component GARCH, CGARCH, on all variable of interest when it is applicable. We also try to investigate the impact of different shocks to oil price on the short run and long run oil price uncertainty. As a first step in modeling and estimating any time series, tests for unit root and stationary are important. In this chapter we provide more powerful unit

root tests than simple OLS Dickey Fuller tests by using GLS detrended class of unit root tests. The strategy developed by Ng and Perron (2001) will be adopted.

The rest of the chapter is organized as follows. Section 2 explores the different sources of uncertainty facing oil producing countries and why those variables are important in investment models. In section 3 we review uncertainty definitions and discuss some measures of uncertainty and explain why we chose one rather than others. Also in this section we discuss various econometric models of uncertainty and present the models used in this study. Section 4 presents the data and the empirical results. Component GARCH model of oil price is estimated in section 5.

1- Macroeconomic Uncertainty in Oil Producing Countries

The previous chapter proposes certain variables to be considered as uncertainty proxies in investment model in oil producing countries. In this section I will focus on these proposed variables. In particular, we consider uncertainty of inflation, exchange rate, credit cost (real interest rate), the credit availability, and oil price. The latter may not be important in other countries, but it is in our study because most of countries in our sample are exporting oil.

Inflation is a measure of the relative price of goods today and goods tomorrow; thus, uncertainty in tomorrow's price impairs the efficiency of today's allocation decisions. Inflation is often taken as a summary measure of the overall macroeconomic stance, and hence the volatility of its unpredictable component can be viewed as an indicator of overall macroeconomic uncertainty (Eberly, 1993). The unpredictability of future inflation is a major component of the welfare loss associated

with inflation. When inflation is unpredictable, risk-averse economic agents will incur a loss, even if prices and quantities are perfectly adjusted in all markets (Engle 1983). In addition, high inflation rates tend to be volatile. The inflation and uncertainty surrounding it have many impacts on investment. Unanticipated high inflation erodes the real value of financial assets and the volatility of inflation increases the risk associated with holding them. The recent literature regarding asymmetric information in credit markets indicates how higher rates of inflation can hamper the effective functioning of the financial sector, including financial markets. The lower real interest rates associated with high inflation rates increase the level of frictions in credit markets and consequently reducing investment spending (Hubbard and Glenn 1994). Huizinga, 1993 indicates that the typical view of the link between inflation uncertainty and capital expenditures may capture important implications of portfolio diversification but not capture the entire link between uncertainty and investment. In the long run, increased uncertainty raises the cost of capital, given the assumption of irreversibility. For a new firm higher uncertainty would lower the optimal capital stock (Abel and Eberly 1999). On the other hand, existing firms would have greater difficulties in selling capital if uncertainty rose. Also, if the future economic environment is expected to be more uncertain than present, then the required profitability level on new investment projects will rise, leading to an obvious reduction in investment (Caballero 1999). In contrast, aggregate capital spending is likely to be better achieved by stable and credible macroeconomic environment than by frequent changes in interest rates or tax rates (Pindyck 1991). The countries in our study have experienced high inflation

rates in the eighties and nineties. Also, after implementing economic reform programs in these countries the inflation uncertainty rose during the process of economic adjustment. Some countries succeeded in curbing inflation but the others do not and still in the process of reform.

Exchange rate volatility is another source of macroeconomic uncertainty. One of the important channel through which exchange rate changes and its uncertainty transmit to the economy is the investment. Exchange rate affects domestic investment through three forces; sectoral profitability effect, location Effect, and portfolio and wealth effect, Goldberg (1990). Details for this point are discussed in Chapter I. However, we mention to some points regarding exchange rate uncertainty. Sectoral profitability is affected by both Exchange rate changes and exchange rate uncertainty. Depreciation (appreciation) changes relative-price which increase (decrease) demands for exports and import-competing goods. Increased (decreased) profitability of domestic producers caused by depreciation (appreciation) would lead firms to expand (contract) investment in capacity and new plant and equipment. On the other hand, exchange rate uncertainty affects the sectoral profitability via its impact on expected costs of production and revenues from international sales. The sign of this relationship depends on the balance of the: (i) negative effects from risk aversion of investors; (ii) negative effects of investment irreversibilities; (iii) positive effects from convexity in prices; and (iv) negative effects from a profit and price uncertainty relationship that is possible under imperfect competition (Goldberg 1993). The "location effect" refers to the entry and exit of firms from the market in response to exchange rate changes and

exchange rate uncertainty. (Goldberg 1990). These effects depend on the barriers to entry, the sunk cost of exiting. The location channel for the impact of exchange rate uncertainty on investment depends on the exposure of both domestic and foreign producers to foreign exchange rate changes. High exchange rate uncertainty causes more reluctance to enter or exit industries. Thus the elasticity of investment to exchange rate changes will be affected in high uncertainty periods (Goldberg 1990). The "portfolio and wealth effect" of exchange rate changes refers to the redistribution of wealth across international investors via risk aversion and home assets preferences. For example, if the dollar depreciates against the euro, the Europeans gain wealth relative to Americans. This redistribution of wealth may shift aggregate portfolio and direct investment demands. But if the Europeans have strong home assets preferences, the wealth distribution may reduce overall investment in the U.S.

Based on these results we can say the sign of the impact of exchange rate uncertainty on investment is an empirical matter. In developing countries the view may be different. The substitutability between traded and nontraded goods is very weak or may not exist because the traded good sectors in most of developing countries are exporting primary goods, raw material and oil. Also these countries do not have a well-diversified manufacturing base. Therefore, if demand for traded goods rises due to depreciation, resources may not be reallocated toward this sector and away from the production of nontraded goods. Another contractionary effect of exchange rate depreciation originates on the supply side. The increased demand for factor inputs by tradable sector raises the cost of nontradables. Furthermore, the cost of intermediate

goods required in producing nontraded goods will increase due to depreciation. So under exchange rate changes, uncertain economic environment and costly reallocation of resources across sectors, we expect that the response of resource transfer and investment to exchange rate changes is weak.

The high exchange rate volatility that characterizes developing economies creates an uncertain environment for investment decisions by making absolute and relative sectoral profitability (traded vs. non-traded goods sectors) and the cost of new capital goods (because of their high import content) all harder to predict. Ceteris paribus, increased volatility of these variables makes price signals less informative about the relative profitability of investment across sectors, likely hampering and distorting investment decisions (Serven, 2003). In the international finance context an exogenous inflows of capital could lead to a real exchange rate depreciation or appreciation. The effect depends on how these inflows are used, to finance domestic spending or to accumulate capital in the traded or non-traded goods sector. Alternatively, stabilized exchange rate policy may lead to a real appreciation and higher domestic interest rates, inducing greater capital inflows and more foreign investment.

One of the hypotheses to be tested in this thesis is the impact of capital inflows on investment. The neoclassical theory of investment predicts a strong and negative relationship between private investment and the user cost of capital. However, this prediction is not supported by empirical tests applied to the data from industrial and developing countries that find a weak and insignificant link between the two (Chirinko,

1993). Economists have provided one explanation arguing that the quantity of external credits rather than the costs (interest rates) may be more binding in developing economies. Credit constraint in developing countries is likely to be more important because, in part, the quantity of financial resources is limited. Given the fact that most of financial markets in developing countries including MENA are weak and shallow, the researcher claims that capital inflows are channeled via credit provided by banks in these countries. Since the capital inflows are volatile, then its volatility may be reflected in total credit provided by banks. Thus, our concern in this chapter is to explore capital inflows volatility embodied in credit availability uncertainty.

Even though the empirical studies have found no significant effect of the cost of capital on investment, the uncertainty surrounding the real cost of credit may also play a major role in investment decision. Interest rate uncertainty can have two effects on an investment decision. First: the expected value of future payments from investment can be increased due to unpredictable fluctuation in interest rate and this makes the investment more attractive. Second, given the irreversibility of most of private investment in developing countries the uncertainty over the future interest rate can lead a postponement of investment. In our investment model, we need to test the claim that uncertainty stemming from financial markets either from credit availability or real cost of credit plays an important role in determining private investment in developing countries.

The relationship between oil price uncertainty and investment can be explained theoretically and practically. Theory predicts that uncertainty about future oil prices

makes investment behavior more sluggish. The idea is that higher oil price uncertainty implies high possibility for such prices to be reversed, and hence induces firm to postpone its decision to adopt new capital goods. When decision makers face uncertainty about future prices and returns and when their decisions are irreversible, there will be an option value to delay the investment decision. The value of this option increases when uncertainty increases. The expectation that heightened uncertainty, by delaying projects, would lead to a fall in aggregate investment. Practically, oil price uncertainty means oil revenues uncertainty for oil exporting countries and means costs uncertainty of importing ones. This uncertainty feeds uncertainty in the macroeconomic environment, especially when these revenues/costs contribute with high percent in economic development programs.

The effect of macroeconomic instability on growth comes mainly from the effect of uncertainty on private investment. Inflation, real exchange rates, real cost of credit, terms of trade and other key macroeconomic variables are much more uncertain than in industrial economies. The implications of such volatility for aggregate performance have stimulated some attention in recent empirical literature. In investment, the vehicle of economic growth, this concern has been updated by recent theoretical work identifying several channels through which uncertainty can affect on investment. However, some of these effects of uncertainty work in mutually opposing directions, and their magnitude depend on a variety of factors identified in the literature. As a result, the sign of the investment-uncertainty relationship is

indeterminate on theoretical grounds and the empirical work becomes the last resort to help policy analysis.

2- Uncertainty and Volatility: Definition and Measurement

This section provides an overview of different approaches to measure uncertainty, referring to some empirical literature in investment. We discuss the advantages and disadvantages of each measure and argue why we focus on GARCH. We conclude the section with the definition of uncertainty.

In empirical literature we can identify two main approaches to obtain uncertainty measures. The first one is to use historical values of the variable to establish statistical or econometric estimations of the variability of it and then use this measure as a proxy for uncertainty. We refer it as ex-post uncertainty measures. The second approach is to estimate uncertainty from surveys of economic expectations and we refer it as ex-ante uncertainty measure or survey based model for uncertainty.

2.1 Ex-ante Uncertainty Measures (Survey-Based Measure)

In the survey based-models we obtain the standard deviation from the point forecasts made at a point in time by several different forecasters. This variability is actually a measure of the disagreement among the forecasters and is used as a proxy for uncertainty. In their remarkable work, Zarnowitz and Lambros (1987), introduce the most direct measures of uncertainty that can be used from survey of expectations, and use it to study inflation uncertainty. To get the idea we give an example, the oldest quarterly survey of macroeconomic forecasters in the United States, which is the

Survey of Professional Forecasters (SPF). It was began in 1968 and conducted by the American Statistical Association (ASA) and a National Bureau of Economic Research (NBER) and known as the ASA-NBER survey. In 1990 Federal Reserve Bank of Philadelphia and NBER assumed responsibility for that survey.

In brief, the forecasters in the SPF come largely from the business world and Wall Street. Most of he questions ask for point forecasts, for a range of variables and forecast horizons. Also each forecaster is asked to attach a probability to each of the number of intervals in which the variable of interest might fall, in the current year and in the next year (Diebold 1998). In fact, we can retrieve a direct measure of uncertainty from the standard deviation around those probabilities. In addition, this measure summarizes the dispersion among forecasters at a point in time, but do not measure each forecaster's certainty about their inflation forecast. Also this method provides measures of dispersion such as the difference between the upper and lower quartile forecasts and the difference between the maximum and minimum forecasts.

Among the benefits of survey-based measure is that better represents what economic agents really perceived at the time they made decisions. If these surveys reflect the market's perceptions, then the level of uncertainty in the market about the expected realization of the most important macroeconomic variables can be acquired from them (Sepulveda 2003). The validity of survey measures of uncertainty is often questioned, since they do not take account of the level of uncertainty of each individual forecaster (Grier and Perry 2000). We can argue that in a given period each forecaster could be extremely uncertain about inflation and then submit similar point

estimates of future inflation, and then the survey based measure of inflation uncertainty would significantly underestimate the actual level of uncertainty about future inflation. However, there is some evidence that the dispersion of inflation forecasts across survey respondents is positively correlated with the uncertainty of each individual forecaster (Zarnowitz and Lambros 1987).

Most of the countries in our study did not conduct this measure on macro level. We might find micro studies about specific industry conducted by MNCs before they inter the market. Also the macroeconomic environment in these countries is very uncertain not only due to economic factors but also due to political factors. In addition, the governments have the power to intervene and monitor the market. Those factors make forecasts difficult to get for those countries.

2.2 Ex-post Uncertainty Measures (Historical Data-Based Measure)

In those measures total volatility of a certain variable consists of two components expected and unexpected. We can distinguish between two main categories. The first is the conditional variance, in the sense that volatility depends on the past volatility and the second is the unconditional variance. The conditional variance should be the stronger measure of unexpected volatility while the unconditional variance should be stronger measure of total volatility, which includes both components.

According to the literature mentioned above, uncertainty means that the economic environment tomorrow is not known today and at best, there exists a set of alternatives, mutually exclusive, one and only one of which will materialize (Dreze

1999). Accordingly, uncertainty refers to situations in which the probability of future events cannot be determined. This is different from a risky event for which an explicit probability can be assigned. Future volatility in an economic variable is the sum of both predictable and unpredictable components. The uncertainty of an economic variable can then be more precisely defined as the unpredictable part of volatility (Crawford and Kasumovich 1996, Grier and Perry 1998).

Volatility of economic variable =Volatility of predictable component + Volatility of unpredictable component

Or equivalently:

=Expected Variability + Unexpected variability (Uncertainty)

As noted above volatility is a stochastic process since the stochastic process is a variable that evolves over time and at least part of it is random, and the other is partly deterministic. Intuitively, uncertainty of an economic variable is the degree to which the future value of that variable is unknown in the sense of not being predictable, given past performance (Golob 1993).

We compute the unconditional variance, total variability, using conventional variance formula, which gives us a time–invariant measure of the average of the squared deviation from the mean. To get unconditional variance as a time variant measure of uncertainty, we use "rolling" or "moving" variance. For instance, assume we have time series for y variable from 1975 to 2003 and we want to construct a measure of volatility using five years moving average, n=5. The five-year overlapping periods start with 1976-80, then we drop 1976 year and add 1981. So, we have 24 time series observations (1980-2003) on uncertainty starting from t=1980 for the

period 1976-80 to t= 2003 for the period 1999-2003. The rolling variance with moving period window n, n=5 in our example, is computed as follows:

$$v_t = \frac{1}{n} \sum_{i=1}^{n} (y_{t-1} - \bar{y})^2 \qquad (1)$$

In the investment literature Pindyck and Solimano (1993) work with the moving average standard deviation of the relevant time series to construct uncertainty measure. This measure of total variability as a proxy for uncertainty can be criticized on both economic and statistical grounds. One standard criticism is that at least part of the total variability of a variable is predictable (Crawford and Kasumovich 1996). For instance, the rise in long-run variability may be due to a certain policy, which may be announced well in advance of its implementation and therefore highly predictable. Thus the series may be very variable, however it is very predictable and easy to forecast. What is important for economic agents is the unpredictable part of the series, simply because greater unpredictability implies more uncertainty. Also, the range of moving average is chosen arbitrary.

In the same line of thinking, the variance of the unpredictable part of the series can be considered by specifying a stochastic process of that series. This method of measuring volatility can be summarized in two steps. First: we set up a forecasting equation for the uncertainty variable as in equation 2 and estimate it to obtain the residual- the unpredictable part of the fluctuations of that variable, as follows:

$$y_t = z_t^{'} \delta + \varepsilon_t \qquad (2)$$

where z_t a set of variables in the information set. Second: We compute the variance of the estimated residuals as uncertainty measure. In our example, we estimate equation 2 having annual data over the five-year overlapping periods. The variance of the residuals from these regressions (24 regressions) is the measure of uncertainty.

$$\eta_t = \frac{1}{n} \sum_{i=0}^{n} \varepsilon_{t-i}^2 \tag{3}$$

In fact we can consider first and second methods mentioned above as one, since the unpredictable part of a stochastic process is assumed to be given by the deviation from the mean. However, the second one involves the process that generates the predictable part of the stochastic process. The stochastic process that generates the predictable part can be any ARMA (p, q). In general, applying this method requires the correct information set to rule out the predictable part.

Goldberg (1993) constructed exchange rate volatility using rolling twelve quarters ARMA (1, 1) regressions over the entire sample. Aizenman and Marion (1993) estimate the predictable part by AR process and calculate the standard deviation of the difference between the actual and predicted series as a measure of volatility. Ghosal and Loungani (1996) used AR (2) process to measure uncertainty of industry product price.

As we see in the rolling variance equation, it gives an equal weight to correlated shocks and single large outliers so it could significantly overstate the actual level of uncertainty. Also this method is based on the assumption of constant unconditional variance and the range of moving average is chosen arbitrary.

Unfortunately, these assumptions are not realistic. In spite of these shortfalls, this measure is commonly used due to the data limitations. But the most important criticism is that these measures do not tell us the model that governs the uncertainty itself, as we will see next.

Engle (1982) introduced the ARCH methodology, which was later extended to incorporate a lagged dependent variable in the conditional variance (GARCH) by Bollerslev (1986). In contrast to rolling standard deviation and dispersion, the ad hoc measures of uncertainty, this approach estimates uncertainty of the variable on the basis of an econometric model. This method is presumed to capture volatility in each period more accurately than simple rolling standard deviations, which give equal weight to correlated shocks and single large outliers. Engle's (1982) proposed the following model to capture serial correlation in volatility:

$$y_t = x_t \beta + \varepsilon_t$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \varepsilon_{t-2}^2 + \dots\dots\dots + \alpha_q \varepsilon_{t-q}^2 \qquad (4)$$

where $\varepsilon_t | \Phi_{t-1} \sim N(0, \sigma^2_t)$ is the innovation in the series, ε_t^2 and α_i are the ARCH parameters up to q order, $\alpha_0 > 0$ and $\alpha_i \geq 0$. The ARCH model characterizes the distribution of the stochastic error ε_t conditional on the realized values of the set of variables $\Phi_{t-1} = \{x_t, y_{t-1}, x_{t-1}\}$. The stylized facts for many economic and financial data are captured in this model. These facts are thick tails for the unconditional distribution, changing in variance over time, and volatility clustering, and serially uncorrelated movements. A number of lags are required in many of the applications with the linear ARCH (q) model. Computational problem may arise when the model presents a high

order. To facilitate such computation, Bollerslev (1986) proposed a generalized ARCH or GARCH (p, q) model to include lagged values of the conditional variance. The GARCH (p, q) can be written as:

$$y_t = x_t\beta + \varepsilon_t$$

$$\sigma_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \ldots\ldots + \alpha_q\varepsilon_{t-q}^2 + \gamma_1\sigma_{t-1}^2 + \ldots\ldots + \gamma_p\sigma_{t-p}^2 \qquad (5)$$

where γ_is are the GARCH parameters up to order p. The conditional variance σ^2_t (the proxy of uncertainty) is one-period ahead forecast variance based on the past information and it is a function of three terms: (I) - the mean level of volatility, (II) - the ARCH terms which are the lag of squared errors from the mean equation, news about volatility from the previous period, and (III) - the GARCH terms which are the last lagged forecast variance. The economic agent predicts the uncertainty by forming a weighted average of a long-term average (the constant), the forecasted variance from last period (the GARCH term), and information about volatility observed in the previous period (the ARCH term). To ensure a well-defined process, all the parameters in the infinite order AR representation must be non-negative, where it is assumed that the roots of the polynomial lie outside the unit circle. For a GARCH (1, 1) process this will be ensured if α_1 and γ_1 are non-negative. It follows also that ε_t is covariance stationary if and only if $\alpha_1 + \gamma_1 < 1$. In most applications a lag length of p=q=1, will represent the conditional variance, Bollerslev, Chou and Kroner (1992).

In this chapter conditional variances from both GARCH (0, 1) and GARCH (1, 1) are used to generate conditional variances of inflation, exchange rate, real interest rate, and the credit. The GARCH (1, 1) is estimated first for each series, and when it

fails to fit the data GARCH (1, 1) is applied. The use of the GARCH approaches to model volatility seems to be attractive. However, one criticism of the econometric approach to measuring uncertainty is that such a measure seems to be highly sensitive to model specification (Carruth, Dickerson, and Henley 2000b). As well, they require high frequency data and longer time series and this may be the reason for its limited application in investment. Also both this measure and the rolling variance of uncertainty are backward looking in nature, in contrast to the survey-based measure of uncertainty, as we mentioned above. In spite of these criticisms, GARCH methods have been used to derive measures of uncertainty and numerous studies have found a relationship between the resultant variable and investment.

2.3 Components GARCH (CGARCH)

An interesting development of the basic GARCH model is the so-called components GARCH (CGARCH) of Engle and Lee (1999). They decompose the conditional volatility from a GARCH model into a time varying trend and deviations from that trend. In other words, into permanent volatility component or long run volatility and transitory volatility or short run volatility. Those authors describe the long memory behavior of the volatility process as the sum of two conventional models where one has nearly a unit root, and the other has a much rapid decay. Following Engle and Lee (1999) and Ding and Granger (1996), there has been some recent work on decomposing macroeconomic volatility and assessing its impact on the real economy, which emphasize on the importance of the source of uncertainty Baum et al. (2001), Chadha and Sarno (2002). They provide a differential effect of uncertainty

on investment depending on whether it is long run or short run. Engle and lee set out the GARCH (1, 1) model as characterized by reversion to a constant mean (ϖ):

$$\sigma_t^2 = \varpi + \alpha_1(\varepsilon_{t-1}^2 - \varpi) + \gamma_1(\sigma_{t-1}^2 - \varpi) \qquad (6)$$

Where ϖ is the unconditional variance, $(\varepsilon_{t-1}^2 - \varpi)$ serves as the shock to the volatility of the relevant variable and $\alpha + \gamma$ represents the mean reverting rate or the persistence rate. The question that Engle and Lee raised is whether the long-run volatility represented by ϖ in GARCH (1, 1), is truly constant over time. They replace ϖ with the long run volatility q_t, which is given a time series representation and allowed to evolve in AR manner. Thus the model is written as:

$$\sigma_t^2 - q_t = \alpha_1(\varepsilon_{t-1}^2 - q_{t-1}) + \gamma_1(\sigma_{t-1}^2 - q_{t-1}) \qquad \text{Temporary component} \quad (7)$$

$$q_t = \alpha_0 + \rho q_{t-1} + \varphi(\varepsilon_{t-1}^2 - \sigma_{t-1}^2) \qquad \text{Permanent component} \quad (8)$$

Equation (7) defines the temporary component $\sigma_t^2 - q_t$, whilst equation (8) is the permanent equation. When $0 < \alpha + \gamma < 1$ short run volatility converges to its mean of 0, while if $0 < \rho < 1$ the long run component converges to its mean of $\alpha_0 / (1-\rho)$. As the long run volatility is more persistent than the short run, it is also assumed that $0 < \alpha_1 + \gamma_1 < \rho < 1$. For non- negative variance, sufficient conditions are that α_1, γ_1, and α_0 are positive and that $\gamma_1 > \varphi > 0$.

The interpretation of the volatility component is straightforward (Engle and Lee, 1999). First, when $\alpha_1 + \gamma_1 < 1$ the component model allows reversion to a varying mean q_t. Secondly: the short-run volatility component mean reverts to zero at a geometric rate of $\alpha + \gamma$ and the long run volatility component itself evolves over time

following an AR process, which, if $0<\rho<1$, will converge to a constant level defined by $\alpha_0 / (1-\rho)$. Thirdly, the model assumes that the long-run component has a much slower mean reverting rate than the short run component, or in other words, the long run component is more persistent than the short run one, i.e., $0 < \alpha_1 + \gamma_1 < \rho < 1$.

3- Data and Empirical Results

The data set used in this chapter applies to the 1981-2003 period and contains 12 oil producing countries and Israel. Some of the oil producing countries are members in OPEC such as Algeria, Indonesia, Iran, Kuwait, Nigeria, Qatar, Saudi Arabia, UAE, and Venezuela. The other 3 countries, Egypt, Syria, Tunisia, are producing oil but are not members in OPEC. Israel is not producing oil but it is included in the sample to be a comparison point in the Middle East area. The sample is selected based on the potential economic cooperation among some of Middle Eastern countries and some of North African Countries, which is called MENA countries. Also the selection is based on the availability of data in monthly frequencies in the period of study. Also the period of study is constrained with the availability of data on annual investment in these countries from 1981 and the investment model under uncertainty will be investigated in the next chapter. We model uncertainty for some macroeconomic variables such as, inflation, exchange rate, cost of credit, and credit in these countries, in addition to oil price. All variables are in monthly frequencies and are taken, except oil prices, from the World Development Indicators and International Financial Statistics of International Monetary Fund (IMF) CD-ROMs 2003. Data on oil prices are taken from the OPEC Annual Bulletin. The data spans from 1974:01 to

2003:10 for the oil price and from 1981:01 to 2003:10 for the other variables. We utilize G/ARCH and CGARCH specification as indicated above to generate conditional variances. Also we will estimate short run and long run uncertainty when the model is applicable, for all series. We can organize the procedure to generate conditional variances in the following steps: first we test for stationarity and check the distribution characteristics of variable of interest; second: we estimate G/ARCH; third: we test for the presence of G/ARCH in the residual, using GARCH-LM test, to make sure that the model is well-specified; finally: if the G/GARCH is significant then we generate the conditional variance to use it as a measure of uncertainty. If the G/ARCH is not significant, then we look for another measure of uncertainty as cited in the literature above.

For stationarity test, we take the log of all series, except interest rate, and apply the traditional unit root tests. The Augmented-Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) unit root tests are for implemented with and without trend on the log level. In all test we do not reject the existence of unit root. The results show that all series are non-stationary except real interest rate in Egypt and Israel. When we carry out the test for the log first differenced, we find evidence that the variables are stationary. Namely, the PP tests suggest stationarity in all variables considered. The ADF tests further substantiate the stationarity of inflation, credit and real interest rate when expressed in log first differenced (for brevity the results of the ADF test are not reported her).

It is well known that Dickey Fuller unit root type tests have low power; hence Phillips and Perron (1988) propose a nonparametric modification to deal with serial correlation of errors in these tests. Schwert (1989) suggests that there may be substantial size distortions in finite samples when the data shows negative autocorrelations in first difference. ADF tests may require a substantial lag to deal with moving average errors; hence have low degrees of freedom and low power. To address this loss of power, Elliot, Rothenberg and Stock (1996), hereafter ERS, present an asymptotically efficient test of the unit root hypothesis based on the quasi-differenced data obtained from the GLS regression. They suggest that GLS local detrending yields substantial power gains over the standard ADF unit root test. Inflation rates and Exchange rates and other financial series often display large negative MA roots. Ng and Perron (1996) suggest modified tests and show that their test maintains good power whilst correcting for the moving average errors encountered in most macroeconomic series. Furthermore Ng and Perron (2001) suggest utilizing GLS detrending and construct four further modified test statistics. In this chapter we employ NG and Perron tests and ERS. The evidence in tables 2.1, 2.2, 2.3, and 2.4 shows that the DFGLS tests proposed by ERS and Modified tests suggested by Ng and Perron fail to reject the null of unit root in most series with few exceptions in real interest rate in Egypt and Israel and in exchange rate in Indonesia and Venezuela. When we run the tests on log first differences we got stationary series for all variables.

We apply the univariate GARCH model to the log-differenced monthly series. In this model the mean equation includes a constant and AR terms. The estimated AR and GARCH models for the series considered in this study are reported in tables 2-5, 2-6, 2-7, 2-8. The coefficients of fitted GARCH (p, q) have the theoretical signs and magnitude, although insignificant in some countries. The conditional variance equations are all stable with $\alpha_i \gamma_1 < 1$. All of the specifications are GARCH (1, 1) Except Qatar where an ARCH (1) specification was the simplest acceptable by the data.

We first consider the estimation results of inflation uncertainty. In Table 2.5, the intercept in the conditional variance ϖ is significant for most countries however it is not in Algeria Iran, Kuwait, Qatar, and Saudi Arabia. The lagged squared error term, α_1, is larger in Venezuela, Israel and Egypt compared with the other countries which reflects high persistence of short run volatility in the future uncertainty proxied by conditional variance. The lagged conditional variance terms are highly significant in all countries. Also the uncertainty process is stable in all countries, where $\alpha_i \gamma_1$ is less than one.

From the conditional standard deviation graph, Figure 2.1, we can notice that the inflation uncertainty declines in Egypt, Israel, Qatar, Syria, Iran, and Venezuela. However, it is less persistent in Israel compared with Egypt, Qatar, and Syria. For Israel the inflation uncertainty declined sharply after 1986 and almost stationary. This is attributed to the economic reform program, which started in 1985 in Israel, in 1991 in Egypt, and in 1994 in Syria. In Algeria, and Venezuela the inflation uncertainty was

very fluctuated and persistent. The stability process is supported by lower values of α,γ_1 in both countries. However, it maintains at a higher level. The uncertainty bounded in 1992 in Algeria when the civil war ended and maintains at a higher level. However, the uncertainty continues to fluctuate in Venezuela due to political instability. In Tunisia, Saudi Arabia, Kuwait, and Nigeria, the inflation uncertainty process seems to be stable over time except some spikes after and during Kuwait invasion, this might drive all prices up. In sum, we can say, in most of oil producing countries, inflation uncertainty is bounded and stable and this may be due to attempts in these countries to control inflation via different packages of fiscal and monetary policies.

Examining the real exchange rate uncertainty equations in Table 2.5, we can conclude the following: there is no G/ARCH model for Tunisia and Saudi Arabia. So we measure exchange rate uncertainty using 6 month moving average of the squared error. By examining the exchange data for these countries, we claim that 6 months is enough to capture the exchange rate volatility. For the other countries the G/ARCH models are successfully specified. The intercept in the conditional variance is significant for Indonesia, Israel and Venezuela but not for other countries this may be due to the fixed exchange rate regime in these countries which was dominant until the late of nineties. The lagged squared error is significant in all countries. Except Egypt, Indonesia, and Israel the ARCH coefficient was very small in suggesting their persistence of volatility. The lagged variance terms, GARCH, are highly significant in all countries. Nigeria, where ARCH model with one lag is specified, the coefficient of

ARCH is large suggesting short run persistence of volatility. Also, the exchange rate uncertainty models in those countries are stable, where $\alpha_i\gamma_1 < 1$.

The conditional standard deviation graphs, Figure 2.2, are quiet comparable in Algeria, Egypt, Iran, and Syria. We can notice jumps in uncertainty in Algeria, Egypt and Syria, after that the uncertainty declines. The reason is that most of those countries experienced high inflation rate, overvalued currencies and other macroeconomics problem before the economic reform and they followed the same procedure in financial reform, which is to float their currencies. Most of those countries float their currency in the mid of nineties after a long era of following fixed exchange rate regime with some officials movements in exchange rates. This is indicated by the jumps in the conditional standard deviation graphs for those countries but the timing of reform was different in each country. The IMF economists say that the adjustment mechanism will bring a stable exchange rate after a period of fluctuations in the exchange market depending on preconditions in each country. We can see that from the graph. Israel was an exception from that because its currency was floated in 1982. Also, as noted from the conditional standard variance graphs, Figure 2.2, the exchange rate uncertainty in Algeria, Egypt, Iran, Kuwait, and Qatar is bounded, however it starts rising in Egypt in the last two years. Finally, if we look at the conditional standard deviation graph in Indonesia and Venezuela, we will notice that exchange rate uncertainty was almost stable in the past until 1998 and after that it became very volatile. The explanation for that is founded in the currency crises that blow away Asian countries.

The results of estimating the real interest rate uncertainty, in Table 2.3, show that the intercept in the conditional variance is significant for all countries except Iran and Saudi Arabia. Also, the lagged error terms in all countries are significant. The uncertainty process of real interest rate is stationary in all countries where $\alpha_1\gamma_1 < 1$. For Egypt, Indonesia, Iran, Tunisia, and Saudi Arabia, where ARCH model with one lag is specified, the coefficient of ARCH is larger in Indonesia and Egypt but very tiny in Iran and Saudi Arabia. The reason for that may be the unimportant role of the interest rate in these countries, as Islamic countries. Also, this means the shocks to uncertainty are more persistent in the short run in Egypt and Indonesia compared with Iran, Saudi Arabia, and Tunisia. This is supported by the conditional standard deviation graphs, Figure 2.3, In Egypt and Israel, the uncertainty is bounded but it takes longer time in Egypt than Israel. The conditional standard variance became less volatile after 1986 in Israel and after 1998 in Egypt This is explained by the economic reform steps which are taken earlier in Israel in 1986 whereas in 1991 in Egypt. In Algeria, the real interest rate increases over time perhaps due to the high inflation rates in this country.

Considering the uncertainty about the total credit, table 2.4, the intercept in the conditional variance is significant for all countries except Iran, Saudi Arabia, Syria, and Venezuela. The GARCH (1, 1) was specified and was significant for all countries except Tunisia where ARCH (1) was significant. The uncertainty process of real interest rate is stationary in all countries except Israel where $\alpha_1\gamma_1 = 1.02$. From the conditional standard deviation graphs we can notice that the uncertainty surrounding

total credit in Algeria, Indonesia, Syria, and Kuwait is increasing over time and this is supported by the small ARCH coefficient in these countries. The reason for that may be the volatility of capital inflows to those countries that included in the total credit. In Gulf countries Saudi Arabia and Qatar seem to have the same pattern of uncertainty. The uncertainty of total credit in Algeria, Indonesia, UAE, Kuwait, and Syria is increasing over time. However, the level of uncertainty is different in each country. For Israel, we can notice the effect of economic reform in 1986 on total credit uncertainty; it fell sharply and became stable except the period from 1993 to 1995.

When we apply CGARCH to all series, as the second step after successful GARCH/ARCH specification, unfortunately component GARCH in most of the series is insignificant and negative in some cases, which implies model's instability except for oil price series. The good news here is the well-fitted CGARCH model for oil prices. This enable us to go further and investigate the effects of old and recent shocks to oil prices to extract the short and long run uncertainty as we will see in the following section.

4- Estimating Component GARCH of Oil Price

Given the importance of oil is produced in Gulf area and Middle Eastern countries, the political and economic instability in these countries is important for both producing countries and the rest of the world because this instability will be reflected by some way in the price of oil. Although prices of raw material are often modeled as geometric Brownian motions, it could be argued that they should somehow be related to long-run production costs (Dixit & Pindyck 1994). As the price of oil might

fluctuate up and down in the short run in response to wars or political instability in oil producing countries, or in response to the weakening and strengthening of the OPEC cartel, in the longer run it ought to be drawn back towards the marginal cost of producing oil. Thus as Dixit and Pindyck suggest, the oil price should be modeled as mean- reverting process.

We can use component GARCH to assess the short run volatility due to wars, political instability, etc. and the long run one. As Engle and lee (1999) explain, the long memory behavior of the volatility process can be described as the sum of two conventional models where one has nearly a unit root, and the other has a much rapid decay. Using the model represented by equations (6) and (7) we can estimate short run and long run volatility of oil price. To investigate the effect of Kuwait invasion in August 1990, September 11 attack in 2001 and Iraqi war April 2003 on the volatility of oil price, we use two sample periods of the oil prices for each event. For the Kuwait invasion in August 1990, we use the period of 1971:1-1990:7 and the period of 1974:1-2001:8 since the former excludes the Kuwait invasion and the latter excludes September 11 effect. For the September 11 in 2001 we use the period of 1974:1-2001:8 to isolate the Sept 11 effect and the period of 1974:1-2003:3. The latter allows assessing the Sept 11 effect and excludes the Iraqi war, which is waged in April 2003. For the Iraqi war, we use the period of 1974:1-2003:3 and the period of 1974:1-200:10. The estimation results should not differ significantly across the two sample periods if the effect of interest is not dramatic.

First, for the Kuwait Invasion, we can see from table 4 that the shock affects on both components. They turn out to be significantly larger by including the invasion period in the sample set: (α, φ) are (0.159, 0.06) for the period of 1974:1-1990:8 and (0.351, 0.107) for the period of (1974:1-2001:8). This indicates the severity of the market rise after the invasion. The mean-reverting features of the volatility components are also significantly affected. By including the Invasion, $\alpha + \gamma$ changed from 0.781 to 0.902. Also ρ does change little bit, increasing from 0.983 to 0.9981. This suggests that the short-run volatility component mean reverts to zero at a geometric rate of $\alpha + \gamma$ =0.902 higher than its rate in the period before invasion, ($\alpha + \gamma$) =0.781. The larger mean reverting rate means the more persistent of the volatility expectation to the market shocks in the past. The high mean reverting rate combined with the increase in ρ implies that the effect of Kuwait invasion is more permanent than transient.

These results are consistent with oil market movements after Kuwait Invasion. The volatility increase in the oil market persisted after the Invasion. Secondly, for the September 11 attack in 2001, we can see from table 4 that there is a significant effect on both transitory and permanent component. However, the shock is more transient then permanent. This is indicated by very little change in ρ, declining from 0.9981 to 0.9976 and a big change in the short-run component where the mean reverting rate declines from ($\alpha + \gamma$) =0.902 in the period before September 11 to ($\alpha + \gamma$) =0.833 in the period of 1974:1-2003:3. This implies that the change in volatility due to the shock decayed very quickly, smaller reverting-rate. Thirdly, for the Iraqi war in April 2003,

we can see from table 4 that the shock is more transient than permanent. There is almost no effect on the long run component. However, the mean reverting rate declined from 0.833 to 0.68, which means the effect of the shock, decayed rapidly in few months. We conclude that the Kuwait invasion is the most permanent shock to the oil price, while the following two shocks, September 11 and Iraqi war are transient. The dominant transitory effect of the shock to oil prices has important economic implications since this uncertainty can be resolved quickly.

CHAPTER III
THE INTERACTION BETWEEN DOMESTIC INVESTMENT AND CAPITAL INFLOWS UNDER UNCERTAINTY AND CREDIT MARKET IMPERFECTION: DYNAMIC PANEL EVIDENCE FROM OIL PRODUCING COUNTRIES

Capital flows and their repercussions to developing economies have been the subject of much discussion in recent years in both policy circles and academic arenas. In addition, capital flows are considered as one of the principle means of global integration. The strand of the discussions follows the developments in the magnitudes and components of capital flows over the last three decades. In specific, during the 1970-1990 periods, international capital flows were mainly in the form of foreign bank lending (FBL) directed to governments and/or to the private sector. The literature in that period attempted to examine three main issues. First: the causes of these inflows and whether are they driven by "push" factors (external), or by "pull" factors (internal). The second was the policy challenges posed by resurgence in capital flows. The third was focusing on the behavioral characteristics of the different types of capital flows. In the 1990s, the composition of capital flows changed dramatically. It took the form of foreign direct investment (FDI) mainly and foreign portfolio investment (FPI). These changes motivate the literature to answer questions such as: does FDI behave differently from FPI? Are short-run flows more volatile and subject to sudden stop or reversals? Taking the causes of flows as given, the new literature turned its attention toward the effects of capital flows on the recipient countries.

Domestic investment is the most important channel through which foreign capital flows affect economic growth. However, the role of capital flows in improving economic performance can be limited in the presence of capital market imperfection. For oil producing countries, capital inflows can augment private saving and help those countries reach higher rates of capital accumulation and growth. Some types of capital inflows such as: FDI may also accelerate growth through the transfer of technology and management skills. Also, foreign portfolio investment (FPI) and foreign bank loans (FBL) are seen as adding to the depth and breadth of domestic financial markets.

In this chapter a four simultaneous equations model is developed to capture the dynamic interaction between capital inflows and domestic investment in uncertain environment. We employ Wooldridge's (1996) Generalized Method of Moments three stage least square, (GMM- 3SLS), to estimate the simultaneous equations using different instrumental variables for each equation in a dynamic panel framework.

The contribution of this chapter to the literature is threefold. Firstly, it combines the issue of the behavioral characteristics of different types of capital flows raised in the 1970-1990 periods and the more recent issue of their impact on domestic investment in the recipient countries. Secondly, the paper is different from previous empirical studies in the following aspects. First, it considers the impact of uncertainty on investment, but distinguishes whether the uncertainty is persistent or not. Because the type of uncertainty matters, we consider it by decomposing uncertainty into transitory and permanent components. Second, we consider that the imperfection of financial markets in these countries may lead investors to explore other channels to

pass through capital inflows. So we focus on specific potential sources of credit market uncertainty: real interest rate uncertainty and uncertainty of credit availability. Finally, we consider the possible different effect of each type of capital inflows on domestic investment to see if there are important differences. Thirdly, up to our knowledge, the subject of the study has been never addressed using GMM-3SLS technique. The policy implications of this study is essential for macroeconomic policy-makers given that increasing capital mobility weakens the macroeconomic autonomy via its potential effects on inflation, real exchange rate, and financial sector.

The rest of the paper is organized as follows: section 2 reviews the literature, in section 3 we lay out the model, section 4 describes the data and the empirical results, in section 5, we evaluate the model, and section 6 concludes.

1- Literature Review

Before analyzing the impact of capital flows on domestic investment in oil producing economies, it is important to understand the interaction relationships between domestic investment and each type of capital flows; FDI, FPI, and FBL. From the recipient country view, capital inflows are seen as a way of filling gaps between domestic saving, foreign exchange, and government revenue and skills from one side and the planned resources needed to achieve development targets. FDI may serve a stimulus to additional domestic investment; it may directly stimulate more domestic investment if it is used to improve the country's infrastructure 9Meier, 1995). FDI is an internalized investment flow (within the same MNC), which includes capital assets as well as intangible assets. In FDI the investor derives benefits from its

investment through increase in sales (on local market or export to third market), reduction of costs of production, or increase in production efficiency of the group of MNC subsidiaries. It is often asserted that FDI is one important channel through which adoption and implementation of new technologies and ideas may take place. The new introduced technologies may spillover from subsidiaries of MNC to domestic firms (Findally 1978). The spillover may take place through technology imitation, competition, backward and forward linkage through transaction between MNC and domestic firms, and acquiring/upgrading new/existing skills (Sjoholm, 1999).

Foreign portfolio investment (FPI) is a purchase of securities (equities or bond) issued by a company or government entity of a foreign country. Portfolio investment is not accompanied by a transfer of intangible assets and management know-how and it does not result in a loss of ownership. The prime motivations of FPI are yield seeking and risk –reducing through portfolio diversification. Portfolio investment requires well-functioning financial markets. An efficient financial system should perform three functions; adequate mobilization of savings (including foreign savings); efficient intermediation between investors and borrowers; efficient allocation of resources to productive uses (UNCTAD, 1993). Having different types of institutions and instruments, which responded to different risk/return, and time preferences of investor, FPI is expected to help in further development of capital markets. As liquidity increases, by FPI, turnover also increases and price volatility might be reduced, thus inducing firms and investors to use capital markets to invest and raise funds through issuing financial instruments. Also FPI enhances the standard of local capital markets

by acquiring more quality of information and transparency. Moreover, FPI could also stimulate the development of new institutions such as investment management and financial advisory services, which improve and increase financial transactions (UNCTAD, 1999). There could be many interactions between FDI and FPI. Through backward and forward linkages FDI can encourage the creation or expansion of domestic companies; which in turn would provide access to FPI for financing. In turn, FPI enhances domestic capital markets and strengthen financial infrastructure, which help to attract FDI and facilitate operations of MNC. On their impacts on macroeconomy, it is often believed that the macroeconomic impact of FPI is higher than of FDI, because FPI is not linked to any particular firm or sector. FPI not only can just channel finance to investments, but also can exacerbate financial and exchange rate crisis. In addition, the increase in local borrowing by MNCs' subsidiaries brings the risk of crowding out local firms from local capital markets.

Based on the existing empirical research on the determinants of investment in developing countries, I have settled for a less structured approach. The empirical literature on investment concludes three differing views of investment behavior. The first model, actually the oldest one, is the theory of accelerator. It emphasizes the proportionality between the stock of capital and output and links investment to the rate of growth of output. The second one is the early version of neoclassical investment model. It expands on the accelerator model by relating the optimal stock of capital to the relative cost of capital as well as the level of output. The cost of capital is a function of the price of capital goods, taxes, the rate of interest, and the

depreciation. The third one and the most recent version, associated with Tobin, Brainard, and others, focuses on the relationship between the market value of additional investment and its replacement costs- the marginal q ratio- as a determinant of investment. The use of q yields a well-defined investment relationship since it is compatible with forward-looking expectation and also incorporates the adjustment costs.

The ample relatively recent theoretical literature about the role played by uncertainty in shaping the investment behavior (Dixit and Pindyck, 1994) indicates the importance of considering uncertainty in investment models, as we explained in the Chapter I. It is well known that the combination between irreversibility and uncertainty may have a substantial effect on the investment behavior (Chirinko, 1993). Theory does not lead to any clear-cut conclusion about the impact of uncertainty on investment, so that the importance of uncertainty is clearly an empirical matter. In practice, most of the empirical research on investment in developing economies under uncertainty has been driven rather ad hoc approaches that are influenced by the data availability. A 1993 World Bank study (Rama, 1993) has surveyed a large number of these studies. Our survey of these earlier studies of investment functions leads us to formulate investment function as a function of capital inflows, output growth, government expenditure, real exchange rate, inflation rate and a set of uncertainty measures.

A comprehensive study by Bosworth and Collins (1999) provides evidence concerning the effect of capital inflows on domestic investment for 58 developing

countries during 1978-95. The authors distinguish among three different types of inflows: FDI, portfolio investment, and other financial flows - primarily bank loans. Both capital inflows and domestic investment are expressed as percentages of GDP. They find that an increase of a dollar in capital inflows is associated with an increase in domestic investment of about 50 cents. This result, however, masks significant differences among types of inflow. FDI appears to bring about a one-for-one increase in domestic investment; there is virtually no discernible relationship between portfolio inflows and investment (little or no impact); and the impact of loans falls between those of the other two. These results hold both for the 58-country sample and for a subset of 18 emerging markets.

The study of each component of capital flow should matter. Lane and Milesi-Ferretti (2000) document that different types of capital flows have different properties with regard features such as risk, liquidity, tradability, reversibility, and exportability and tax treatment. FDI is connected with transfer of technology and entrepreneurial skills whereas FPI may be useful in stimulating stock market development and improvement, especially for developing countries. Compared with FBL, FDI and FPI entail different risk sharing properties between domestic and foreign residents.

Public expenditure may have a complementary relationship with private investment if that type of expenditure improves the productivity of private investment. In this case, an increase in public spending leads to an increase in private investment. However, public spending may "crowd-out" private investment if the relationship between them is based on substitutability. The inclusion of government spending as an

explanatory variable enables us to test the "crowding-out" hypothesis of government spending.

While there is an extensive empirical literature on uncertainty and investment (see the review in Carruth, Dickerson and Henley 2000), it is mainly undertaken on the basis of one country or one indicator. Carruth et al. (2000) are of the view that broad consensus is that the relationship is negative and this consensus emerges from a wide range of models and alternative methods of proxying uncertainty. On the other hand, Huizinga (1993) suggests that effects vary depending on the source of uncertainty. For example, differing results for exchange rate volatility have been found by authors such as Goldberg (1993) and Darby, Hughes Hallett, Irelands (1998) depending on the countries studied and the data period used.

On the impacts of uncertainty of macroeconomic variables on the composition of international capital flow the theory is silent. Sercu and Uppal (1998) analyze the impact of exchange rate volatility on the trade volume between countries. In their model the trade volume is the mirror of capital flows. They used a general equilibrium stochastic endowment economy model with imperfect international commodity markets to show that exchange rate uncertainty can either increase or decrease the volume of trade depending on the source of the shock. They predict that an increase in exchange rate uncertainty due to an increase in uncertainty of endowment process will increase the volume of trade and thus a decrease in capital flows. When the source of the shock to exchange rate uncertainty is due to an increase in market segmentation, the increase in exchange rate uncertainty deteriorates the volume of trade and hence

increase capital flows. However, Portes and Rey (2002) show that there is strong empirical evidence that trade in financial markets is not a perfect substitute of trade in goods. They also find that the "gravity" equation performs at least as well in explaining asset trade as goods trade.

Recently, panel econometric methods have become popular in multi-country macroeconomic studies. These methods, which have both a time series and cross sectional dimension, are a means of increasing efficiency of parameter estimates when testing a particular long run hypothesis. However when adopting this approach it is important to test for cross sectional heterogeneity to ensure that panel estimates are not biased due to unreasonable pooling of countries. Hechet, Razin and Shinar (2002) explored econometrically the interaction between domestic investment and various types of capital inflows using an international panel data set of 64 countries for the period 1976-1997. They found an interaction especially in the FDI and loans inflows. Also they found that the impact of FDI inflows on domestic investment is a bit weaker than previously suggested in the literature, which was plagued, by the endogeneity and non-stationarity problems. Still, the FDI inflows are ranked at the top, compared to the other types of capital inflows in terms of its impact on domestic investment. Since considering uncertainty in the interaction between capital inflows and domestic investment may alter the directional relationship, including the effect of uncertainty in the model becomes important. This paper will address the issue of uncertainty and its effect on the interaction between various types of capital inflows and investment. Also the endogeneity problem is addressed in this paper. Accordingly, we estimate the

effect of FDI inflows, portfolio inflows and loan inflows, jointly on domestic investment, with also the reversed effect of domestic investment on these three types of inflows, using a Two-Stage Least Squares estimation technique.

On the source of uncertainty, there has been some recent work emphasizes that the source of uncertainty matters. In assessing the real impact of uncertainty, Baum et al. (2001) explained the importance of separating transitory from permanent volatility. Chadha and Sarno (2002) provide evidence of a differential impact of price uncertainty on investment, depending upon whether the uncertainty is long run or short run, with short run volatility being most damaging. Developing from these strands of work, we investigate the impact of permanent versus transitory component of oil price uncertainty on investment and capital inflows using the methods of Engle and Lee (1999).

2- Model and Econometric Specification

The model is based on four simultaneous equations, one for domestic investment and one for each type of capital flows. The modal to be estimated takes the form:

$$I_{it} = \alpha_i + \alpha_1 I_{it-1} + \alpha_2 FDI_{it} + \alpha_3 FBL_{it} + \alpha_4 FPI_{it} + \alpha_5 DC_{it} + \alpha_6 RR_{it} + \alpha_7 RPK_{it} + \alpha_8 GGDP_{it} + \alpha_6 GGDP_{it-1} + \alpha_7 T_{it} + \alpha_8 G_{it} + \alpha_9 \sigma_{it} + u_{1it} \quad (1)$$

$$FDI_{it} = \beta_i + \beta_1 FDI_{it-1} + \beta_2 I_{it} + \beta_3 GGDP_{it} + \beta_4 GGDP_{it-1} + \beta_5 T_{it} + \beta_6 G_{it} + \beta_7 \sigma_{it} + u_{2it} \quad (2)$$

$$FBL_{it} = \gamma_i + \gamma_1 FBL_{it-1} + \gamma_2 I_{it} + \gamma_3 GGDP_{it} + \gamma_4 GGDP_{it-1} + \gamma_5 WI_t + \gamma_6 \sigma_{it} + u_{3it} \quad (3)$$

$$FPI_{it} = \delta_i + \delta_1 FPI_{it-1} + \delta_2 I_{it} + \delta_3 GGDP_{it} + \delta_4 GGDP_{it-1} + \delta_5 WI_t + \delta_6 \sigma_{it} + u_{4it}. \quad (4)$$

In each equation the constant has subscript *i* to represent the part of the behavioral relationship containing time invariant variables that differ substantially from one country to another (fixed effect). We assume that the error terms are homoscedastic and serially uncorrelated. Also errors are allowed to be contemporaneously correlated to exploit the joint information in the system.

In the equation (1), I use a simple empirical specification for investment function relating domestic investment (I_{it}) as a percentage of GDP to its lag, each type of capital flow, a set of standard investment determinants, and a set of uncertainty measures(σ_{it}). Each type of capital flow, Foreign Direct Investment (FDI_{it}), Foreign Portfolio Investment (FPI_{it}), and Foreign Bank Loan (FBL_{it}) was expressed as a percent of GDP. Among Standard investment variables, I include the current and lagged levels of the log of real GDP to capture the accelerator effect, the user cost of capital (relative price of capital goods measured by the log of investment deflator to GDP deflator, and the real interest rate (Serven, 1998)). In theory as explained in Chapter I, the two variables of user cost should have a negative effect on investment. However, in the presence of credit market imperfection (interest control, non-price rationing mechanisms in developing countries), interest rate may not have a decisive role in investment and become uninformative as a true marginal cost of funds. So we need a variable that reflects the overall tightness of credit market. Empirical studies suggest a proxy relating the flow of domestic credit to nominal GDP (Serven 1998). Indeed this variable has been used in several empirical researches to reflect the degree of financial development also. The uncertainty surrounding the access to credit may exert a negative impact on

investment. Hence, not only is the credit flow to GDP important to reflect credit market imperfection but also the uncertainty of credit flow. One should expect a positive effect by the former and negative by the latter on investment. The tax policy (T) and government expenditure are included to show how policy variable affect domestic investment and FDI. To the previous determinants, I added the measures of macroeconomic uncertainty, which includes inflation uncertainty, exchange rate uncertainty, real interest rate uncertainty, Credit uncertainty, and short run and long run uncertainty of oil prices. I used the conditional variance of the innovations to these variables of interest as obtained from both GARCH and CGARCH procedures, because they are closest in spirit to the notion of uncertainty as discussed in Chapter II. The exogenous variables used is the σ vector of uncertainty measure include inflation uncertainty (INFU), exchange rate uncertainty (EXU), credit uncertainty (CU), real interest rate uncertainty (RRU), short run oil price uncertainty (SROIL), and Long run oil price uncertainty (LROIL).

Equation (2) shows factors that determine FDI. The extensive literature on FDI consists of three main models. The so-called OLI identifies the attractiveness of a country for FDI on the basis of ownership, location and internalization (Dunning, 1993). The gravity model attempts to predict FDI on the basis of macroeconomic factors such as the level of GDP, GDP growth and the population size (Brock, 1998). The transaction costs model, which try to determine the most suited investment mode based on cost structure (Buckley and Casson, 1981). Our specification for FDI is closest to gravity model. In addition to a lag of FDI and domestic investment, we include GDP

and GDP growth to reflect the market size and we expect that would have a positive effect on FDI. Also we include the set of uncertainty variables mentioned above.

Equation (3) and (4) specify the FPI and FBL flows. The economic theory suggests several factors (external and internal) that explain the FPI and FBL flows. In addition to lag of FPI and FBL and domestic investment which capture the interaction, we include GDP growth rate and its lag to reflect improvements in economic fundamentals, world interest rate (WI) to mark favorable global macroeconomic conditions, and total credit as a percentage of GDP to reflect the development in capital markets. To the previous variables, we added the same set of macroeconomic uncertainty. In addition to the interactions between domestic investment and each type of capital flows, the purpose of the model is to show the impact of some macroeconomic uncertainty on the capital flows as well as on domestic investment. So that in order to focus directly on the problem, we do not include explicitly into the model a number of issues related to underdeveloped infrastructure, bureaucracy or widespread corruption, and political risk, which are undoubtedly taken into account in the process of capital flow.

To estimate the system we discuss some methodological issues. We consider a four simultaneous equation models (SEM) to assess the interaction among domestic investment and each type of capital inflows as mentioned above. It is well known that estimating a SEM using OLS and GLS will be inconsistent. We could apply single equation methods to each of them like 2SLS, but we will exploit the joint information of all the system variables to improve the efficiency. Wooldridge (1996) explained that

a SEM with measurement error in some exogenous variables, or with some omitted variables correlated with what would be exogenous variables, can also be estimated as a system of equations if different instruments are valid for different equations. He offered a set of regularity condition under which the nonlinear three stage least squares estimator is the asymptotically efficient GMM estimator. One of the conditions to get an efficient GMM estimator is to use the optimal weighting matrix. The system of three-stage least square (3SLS) estimator is a GMM estimator that uses a particular weighting matrix based on the assumption that the conditional variance of the error given the instruments is constant. Under the identification conditions and a certain assumption about the weighting matrix, GMM-3SLS is an efficient GMM estimate and is consistent. It is also known as the Full-Information Instrumental Variables (FIV) estimator (Hayashi, 2000). In general the GMM-3SLS is preferred because it is more efficient and allows for using different instruments for different equations. In our study different instruments are used for each different equation.

Our sets of instruments are composed of common and unique instruments for each equation. Each equation has at least one unique instrument that is the second lag of the first difference of the dependent variable. If possible, we also use other unique instruments for each equation. In addition to the second lag of the first difference of the dependent variable, we use the following instruments for each equation. For domestic investment, equation (1), we use a constant and one lag of the differences of FDI, FPI, and FBL, tax revenues, government expenditure, and three lags of the differences of GGDP. As another unique instrument, we used degree of openness,

measured by the sum of export and imports divided by GDP. This instrument is highly correlated with each type of capital flow because it implies that capital flows can move more freely and at a lower cost between countries but is not correlated to the error.

For foreign direct investment, equation (2), we use a constant and the lagged first difference of domestic investment, income tax rates, government expenditure, and three lagged differences of GGDP. For a unique instrument we also use the number of fixed telephone lines in each country. This instrument is an indicator to infrastructure development, communications and information technology in the host countries and it is correlated with domestic investment and FDI but not correlated with the error. For Foreign bank loans, equation (3), we use constant and lagged differences of domestic investment, world interest rate, and three lagged differences of GGDP. For foreign portfolio investment, equation (3) we use a constant and lagged differences of domestic investment, world interest rate, and three lagged differences of GGDP. In addition to the ΔFPI_{it-2} as a unique instrument, we use total credit/ GDP ratio as another instrument. This ratio is a sign of financial market breadth in these countries and it is highly correlated with domestic investment and FPI and orthogonal to the error.

3- Data and Empirical Findings

Our data covers 13 countries of oil producing countries. The data spans from 1981 to 2003. There are two kinds of data on foreign direct investment provided by IMF, net and gross foreign direct investment. Net foreign direct investment refers to inflows net of outflows while the gross refers only to inflows, that is, foreign direct

investment into the country. Also OECD statistics provide FDI originated in OECD member countries into developing countries (Geographical Distribution of Financial Flows to developing Countries). The main source of the data is WDI CD-Rom and IFS IMF CD-Rom. We construct private investment (domestic investment % of GDP) by removing government investment from total investment. We obtain government investment from Government Finance Statistics of the IMF (GFS). It consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements, plant, machinery, and equipment purchases. The construction of roads, railways, and the like, include commercial and industrial buildings, offices, schools, hospitals, and private residential dwellings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, see WDI tables 1.4 and 4.9. Foreign Direct Investment (FDI), net inflows (% of GDP). It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short term capital as shown in the balance of payments, see WDI table 5.1. Foreign Portfolio Investment (FPI), excluding portfolio investment excluding liabilities constituting foreign authorities' reserves (LCFAR) covers transactions in equity securities and debt securities. Data are in current U.S. dollars. Foreign Bank Loans (FBL) or Bank and trade-related lending data cover commercial bank lending and other private credits. Data are in current U.S. dollars. For more information, see WDI table 6.7. Each type of capital inflows is measured as a proportion of GDP. The average share of real government consumption in real GDP measures government consumption expenditure. GDP growth is measured

in annual %. It seems more appropriate to use gross data since we are interested in the benefits that capital inflows may have in the host country via increasing loanable funds, transfer of knowledge and other spillover effects. Also this is consistent with other studies see (Borensztein, De Gregorio, and Lee 1993). Our panels are unbalanced, with the sample restricted to oil producing countries that have a minimum of 10 observations and have monthly data to construct uncertainty measures for other macroeconomic variables we mentioned in Chapter II.

Table 1 shows the results of GMM-3SLS estimation for domestic investment function using conditional volatility of nominal exchange rate (EXU), consumer price (INFU), real interest rate (RRU), and total credit (CU) estimated using GARCH. Also, transitory (SROILU) versus permanent (LROILU) uncertainty of the log difference of oil price estimated by CGARCH are included, as set out in Chapter II. In column 1 Table 1 a one percent increase in FDI as a percent of GDP is followed by 0.52 percent increase in future domestic investment as a percent of GDP in oil producing countries. We notice that the foreign direct investment and lagged domestic investment have a similar impact on domestic investment. A one percent increase in either FDI or domestic investment will increases current or future domestic investment as a percent of GD by about 0.55 % respectively. To understand what is driving these results, we have to decompose total domestic investment into private and public domestic investment and see the effect. It has been cited in the empirical studies that the FDI has no effect of public investment in developed countries and in the short run in developing countries and it does in the long run, however it has a strong effect of

private investment in both group of countries (McMillan, 1999). Unfortunately, for most of the countries in the sample the breakdown into private and public domestic investment is not available. However, when we look at the effect of lagged FDI on domestic investment, we find that its impact is more than one and half times the impact of lagged domestic investment on domestic investment. For example a 1% increase in FDI as a percent of GDP increases the following years' domestic investment as a percent of GDP by 0.88 %. This explains the spillover effect of FDI on private investment specifically and on total investment in general. Also it shows the importance of FDI as a vehicle to transfer technology.

Foreign bank lending, the second type of capital flows carries significant coefficient, but its impact on domestic investment is much less than FDI. A 1 % increase in foreign bank lending as a percent of GDP increases domestic investment as a percent of GDP by 0.13 %. The foreign portfolio investment has no significant impact on domestic investment. The reason for that is most of these countries has inefficient financial institutions or not developed yet. On the other side, the estimated coefficients on the standard investment determinants appear reasonable and have their expected signs. GDP and credit availability have a positive and significant impact on investment, while the opposite applies to the real interest rate (insignificant) and relative price of capital. In turn, most of uncertainty proxies have strong significant impact on domestic investment. Interestingly, short run oil price uncertainty has a negative and more destructive effect on investment than long run uncertainty, which has a positive impact on investment. One interpretation of the positive sign of long run

uncertainty on investment is that an increase in uncertainty may increase the value of a marginal unit of capital and, ceteris paribus, increase the incentive to invest. Also increased volatility may raise the required rate of return before investment will be undertaken. On the other hand short run uncertainty has a negative effect on investment because short run uncertainty combined with the irreversibility will induce wait and see behavior which results in postponing investment. Exchange rate and inflation uncertainty both carries significant and negative coefficients. The magnitude of inflation uncertainty is larger than the magnitude of exchange rate. This highlights the importance of controlling inflation to have investment boost. Overall, these results in broad agreement with results reported by some earlier studies (Serven and Solimano, 1993; Darby et al, 1998)

Though, the real interest rate is insignificant, the real interest rate uncertainty is significant. Also, the credit availability coefficient is significant and has a small impact on investment. However, the uncertainty surrounding credit availability is highly significant (negative) and has a larger impact. The significant effect of total credit and insignificant effect of real interest rate is a remarkable. It means that investment in these countries is more driven by quantity rather than price effects stemming from financial market. As we indicated in the theoretical part in Chapter I, the informational asymmetries in capital market combined with uncertainty have a depressing effect on investment while the effect on the real interest rate is indeterminate. This explains why real interest rate is significant. The quantity of credits rather than the costs may be more binding in developing economies because of credit rationing and lack of well-

functioning financial markets. Credit constraint is likely to be more important, partly because the quantity of financial resources is limited due to the lack of equity financing instruments. Moreover, controls over interest rates and credit rationing in the financial markets in most of oil producing countries reduce the role of the cost of capital (proxied by real the interest rate). The role of financial development in oil producing countries is highly significant which suggests the importance of improving these markets to attract investment. However, the effect of uncertainty in credit market dampens the effect of financial development and this may explain why the real interest rate is insignificant. Fiscal policy in oil producing counties plays an important role in affecting investment. Both taxes and government expenditure carry significant coefficients. A 1% increase in government expenditure as a percent of GDP increases investment by 0.09%, while taxes decrease the investment by 0.19 %.

Next we consider the effect of domestic investment and uncertainty on foreign capital flows. The last three columns in table 1 show how each type of capital flows reacts to domestic investment and other variables. While the domestic investment has a very small impact on FDI, a 1% increase in domestic investment as a percent of GDP stimulates 0.008 % in FDI as a percent of GDP; it has no significant effect on the other type of capital flows. This is an expected result since financial market in thee countries are not well developed and some of these countries put some restrictions on the foreigners' ownership. We noticed that there is no interaction among the three types of capital flows; each one is independent from the other. However, for each type of capital flows the lagged of the variable itself was highly significant which means an

increase in FDI, FBL, and FPI by 1 % will increase each type by 0.58%, 0.78%, and 0.13% in the future, respectively. Certainly, the initial level in each country is an important point in assessing capital flows sustainability. Also, fiscal policy has no significant impact on capital flows. Interestingly, the total domestic credit has a positive and significant impact on FBL. This may suggest strategic complementarities between foreign lenders and domestic credit market. An increase in domestic credit conveys a signal to foreign lenders to increase their loans. In fact developing countries do not need this kind of relation because they do need FBL in the periods where expanding domestic credit is policy problematic, they need FBL as a substitute source of finance. Of course, the world interest rate is the most influential variable in stimulating FBL and FPI and our results confirm that in oil producing countries. World interest rate carries significant coefficients for FBL and FPI. A 1% increase in world interest rate increases FBL by 0.05%, while decreases FPI by 0.2% as a percent of GDP.

The effect of uncertainty on capital flows is different for each type. Inflation uncertainty has no impact on FBL and FPI but it has a significant impact (negative) on FDI. Foreign exchange rate uncertainty has a significant impact (negative) on FDI; however it has no impact on FBL and FPI. Both real interest rate and uncertainty surrounding it have no significant impact on any type of capital flows. Credit uncertainty has significant impact (negative) only on FBL. Again, this result confirms the strategic complementarities between foreign lenders and domestic credit market. The foreign lenders look at the domestic credit market before providing loans.

Permanent and transitory uncertainties of oil prices affect both foreign direct investment and foreign portfolio investment. The effects of short run uncertainty on FDI and FPI are larger than the effect of long run uncertainty and both reduce FDI and FPI. However, the short run uncertainty of oil price increases the FBL. One possible explanation for this result is most of FBL are short-lived in nature. It actually seeks for higher interest rate, which will be high considering risk premium, associated with the short run oil price uncertainty in these countries. On the other hand, long run oil price uncertainty carries significant coefficient and expected sign (negative).

4- Model Evaluation

To evaluate the model, we look at the model's prediction against historical data using actual values for both exogenous and the lagged endogenous variables of the model. For doing so, we have employed static deterministic simulation. This simulation is typically used to produce a set of one-step ahead forecast over the historical data so as to examine the historical fit of the model. In static solution of the model, values of the endogenous variables up to the previous period are used each time when the model is solved and lagged endogenous variables are based on the actual values. A static solution can not be used to predict more than one observation into the future.

The results of one-step ahead forecast for each endogenous variable are shown in figures 3-1, 3-2, 3-3, and 3-4. For domestic investment, the substantial year-to-year swings in investment are one of the features of investment series in most countries. These swings drive the business cycle and therefore will affect on most of other

macroeconomic variables. We can say that the model fits fairly well the domestic investment in most countries. The model quite predicts the smooth changes in investment but it fails to predict sharp fluctuations. For example, the 1993 peak in Egypt, Kuwait in 1996, Nigeria in 1994, the 1994-drop in investment in Iran, and the 1989-drop in Tunisia are not predicted well by the model. A possible explanation for that could be the reluctance associated with implementing privatization and other program of economic reforms in most of the countries which started in late of 1980s and still in progress.

For capital inflows, when we examined FDI, FBL, and FPI charts in figures 3-2, 3-3, and 3-4, we generally notice that the model predicts quite well the path of FDI and FBL and little for FPI. In 1992 most countries in the sample endured a decline in both FDI and FPI and we would say this caused the peak in domestic investment. The high-rise in FDI in Saudi Arabia in 1989 and FDI swings in Tunisia are not well fitted. The high rise in FDI in Saudi Arabia in 1989 was a result of government's encouragement in petrochemical industry after the sharp decline in oil prices in the second half of 1980s. FDI swings in Tunisia were mainly due to the uncertainty akin to the economic reform program. However for the rest of the sample FDI and FBL are well fitted.

For foreign bank loans, the model predicts the changes fairly well and we can generally render much of the simulation uncertainty to the large residual in investment equation, which is creating a lot of variation in investment and foreign direct investment as we mentioned above.

For foreign portfolio investment, the model fits well for Algeria, Venezuela, United Arab Emirates, Qatar, Indonesia, and Egypt but not very much for the rest of the sample. One possible explanation for that is most of these countries are classified as emerging markets and they may be affected by institutional factors such as financial infra structure and development of other financial intuitions which are not included in the model.

5- Conclusion

This paper has developed an empirical model to analyze the interactions between capital flows and domestic investment under different macroeconomic sources of uncertainty. The model is applied on a set of oil producing countries using GMM-3SLS in a SEM framework. Having evaluated the model, I conclude that the interaction exists at least for foreign direct investment. Foreign direct investment and foreign bank lending are the effective components in capital flows to stimulate domestic investment in oil producing countries. FDI is the strongest catalyst in capital flows for domestic investment. The interaction between FDI and domestic investment is bi-direction, however FDI induces domestic investment more than domestic investment stimulates FDI. The dynamics shows that the lagged FDI has a stronger impact on domestic investment than the lagged of domestic investment itself. This suggests that FDI, by bringing technological and capabilities, induces domestic investment and makes it more profitable. FBL is the second important component in capital flows stimulating domestic investment but its impact is much less than FDI. Both domestic investment and all types of capital flows are affected by short run and

long run uncertainty of oil prices. However, the effect of short run uncertainty is much larger than long run. Uncertainty combined with the capital market imperfection has a negative effect on domestic investment. The negative effects exerted by uncertainty dampen the positive effects on investment due to financial development and this may explain why the real interest rate is not significant.

CHAPTER IV
CAPITAL FLOWS AND MACROECONOMIC POLICY RESPONSE: SIMULATIONS FROM THE EGYPTIAN ECONOMY

The rationale for forecasting is to develop a view of future economic developments and to identify and correct undesirable trends. The goal of the forward looking economic policy is to anticipate events well before they actually occur. The economic forecast generally is the solid ground on which strategic policy initiatives can be implemented and this forms the framework of managing small open economy. Among other economic forecasts, the capital flows and its interaction with the domestic investment is one of major interests for economic policy makers. Developing and developed countries have never shared such a strong interest in ensuring the stable growth of international capital flows. Both north and south are trying to benefit from the recovery now underway in the global economy, which coincides with a resurge in financial flows to developing countries (World Bank, 2004). The main challenge for policymakers is to find a way to translate these gains into investments that promote development. Having upturned capital flows in 2003 from the subdued levels of the past five years, the movements of international capital flows- whether in or out- can have significant macroeconomic consequences. In the last decade, the macroeconomic distress and other macroeconomic problem such exchange rate crises in emerging markets have confirmed again the need for appropriate policies to handle international capital flows. Moreover, the cost of poor policy design will increase as involving with a world of increasingly integrated financial market.

These premises apply to the oil producing countries for which the accession to the world economy is inevitable. Some of these countries have already experienced substantial capital flows and the likely course of future events will further increase their importance. Accession countries have implemented the reforms and adopt the policies necessary to comply with the globalization and a functioning market economy. Many of those economies have already liberalized capital account transactions substantially and removed most of capital controls while others have an interim period to do so. The increasingly exposure to capital flows recalls the problems associated with it. How this was linked to the other macroeconomic policies pursued is one of the principal questions I try to resolve.

The overheating threat associated with large capital flows evokes a policy response from policymakers. The magnitude, sequencing, and the timing of policy response should be based on the factors driving these inflows and the recipient country's objectives. A better understanding of these issues is important because developing countries are responsible in part for the causes and consequences of capital flows. As World Bank Report (2004) indicates, the recovery in private flows was encouraged, in part, by structural improvements in the developing countries and the extent to which the recipient countries harness and benefit from capital flows depends on the policy coping and handling these flows.

There are many approaches of obtaining economic forecasts, qualitative and quantitative. Judgmental or non-extrapolative forecasting is an example of the qualitative method in which an individual or small group of people makes assessments

of likely future conditions. To the extent to which experienced persons are involved, the technique can produce very good forecasts, however, judgmental approach can be subject to bias and other sources of error (Guajardo and Miranda, 2000). Two general methods of quantitative forecasting models exist. One is a time series approach that consists of large number of techniques that generally assume that history provides a good guide to future events. The other method of quantitative forecasting, more complex, is the econometric models. While still incorporating time series data, these models construct causal model. Once the model is estimated, the parameters can be employed to generate forecasts of the variable given their explanatory variables.

In this chapter econometric model is employed. Based on our estimated model in the previous study (Chapter III), we simulate the effects of policy options facing oil producing countries as they continue along the path to integrate with the global economy. The model is used to explore the consequences of sterilized intervention, fiscal policy and stabilizations policy proposed by international economist on capital inflows and domestic investment. The rest of the chapter discusses the macroeconomic effects of capital flows, the problems they create, and the policy responses to enjoy the benefits of capital mobility while mitigating the costs in the second section. The third section, provide the simulation technique used in the study and presents the simulation results. The last section provides concluding remarks.

1- The Macroeconomics of Capital Flows

1.1 Causes of Capital Flows

The diagnosis of the causes of capital inflows will help determine the appropriate response. Factors driving capital inflows can be categorized in the following categories; pull factors; push factors, and financial integration and globalization. In general, pull factors are the factors that generate an abrupt change between domestic saving and investment, which in turn triggers capital inflows. Pull factors include political and economic reforms that boost confidence in the economy, debt restructuring to reduce the debt overhang and enhance the foreign exchange inflows, proliferation of specific incentives and simplification of the procedures for foreign direct and portfolio investment, liberalization of foreign exchange market, and dismantling the restrictions on private sector foreign borrowing(Gooptu, 1994),.

Push factors or external factors, which affect an economy directly. Among push factors, the lower rates of return on assets in lending countries. This happens in response to cyclical factors that deteriorate the risk-return characteristics of assets issued by developed countries (Agenor and Montiel, 1999). We might call it external financial shock. Of course this temporary shock may be reversed because of its cyclical origin that represents a threat to recipient countries. Even we assume the shock will last, the benefits from it will depend on the recipient country's conditions. More capital will flow to countries that had been credit constrained and remain heavily indebted (Edward, 2000). The second main push factors are the portfolio diversification preferences combined with the changes in financial structure in capital-

exporting countries. Due to either the increased role of mutual or pension funds as financial intermediaries or information technologies, developed countries favor lending to emerging economies. Flows driven by this factor are likely to sustain for an extended period of time. The policy questions about push factors are, is it optimal to consider the probability of capital flows reversal driven by the first reason? Or/and how the policy copes with the sustainability implication that the second reason might have?

Financial integration and globalization are most recent factors that drive capital inflows. The upturn of capital flows may reflect increased financial integration either as a result of policy choices in both developed and developing countries, such as capital account liberalization and removing barriers impeding cross border capital flows or due to advances in technology affecting information costs. Also, capital inflows may reflect structural distortions in domestic capital markets and easier access to global markets. When global access is increased as an act of policy, domestic residents exploit the comparative advantage that foreign capital markets enjoy. Also, successful development of domestic capital markets may eventually mitigate the need to rely to heavily on foreign capital. Permanent reliance on foreign capital remains relatively rare. Economists have spent three decades trying to explain the Feldstein-Horioka puzzle for developed economies: national saving and national investment are much more highly correlated than perfect global capital mobility would imply which casts doubt about capital mobility.

1.2 Capital Flows and Policy Responses

Attracting capital flows is a mixed blessing and the trouble associated with them is well known for policy makers. Therefore, the appropriate policy to deal with them need to be investigated. On one hand, capital flows have led to increase financial integration for individual countries. Capital flows boost growth in developing countries by financing investment, smooth consumption, and allows international borrowing to offset the temporary decline in income. On the other hand, the excessive expansion in aggregate demand implied by capital flows may have negative effects on macroeconomic indicator in general and on financial sector specifically.

In this section examines the mechanisms through which these consequences happen. Open macroeconomic models predict that the main macroeconomic challenge posed by the arrival of capital inflows is the possibility of having excessive aggregate demand caused by exchange rate appreciation and domestic inflation. This problem, called "overheating", works through the following mechanism. With a fixed nominal exchange rate, a large increase in capital inflows is likely to create an overall surplus in balance of payments (Montiel 2000). To avoid the nominal appreciation, due to the surplus, the central bank intervenes to buy the excess supply of foreign currency at the prevailing exchange rate. This would result in an expansion in monetary base which would ignite the aggregate demand and domestic price level. With the fixed exchange rate and rising domestic prices, the real exchange rate will be appreciated. Having this circle, the policy intervention can be achieved at many points along the transmission track to break this causal chain (Montiel, 2000).

Adjustment to capital flows is a policy issues for many reasons. First: International financial markets are incomplete, and the risk generated by its volatility can not be insured. Second: International financial markets are subject to fads, bubbles, or contagion effects, in which international investors make sudden reversions for an economy that may be unwarranted by underlying fundamentals. Third: Distortion in product market and imperfection in domestic financial market make the process of adjustment to capital flows suboptimal. Fourth: Sudden shifts in capital flows may interfere with the effectiveness of other government policies such as price stability and managing aggregate demand. These considerations raise many related policy questions. For example: Should fiscal policy expand or contract when capital flows become more scare? What exchange-rate regime provides a better adjustment to sharp changes in capital flows? Can the policy aim at reducing the uncertain environment within which domestic investment and capital flows operate affect the interaction between them?

Accordingly, policy intervention can be classified as follows: policies that accept the reserve accumulation associated with a balance of payment surplus, but attempt to improve its effects on the monetary base (sterilized intervention); policies that accept an increase in the base, but attempt to restraints effects on broader monetary aggregates. Increases in reserve requirements and quantitative credit restrictions are example of such policy; Policies that accept a monetary expansion, but attempt to offset expansionary effects on aggregate demand that could result in

inflation and/or real exchange rate appreciation (fiscal contraction). We will discuss each policy in details in the following section.

Sterilization policy: To illustrate how the Intervention and sterilization work, we use two identities. First, the balance of payments identity which implies that the sum of the current (CA) and the capital account balance (CAP) equals the change in the (net) foreign assets of the central bank (ΔFA).

$$CA + CAP = \Delta FA \tag{1}$$

Assume that the current account is balanced ($CA = 0$) at the prevailing exchange rate (holding everything else constant). For any reason, assume there is a tendency for capital inflows in a foreign currency (U.S. dollars). This puts pressure on the exchange rate to appreciate. If the local central bank wants to prevent currency appreciation, it will intervene in the foreign exchange market by purchasing U.S. dollars, thus increasing its holding of foreign assets. The outcome is positive capital inflows and an increase in foreign assets ($CAP > 0$, $\Delta FA > 0$). If the central bank does not intervene, the exchange rate will appreciate freely to the point where it is unprofitable for capital to flow in. In this case, balance of payments equilibrium is achieved with $CAP = 0$ and $\Delta FA = 0$. From the preceding we can say changes in foreign assets of the central bank reflect the balance of payments conditions of a country and its exchange rate policies. Second, the central bank balance sheet implies that a change in reserve money (ΔH), or the (monetary) liabilities of the central bank, is identically equal to the change in its assets, which in turn equals the sum of changes in domestic credit (DC) and in foreign assets (FA) of the central bank.

$$\Delta H = \Delta DC + \Delta FA. \quad (2)$$

Equation (2) implies that a change in foreign assets tends to change the supply of money. The policy attempts to prevent changes in foreign assets from affecting reserve money by implementing offsetting changes in domestic credit, is known as sterilization. For example, Asian countries in the 1980s and 1990s responded to large increases in foreign asset holdings by implementing sharp reductions in domestic credit (Moreno, 1995). In deed many countries have begun to divert a larger share of their capital inflows to reserve accumulation in order to safeguard against sudden capital outflows (World Bank, 2002). The consequences of such policy have been that a smaller fraction of capital inflows is being channeled into domestic investment. Sterilization can also work the other way. In 1994, the Mexican central bank offset the monetary contraction caused by declining foreign asset holdings by increasing domestic credit. Of course, the extent to which balance of payment disequilibria will arise and be reflected in changes in foreign assets depends in part on the degree of capital mobility and on the exchange rate regime in the other part (Kahler, 1998).

Exchange rate regime: Most of developing countries that received large capital inflows during the first half of 1990s resisted the nominal exchange rate appreciation induced by capital inflows. The rationales behind that were the commitments of the country to maintain fixed exchange rate, to delay the real appreciation in order to maintain international competitiveness, or the perception that the capital flows are volatile and temporary in nature. However, as the inflows persisted and reserves accumulated this policy became costly. As a result, exposure to market forces is

resorted either by revaluation or allowing more flexibility in exchange rate determination. The exchange rate regime here played a major role in determining the pattern of balance of payments adjustment to sudden shocks in capital inflows. Under floating exchange rates with no intervention the nominal exchange rate will appreciate freely in response to capital flows. However, under an official commitment to a peg, crawling, or narrow band exchange regime, a decision to revaluate will be necessary. There are several advantages of allowing exchange rate to appreciate: any shock to the capital acc during the periods of large capital inflows (Calvo, Leiderman, and Reinhart, 1994). First, such appreciation will bring ($\Delta FA=0$) so will insulate money supply (ΔH) and domestic credit (ΔDC) from the inflows, which is particularly desirable if the inflows are perceived to be highly reversible. Second, if the economic fundamentals support the real appreciation, then the adjustment will be by real appreciation not via domestic inflation. Despite these advantages, revaluations have been relatively uncommon in response to capital flows. Under flexible exchange rates with intervention (more realistic), the amount of reserve accumulation is a policy choice. The more aggressive is the reserve accumulation, the more thoroughly will the authorities insulate the nominal exchange rate from pressures generated by the capital flows. We should note that under both fixed and flexible exchange rates, the current account would adjust to a sustained capital inflow by two mechanisms. First: the inflows will generally create a reduction in domestic interest rates and an increase in asset prices, thus promoting an increase in expenditure relative to production. This happens under fixed exchange rate as liquidity and bank lending increase._Second: the

inflows will also create pressures for real exchange rate appreciation either under fixed or flexible exchange rate. However, under fixed exchange rate the appreciation may take a long time because it will be created by domestic inflation while under flexible exchange rate the appreciation will be due to nominal exchange rate appreciation.

Fiscal policy: policymakers may react to capital by flowing tighten fiscal policy by either reducing expenditures or increasing taxes, or both. In theory, the contractionary fiscal policy can lower aggregate demand and then offset the expansionary influence by capital inflows. This policy has several advantages. It avoids the costs associated with the sterilization policies. In addition, fiscal restraint is a substitute for exchange rate flexibility as a stabilization device. A cut in government expenditure is likely to limit the appreciation of the real exchange rate since non-tradable goods often represent a significant share of government expenditure (IMF, 1997). However, the devil in the details of how the fiscal gap is closed (Calvo et al, 1994). For instance, an adverse shock in capital flows often implies a sharp decrease in the availability of real resources (non-inflationary) to finance the fiscal deficits and the contractionary impacts of such shock exacerbate the fiscal deficits.

Beyond the two edged sword of fiscal policy as an instrument for stabilization, some economists argue that fiscal policy should become more conservative in the face increased financial integration (Heller, 1997, the World Bank, 1997). As the country increasingly integrates with the global economy, the direction and magnitude of capital flows become very sensitive to perception of domestic solvency. If the long-run fiscal policy is uncertain, short-run changes will be used as a signal on the government's

long run intentions. This limits the flexibility of the fiscal policy in the short run because the government will be concerned about the possibility of giving the wrong signals. Therefore, achieving a reputation for conservative fiscal policy will maximize the short-run policy flexibility in face of capital inflows periods (Lopez-Mejia, 1997).

The fiscal response to such shock and generally to manage volatile capital flows is to set precautionary fiscal targets or decrease government spending but this one has many political problems. Also it has been discussed that it would be desirable to offset the contractionary impact of a sudden reduction in capital flows with a countercyclical fiscal expansion but the scarcity of non-inflationary resources potentially creates the need for a pro-cyclical fiscal contraction instead. Generally, there are practical limits to what should be expected of fiscal policy: it is highly unlikely that any government will react properly either in the magnitude or the speed required to offset the shifts in the capital flows. Also, the debate that precedes the approval to use fiscal tolls makes it inflexible instruments (Lipschitz et al, 2001)

2- Model Simulation

In this section, we use the model developed and estimated in Chapter III to simulate the results under different policy options. It is better to discuss first the simulation methodology, the different types of simulation, and how simulation works.

Simulation refers to data generating by the use of a computer, which simulates results of an experiment. In economics the experimenter cannot use the actual economy and its environment to perform an experiment. Economists instead create the experimental situation in a computer and generate data, which are believed to have the

characteristics similar to data obtained from an actual experiment. In econometrics, simulations are used to generate artificial economic data from an econometric model, which is a set of equations describing an economy or parts thereof (Chow, 1983). Once the econometric model is estimated using actual economic data, we can study its dynamic properties by simulation and see how it responds to different shocks.

Deterministic Simulations: In this simulation, all equations in the model are solved so that they hold without error (deterministic relations) during the simulation period, all coefficients are held fixed at their point estimates, and all exogenous variables are held constant. The deterministic simulation results depend on the chosen solution of the model. If we would like to examine the ability of our model to provide one period ahead forecasts of our endogenous variables, we use the static solution of the model in which values of the endogenous variables up to the previous period are used each time when the model is solved and lagged endogenous variables are based on the actual values. To do this, we can look at the predictions of our model against our historical data, using actual values for both the exogenous and the lagged endogenous variables of the model. (Novales 2000)

But, when we examine how the model performs when used to produce a multi-step forecast, we use the dynamic solution of the model in which we must use our forecasts from previous periods, not actual historical data. A dynamic solution is the correct method to use when forecasting many periods in the future or evaluating how a multi-step forecast would have performed historically.

Stochastic Simulation: Policy recommendations, for example rules for monetary policy, are evaluated with models to examine their ability to handle economic shocks. In order not to depend on one specific historical time series of shocks, we use stochastic simulations. In this simulation, the equations of the model are solved with residuals, which match to randomly drawn errors. In doing so, a distribution of outcomes for endogenous variables in every period is generated and approximated by solving the model many times using different draws for the random components and then calculating statistics overall the different outcomes. The stochastic simulation is typically used to get an idea about the sensitivity of the results to various shocks. In a stochastic simulation the model is solved n times, each time using a new set of time series of the shocks. That is, n new time series for each of the original residuals of the estimated equations. From the results of these n simulations, we can calculate for each endogenous variable in each time period the average of the results and also the 90 %or 95% confidence intervals (i.e. the 5% or 2.5% largest and 5% or 2.5% smallest results). When the confidence intervals are small and the time series averages and standard deviations of endogenous variables do not change very much between simulations, we may conclude that the results are robust. The difference between dynamic and static simulation is in the treatment of the lagged values of the endogenous variables during the simulation. Dynamic simulation uses historical data for lagged endogenous variables if they are dated prior to the first period of the simulation. Thereafter it uses the values forecasted by the model itself. Static

simulation uses actual values for all lagged variables even if they are endogenous to the model

Policy Simulation: Having satisfied with the performance of our model, we can use it to forecast the future values of endogenous variables. The first step to do that is to decide the future values of the exogenous variables that will be used in the period of forecast. The future values of exogenous variables may be based on our best guess on what we expect to happen or they may be one particular policy that we are interested in. In general, we will be interested in constructing several different scenarios (paths) reflecting some macroeconomic policies and then comparing the results. The future values of our exogenous variables reflects the influence of: fiscal policy, (Government expenditure (G) and taxes (T); Monetary policy, domestic credit (DC); Exchange market policy, Exchange rate (Ex); and external shocks, oil price uncertainty and world interest rate (S/LROIL and WR). We compare our model predictions under a variety of different assumptions regarding policy options discussed above.

3- Simulation Under Different Scenarios: The Case of Egypt

We will take the Egyptian economy as a representative case for the Middle Eastern economy to apply the policy simulation scenarios. In additions to the researcher's concern about the Egyptian economy, there are some rationales for the choice. Egypt is undertaking fast steps toward integrating in the global economy in the last few years such free trade agreement (FTA) with the USA. In 1999 and Egyptian-

Europe trade partnership in 2003.Therefore, we want to pursue the different policy scenarios in response the impact of such measures.

When testing different scenarios in a dynamic framework, the basic principle is to compare results with what would otherwise have occurred in the economy in the absence of the scenario. For doing so, the first step is to establish a baseline simulation (sometimes called reference case), which will form the scenario of what is forecast to be the changes in the economy from year to year. In the usual baseline simulation we must provide the forecasts of all exogenous variables in the model and then estimate the baseline model for the periods of (2004-2010). Specifically, our baseline simulation includes forecast of government expenditure, credit to private sector, tax rates, US interest rate, inflation uncertainty, credit uncertainty, short and long run oil price uncertainty, and exchange rate uncertainty. Thereafter, we select some exogenous variables that represent the policymaker's interests, and change them according to the proposed scenario while holding the other future values constant. The comparison between the baselines and the scenario shows policy impacts

For generating out-of-sample forecasts, the first step involves selecting a time period over which each variable is examined. We used monthly data for all uncertainty measures, domestic credit, and US interest rate to construct monthly forecast and then we aggregated them to be annual forecasts. The annual data are used for government expenditure and tax rates. Second step is to construct the stochastic models. Box-Jenkins or ARIMA models were employed. By plotting series, non-stationarity was revealed for some variables. Technically speaking, we found that domestic credit and

government expenditure have a unit root; therefore a non-stationary time series is transformed into a stationary time series by differencing as discussed in Chapter II. Also autocorrelation function (ACF) and partial autocorrelation function (PACF) are estimated.

The ARIMA model is used for generating forecast value of government expenditure, domestic credit, taxes and US interest rate. For government expenditure (G), we found the first difference of ln (G) follows AR (2) process. The government expenditure is projected to grow at 15.7% annually. For domestic credit (DC), the AR (3) process is identified. The forecast result shows that the domestic credit is expected to increase at 9.3 % annually. The historical path of tax rate is quiet different, we cannot follow its rising historical path. Instead, we will assume that the tax rate remains at its last observed historical value over the entire simulation horizon. Indeed, the last observed tax rate was the highest level that is 23% in average. Keeping the last observed tax rate is reasonable assumption for two reasons. First: the government cannot continue raising the tax rate, which is already very high, without taking into account the society's tax capacity and the contractionary effects on the economy. Second: this assumption is matched with the government policy that aims to encourage investment and capital flows.

For the US interest rate, we used ARIMA (1, 1, 1) to forecast the US interest rate over the simulation horizon. The results show that the US interest is projected to increase 4.5% over the first three years of the simulation and then starts declining during the rest of the simulation horizon expected to rise until 2006. For the

uncertainty series, we will use the mean value of the uncertainty measures over the simulation horizon. More specifically, we use the mean value of the uncertainty over the last ten years of the sample periods, from 1994 to 2003, for long-run oil price uncertainty, inflation, and domestic credit. For short-run oil price uncertainty and exchange rate uncertainty we used the recent last five years mean value of the uncertainty measures. Figure (4-1) shows the future forecasts of the exogenous variables.

The baseline forecast provides the base case from which other scenarios are constructed. This forecast assumes that domestic investment policies, capital flows; governments' fiscal policies, and monetary policy would remain constant during the simulation horizon. Also the model assumes that the uncertainty facing the country will be on its mean. The results of the baseline are shown in figure (4-2). With unchanged policies, domestic investment growth would average approximately 2.3% per annum, which is low compared with what would be to achieve the development targets. Growth in FDI is expected to average 7.1% per annum over the simulation horizon. Also this expected growth is not high given the low initial level of FDI in the country. Foreign bank loans are expected to grow at 4.8%. Finally, the foreign portfolio investment is expected to remain as it is over the simulation horizon. These results are matched with the World Bank reports that observe and forecast global development. Indeed, FDI flows to developing countries fell in 2003 for the second consecutive year as reported in global development finance (World Bank, 2004). More specifically, net FDI in the Middle East and North Africa fell from $6 billions in 2001 to $2 billions in

2003. This decline is an observed contrast to the sharp improvement in FPI and FBL. However, the Egypt's share of FPI is not expected to increase too much but at least will be stable. The decline in FDI flows to MENA countries in general and Egypt specifically is rendered to privatization's slowdown following financial crises in 2000 and 2001 and the political instability surrounding Middle Eastern countries. Also the lack of financial infrastructure and developing financial institutions impede the foreign portfolio investment to inflow.

4- Results

Simulation results are reported in Figures 3 to 10. The first scenario illustrates the consequences of following contractionary fiscal policy by reducing government expenditure growth by 5 % of its forecasted level. This policy aims at cooling down the overheating caused by capital flows, as we mentioned before. The deviations from the baseline model indicate the policy impacts. In general the impact on both capital inflows and domestic investment was mixed. Simulation results show that the contractionary fiscal policy succeeded in curbing FBL and FPI. FPI does not respond quickly to the contractionary policy. It maintains its original level in 2004, 2005 and 2006 and starts decreasing in 2007 to 2010 by 1.1 % of baseline. FBL decreased by 6.3% on average during the simulation periods. The response of domestic investment to the government expenditure cut was not too much; it increases by 1.2% against 5% decrease in government expenditure growth. This suggests a little crowding out effect of public expenditure. The impact on FDI was positive; it increases by 0.63% of the baseline. However, the response was delayed for two years, 2004 and 2005.

In scenario (2) we suppose that the government will pursue an expansionary fiscal policy. The average tax rate was reduced by 5% compared with the baseline while other exogenous variable remain unchanged. The results indicated in Figure (4-4) show that foreign direct investment is more responsive to tax reduction than domestic investment. This may suggest a discriminatory tax policy to attract FDI. The impacts on foreign bank loans and foreign portfolio investment are negligible. The weakness of the response in FBL and FPI reduce the effectiveness of tax reduction on domestic investment, despite the sizable rise in FDI. The problem with this scenario is the possibility to raise the price of non-tradable goods and ignite inflation. When we tried the opposite scenario, raising tax rate, we got an interesting result as in figure (4-5). FDI increased in both scenarios. Domestic investment decreased but the response was not symmetric. One explanation for that would be the efficiency of FDI by readjusting and producing at a lower cost. The asymmetric response of investment is expected where investment falls more when tax increased while increases less when tax reduced.

In scenario (4) a contractionary monetary policy is pursued by decreasing domestic credit growth by 5% of GDP compared with the baseline. The results in figure (4-6) indicate that the impact of sterilization policy was stronger on both domestic investment and foreign direct investment than foreign bank loans and foreign portfolio investment. The results show how foreign direct investment depends on domestic financial market as a source of finance. Also, the results show the contractionary impact of sterilization policy on domestic investment. Two explanations

can be offered to this result. First, one of the tools and the side effects at the same time of sterilization policy is to raise the discount rate or required reserve ratio which in turn reduce domestic investment. Second, most of capital flows will be used to accumulate foreign reserves. Thus a smaller amount will be channeled into domestic investment. The decline in FBL and FPI in response to sterilization policy is very tiny and almost reverts to its original path. According to these results we would not recommend a sterilization policy against capital inflows.

In simulation (5) we expect that the US interest will increase. US interest rates had reached a trough after continuously declining over a long period. No one expected them to fall anymore. But why should interest rate be expected to go up? First, there have been a number of signals that the US Federal Reserve Bank would raise interest rates. GDP growth in the US economy is high and inflation is rising. Second, domestic factors including recent data on inflation, GDP and fiscal deficits have raised expectations of higher rates. The inflation rate has been slowly rising. The increase in inflation has led to higher inflationary expectations. If it is reasonable to expect about a 2 per cent real interest in the long run, an increase in the inflation rate suggests that the nominal interest rates should be higher. The increase in US interest rates is expected to lead to a withdrawal of funds from all over the world into the US. Emerging market economies, including Egypt, have seen some indications of this already in last few months. This is expected to lead to a decline in liquidity and therefore, a decline in capital inflows. Simulation of the impact of an increase in US interest rate evokes the question of when and how the interest rate will rise. In our

simulation periods we expect the interest rate to rise in 2004 and over the seven years simulation it might return back to the average of its historical value in the period from 1995 to 2000, which is 6.5%. We will assume the Fed will raise the interest rate by 0.75% each year on average.

The simulation results in figure (4-7) show that US interest shock will cause both domestic investment and capital inflows to decrease. All types of capital inflows decreased sharply especially FPI, which is mainly driven by changes in world interest rate. Our results are consistent with the results of other studies, which found that the global "push" factors have significant impacts on the dynamics of capital inflows in developing countries (Mody et al 2001). The high sensitivity of capital inflows to US interest rate may indicate how risky the capital inflows to developing countries are. Other things being equal, the increase in US interest rate will increase the opportunity cost for capital to flow to developing countries. This implies that the capital inflows in Egypt are driven by external factors. A possible explanation for the decrease in the flows could be the lower level of domestic interest rates. When we modify the scenario to include a higher domestic interest rate vis-à-vis the increase in US interest rate, capital flows began to revert to their original values. However, the lower domestic interest rate can spur domestic economic activity, leading an improvement in credit rating and hence attract more capital inflows. Unfortunately this possible explanation is not supported by the data where the domestic interest rate was insignificant.

In scenario (6) we examine the impact of reducing exchange rate uncertainty by 50% of the mean of conditional standard deviation. As we mentioned in the second

section, the uncertainty surrounding flexible exchange rate may deter investment and capital inflows, therefore reducing it should have a positive impact on both capital flows and domestic investment. Our simulation results in figure (4-8) show that foreign direct investment is more responsive to the reduction in exchange rate uncertainty than domestic investment. FDI increased by 0.4 %, on average, (from 1.2% to 1.6%) while domestic investment increased gradually in range from 0.27% to 2.8% in response to 50% reduction in exchange rate uncertainty over the simulation periods. Not surprisingly, the foreign portfolio investment decreased in response to the reduction in exchange rate uncertainty. However, the reduction in FPI was tiny and about 0.2 % of baseline.

In scenario (7) figure (4-9), we assumed that the short run uncertainty of oil prices can be reduced, by regional arrangement within oil producing countries since they have some power to stabilize the price. We examine the impact of a 50% reduction in the mean of conditional standard deviation of oil price on domestic investment and capital flows. Our simulation results have mixes signals. Domestic investment decreased in the first three years of simulation by about 0.68 % under the baseline value and after that it was above the baseline by 1.5% of the baseline. This implies that the short run oil price uncertainty has a positive effect s on domestic investment and these effects last for three years and after that the traditional relationship between uncertainty and investment dominates. This suggests a delay in policy response to counteract the effects of short run uncertainty. All types of capital flows increased in response to the reduction in short run oil price uncertainty. A 50%

decrease in sort run oil price uncertainty caused foreign bank loans to increase by 7.4% of baseline. Foreign direct investment increase by 8.3 % on average but it reverts to its original path in the end of simulation periods. FPI increased by negligible amount.

The impact of reducing long run oil price uncertainty on domestic investment and capital flows is shown in figure (4-10). The results of the simulation were mixed. Domestic investment and foreign direct investment increased while foreign bank loans and foreign portfolio investment remain unchanged. One possible explanation for the increase in domestic investment and FDI in response to the reduction in long run uncertainty could be the low domestic interest rate associated with the improvement in macroeconomics aggregates due to the reduction in long run oil price uncertainty. When we control for the domestic interest rate in this scenario, we got the same results. This supported the complementary relationship between domestic investment and FDI. The comparison between scenario 6 and 7 suggests that the oil producing countries should work to reduce oil price uncertainty in general to attract more capital inflows. Despite the response of each type of capital inflows is different to the reduction in oil price uncertainty, policy makers have to be cautious in dealing with long run oil price uncertainty because its reducing effect on FBL and FPI. Also, delaying response to short run oil price uncertainty may be a strategic move for domestic investment because higher short run uncertainty triggers more investment in the beginning and after that reduces investment.

5- Conclusion

In this chapter we examined the economic outlook of domestic investment and capital flows in the Egyptian economy. In general the economic outlook is good but not enough to help the Egyptian economy to achieve high growth rate given the anticipated growth in domestic investment and capital flows. The chapter provides several perceptions. Firstly it focuses on the importance of simulation as the main guide in adopting strategic economic polices in a small open economy. Secondly the chapter provides different scenarios for the effects of different policy responses on capital flows and domestic investment. Out-of-Sample forecasts of factors affecting the interaction between domestic investment and capital flows are generated over the periods from 2004 to 2010. Among the policy implication of the chapter are that the sterilization policy is not recommended for the Egyptian economy. In spite of its role in cooling down the overheating caused by the capital inflows, it has a contractionary effect on domestic investment because of increasing interest rate. Also the accumulated reserves associated with the sterilization policy will allow a smaller amount of capital flows to be channeled to domestic investment. Second reducing short run and long run oil prices is favorable and has positive effects on both domestic investment and capital inflows specially FDI. Finally, our simulation results show that the contractionary fiscal policy by reducing government spending is the appropriate policy to curb the undesirable effects of capital inflows.

CONCLUDING REMARKS

Four issues were addressed in this study. First, we examine the dynamic interaction between each type of capital flows and domestic investment, given the specificity of oil producing countries. Second, the impacts of short run and long run uncertainty on investment and capital flows. Third, how frictions originated in capital market with uncertainty and irreversible investments affect both domestic investment and capital flow? Fourth, what are the forecasted paths of investment and capital flows in the next seven years? And what are the best strategic policy initiatives to mange a small open economy?

Using GMM-3SLS estimator in a SEM framework, the results show that the interaction exists at least for foreign direct investment. Foreign direct investment and foreign bank lending are the effective components in capital flows to stimulate domestic investment in oil producing countries. FDI is the strongest catalyst in capital flows for domestic investment. The interaction between FDI and domestic investment is bi-direction, however FDI induces domestic investment more than domestic investment stimulates FDI. The dynamics shows that the lagged FDI has a stronger impact on domestic investment than the lagged of domestic investment itself. This suggests the importance of the initial level of FDI that the country had. FBL is the second important component in capital flows stimulating domestic investment but its impact is much less than FDI.

Defining uncertainty as the unpredictable volatility, we find the main sources of macroeconomic uncertainty in oil producing countries are inflation, exchange rate, real interest rate, credit availability, and oil price. By decomposing uncertainty into short and long run components using CGARCH, we find that both domestic investment and all types of capital flows are affected by short run and long run uncertainty of oil prices. However, the effect of short run uncertainty is much larger than long run. Domestic investment and capital flows are negatively responded to most of uncertainty measures and these results matched with the line of previous studies. However, long run oil price uncertainty has a positive effect on FDI.

While credit market imperfection has significant and negative effect on domestic investment, financial development has a positive and significant effect on both domestic investment and capital flows. Uncertainty combined with the capital market imperfection has a negative effect on domestic investment. The negative effects exerted by uncertainty dampen the positive effects of financial development and this may explain why the real interest rate is insignificant. Although these results are based on more realistic assumptions, uncertainty and imperfect markets, they may underpin the neoclassical theory of investment in which financial factors are ignored.

Out-of-Sample forecasts over the periods from 2004 to 2010 reveals that the economic outlook of domestic investment and capital flows in the Egyptian economy is not enough to help the Egyptian economy to achieve the target growth rate. Among the policy implication of the simulation is that the sterilization policy is not recommended for the Egyptian economy. In spite of its role in cooling down the

overheating caused by the capital inflows, it has a contractionary effect on domestic investment because of increasing interest rate. Also the accumulated reserves associated with the sterilization policy will allow a smaller amount of capital flows to be channeled to domestic investment. Second reducing short run and long run oil prices is favorable and has positive effects on both domestic investment and capital inflows specially FDI. Finally, our simulation results show that the contractionary fiscal policy by reducing government spending is the appropriate policy to curb the undesirable effects of capital inflows.

The role of regional arrangements or establishing economic blocks among oil producing countries in reducing uncertainty and stimulating capital flows might be pursued in future research. The results of the study is limited to oil producing countries, therefore expanding the sample size and including non-oil producing counties need further investigation.

APPENDICES

Figure 1.1
The Effect of Uncertainty and Capital Market Imperfection on Capital Stock

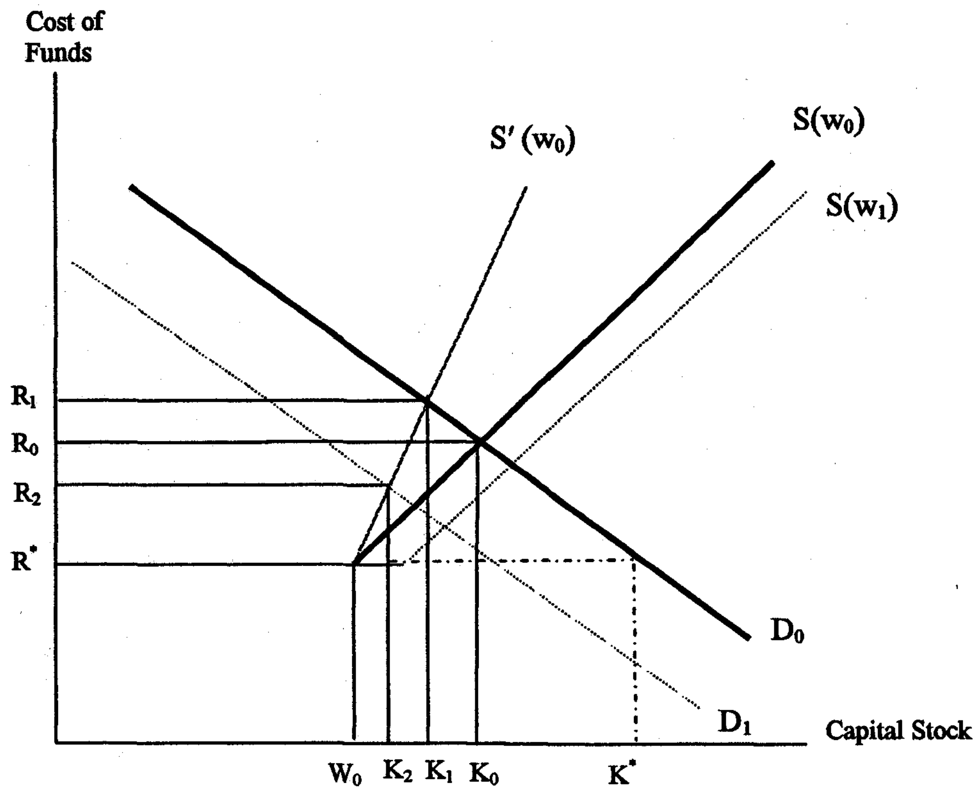


Table 2.1
Unit Root Test on Log of Inflation Rate

		Ng-Perron Test				Elliot, Rothenberg and Stock Test (ERS)	
Country	k	MZ_α	MZ_t	MSB	MPT	ERS P_t	DFGLS
Algeria	2	-9.12	-1.25	0.21	8.86	9.921	-2.19
Egypt	3	-11.5	0.25	0.21	9.34	9.91	-2.21
Indonesia	5	-16.2	-1.87	0.174	9.12	11.4	-2.8
Israel	8	14.58	-1.94	0.23	5.41	7.47	-2.72
Iran	3	-12.14	-1.98	0.22	8.58	9.35	-1.97
Kuwait	3	-7.55	-0.94	0.37	17.49	11.24	-1.27
Tunisia	2	-11.2	-0.15	0.24	5.2	11.21	-2.62
Nigeria	4	-6.24	-2.34	0.27	9.27	18.41	-1.32
Qatar	4	-13.3	-1.82	0.26	17.15	9.07	-2.08
Saudi-Arabia	2	-15.2	-2.31	0.23	5.31	21.1	-2.87
Syria	2	-9.87	-1.94	0.21	7.87	12.31	-2.52
UAE	3	-14.3	-2.61	0.25	5.32	14.54	-2.71
Venezuela	5	-10.1	-2.05	0.17	4.87	12.24	-2.54
5%		-17.3	-2.91	0.168	5.48	5.48	2.977

Notes: k is the lag length determined by MAIC. Sample period 1981:1 to 2003:10. MZ_α and MZ_t is the Modified Phillips-Perron test. MSB is the Modified Sargan-Bhargava test. ERS Pt is the Elliot, Rothenberg and Stock Feasible point optimal test. DFGLS is the augmented Dickey Fuller test.

Table 2.2
Unit Root Test on Log of Exchange Rate

		Ng-Perron Test				Elliot, Rothenberg and Stock Test (ERS)	
Country	k	MZa	MZt	MSB	MPT	ERS P_t	DFGLS
Algeria	1	-10.2	0.25	0.21	13.06	8.91	-1.49
Egypt	2	-1.54	-2.14	0.22	7.14	9.19	-1.91
Indonesia	8	18.3	-2.8	0.17	4.92	2.5	-3.45
Israel	1	-8.31	-0.14	0.29	8.12	10.14	-2.42
Iran	5	-2.25	-1.44	0.2	4.23	7.75	-2.38
Kuwait	3	-7.95	-1.94	0.37	10.94	9.04	-2.18
Tunisia	8	-10.23	-0.25	0.13	4.2	12.31	-2.52
Nigeria	6	-11.54	-2.32	0.15	4.51	13.24	-2.61
Qatar	5	-9.87	-1.94	0.11	3.87	11.24	-2.47
Saudi Arabia	10	-10.24	-1.98	0.12	4.12	12.54	-2.57
Syria	6	12.58	-2.31	0.14	3.14	13.78	-2.68
U.A.E.	3	14.25	-2.61	0.15	3.32	14.54	-2.71
Venezuela	12	19.89	-2.42	0.14	5.24	12.74	-3.12
5%		-17.3	-2.91	0.168	5.48	5.48	-2.977

Notes: k is the lag length determined by MAIC. Sample period 1981:1 to 2003:10. MZ_α and MZ_t is the Modified Phillips-Perron test. MSB is the Modified Sargan-Bhargava test. ERS Pt is the Elliot, Rothenberg and Stock Feasible point optimal test. DFGLS is the augmented Dickey Fuller test.

Table 2.3
Unit Root Test on Real Interest Rate

		Ng-Perron Test				Elliot, Rothenberg and Stock Test (ERS)	
Country	k	MZα	MZt	MSB	MPT	ERS P_t	DFGLS
Algeria	1	-10.2	-1.54	0.11	31.26	10.11	-1.39
Egypt	1	-17.84	-3.44	0.17	5.14	4.17	-3.13
Indonesia	7	15.8.	-1.84	0.18	7.8	8.52	-2.87
Israel	2	-18.1	-3.04	0.17	4.21	4.27	-3.2
Iran	5	-9.85	-1.94	0.11	13.8	11.24	-2.47
Kuwait	1	-7.95	-1.87	0.09	6.39	9.25	-1.98
Tunisia	1	-2.25	-1.52	0.12	6.12	10.25	-1.87
Nigeria	2	-7.54	-1.98	0.15	7.12	12.32	-2.52
Qatar	1	-11.37	-2.47	0.12	28.1	14.21	-2.74
Saudi Arabia	1	-12.15	-1.49	0.73	13.14	11.14	-2.28
Syria	1	-7.54	-1.52	0.12	5.82	10.25	-1.87
U.A.E.	2	-12.35	-2.87	0.14	6.39	9.25	-1.9
Venezuela	8	-12.13	-2.76	0.14	4.39	10.1	-2.o8
5%		-17.3	-2.91	0.168	5.48	5.48	-2.977

Notes: k is the lag length determined by MAIC. Sample period 1981:1 to 2003:10. MZ_α and MZ_t is the Modified Phillips-Perron test. MSB is the Modified Sargan-Bhargava test. ERS Pt is the Elliot, Rothenberg and Stock Feasible point optimal test. DFGLS is the augmented Dickey Fuller test

Table 2.4
Unit Root Test on Log of Domestic Credit

		Ng-Perron Test				Elliot, Rothenberg and Stock Test (ERS)	
Country	k	MZα	MZt	MSB	MPT	ERS P_t	DFGLS
Algeria	5	-13.2	-1.51	0.91	6.08	8.21	-2.19
Egypt	7	-14.24	-1.59	1.2	6.37	7.18	-2.21
Indonesia	6	-16.2	-1.69	0.18	8.2	8.2	-2.81
Israel	3	-10.1	-2.14	0.97	9.37	9.41	-1.87
Iran	2	10.85	-1.98	0.12	7.12	12.31	-2.52
Kuwait	8	-13.05	-2.04	0.32	7.75	10.73	-1.58
Tunisia	1	-11.5	-1.04	0.47	4.14	14.07	2.02
Nigeria	2	-9.25	-1.01	0.13	3.87	9.78	-2.34
Qatar	4	-8.17	-0.87	0.12	2.14	8.744	-1.87
Saudi Arabia	9	-11.45	-1.94	1.37	11.19	8.04	-1.88
Syria	2	-14.8	-2.45	0.14	8.45	9.01	-2.41
U.A.E.	1	-11.35	-1.14	0.10	5.24	5.17	-2.13
Venezuela	8	-12.13	-2.74	0.15	7.32	19.14	-2.81
5%		-17.3	-2.91	0.168	5.48	5.48	-2.977

Notes: k is the lag length determined by MAIC. Sample period 1981:1 to 2003:10. MZ_α and MZ_t is the Modified Phillips-Perron test. MSB is the Modified Sargan-Bhargava test. ERS Pt is the Elliot, Rothenberg and Stock Feasible point optimal test. DFGLS is the augmented Dickey Fuller test

Table 2.5
Estimated AR and GARCH Models of Log-difference of Inflation Rate

Country	AR process φ_0	φ_1	φ_2	φ_3	GARCH(p, q) process ϖ	α_1	γ_1	Kurt-osis	Skew-ness	Jarque-Bera
Algeria	9.6**	-0.011	0.17**	-	4.2*	0.01*	0.93**	19.2	1.2	52.3
	(4.34)	(-0.2)	(2.7)	-	(1.8)	(1.67)	(20.1)			
Egypt	0.3	-0.08	0.29**	0.14*	3.5**	0.31**	0.73**	5.2	0.98	42.8
	(1.15)	(-1.23)	(3.7)	(1.74)	(2.41)	(5.1)	(32)			
Indonesia	0.01	-0.03**	0.029*	-	6.47*	0.03*	0.94**	18	-0.21	54.4
	(1.5)	(2.05)	(1.91)	-	(1.8)	(1.85)	(38.2)			
Iran	0.009*	-0.13*	0.13*	-	0.006	0.12*	0.87**	2.4	0.47	14.1
	(1.65)	(-1.72)	(1.92)	-	(1.4)	(1.8)	(30.3)			
Israel	0.91	0.65**	-	-	54.8*	0.41*	0.33**	4.1	0.65	46.2
	(0.7)	(12.2)	-	-	(1.79)	(1.9)	(5.3)			
Kuwait	0.13	0.8**	-0.25**	-	0.11	0.15**	0.45*	11.2	1.25	23.4
	(1.11)	(7.5)	(-2.2)	-	(1.3)	(1.7)	(1.9)			
Tunisia	0.003*	-	-	-	14.8**	0.03**	-	4.8	-0.29	12.8
	(1.92)	-	-	-	(3.8)	(11.24)	-			
Nigeria	0.08	-0.1*	-	-	0.03*	0.02*	0.95*	17.5	2.34	42.6
	(1.4)	(-1.68)	-	-	(1.76)	(1.66)	(1.67)			
Qatar	0.09	0.03*	-	-	0.009	0.14	-	12.8	0.97	9.5
	(0.27)	(1.64)	-	-	(0.8)	(7.8)	-			
Saudi Arabia	0.01	0.05	0.06*	-	0.07	0.05**	0.92**	18.2	1.23	28.
	(1.4)	(0.73)	(1.83)	-	(1.1)	(2.17)	(13.3)			
Syria	0.03	0.01**	0.05*	-	0.08**	0.01*	0.84**	14.2	0.87	27.5
	(1.2)	(7.2)	(1.8)	-	(2.3)	(1.67)	(2.1)			
UAE	0.003	0.02**	0.12**	-	0.02**	0.07**	0.74**	15	1.23	23.4
	(1.47)	(2.3)	(7.4)	-	(2.2)	(2.8)	(1.72)			
Venezuela	0.01	0.37**	0.14**	0.04*	0.01**	0.72**	0.2**	8.2	0.89	18.2
	(1.2)	(12.2)	(5.4)	(1.71)	(7.3)	(2.5)	(3.4)			

T-ratio in parentheses, ** Significant at 5%.(>1.96) * Significant at 10 % (>1.64)

Table 2.6
Estimated AR and GARCH Models of Log-difference of Exchange Rate

	AR process				GARCH(p, q) process			Kurt-	Skew-	Jarque-
Country	φ_0	φ_1	φ_2	φ_3	ϖ	α_1	γ_1	osis	ness	Bera
Algeria	0.009	0.44	-	-	0.08	0.01**	0.93*	7.8	2.2	39.3
	(1.8)	(4.2)	-	-	(1.19)	(7.5)	(1.65)			
Egypt	0.008	0.513	-0.16	-	0.54	0.23**	0.72**	5.2	0.98	42.8
	(1.15)	(10.23)	(-5.7)	-	(1.4)	(2.1)	(35.1)			
Indonesia	0.03	0.07	0.14	0.54	0.24**	0.28**	0.64**	17.2	1.7	8.2
	(1.2)	(12.8)	(8.2)	(3.4)	(14)	(2.8)	(3.2)			
Iran	0.006	0.47	-	-	0.001	0.19*	0.64**	12.5	2.8	25.1
	(1.92)	(5.8)	-	-	(1.1)	(1.7)	(24.8)			
Israel	0.011	0.55	-0.12	-0.24	0.04**	0.23**	0.41**	4.83	1.34	42.5
	(1.7)	(7.2)	(-2.8)	(-3.3)	(3.2)	(2.09)	(5.9)			
Kuwait	-1.96	0.21	0.173	-	1.2	0.15*	0.83**	5.2	0.32	17.5
	(0.34)	(-0.2)	(2.7)	-	(1.2)	(1.7)	(20.1)			
Nigeria	2.19	0.28	-	-	0.02	0.01*	-	3.2	0.54	34.3
	(0.14)	(4.2)	-	-	(1.07)	(1.72)	-			
Tunisia	0.003	0.17	0.39	-	11.2	0.61	0.43	11.2	3.2	42.7
	(1.3)	(1.2)	(4.7)	-	(1.1)	(0.9)	(1.2)			
Qatar	0.007	0.58	-	-	4.3	0.02*	0.97**	11.3	4.1	21.1
	(1.34)	(-0.2)	-	-	(1.2)	(1.77)	(20.1)			
Saudi Arabia	0.031	-	-	-	0.003	0.05	0.61	5.9	-1.2	51.3
	(1.54)	-	-	-	(0.3)	(0.97)	(1.6)			
Syria	-0.004	-	-	-	1.3	0.013*	0.86**	25.1	-10.3	5.7
	(-1.34)	-	-	-	(0.2)	(3.5)	(25.9)			
UAE	0.69	-	-	-	1.02	0.03*	0.41**	9.2	2.2	22.1
	(0.14)	-	-	-	(1.1.)	(1.7)	(2.1)			
Venezuela	.002	0.011	0.173	-	0.02**	0.01**	0.93**	13.2	3.4	42.3
	(1.34)	(2.2)	(2.7)	-	(17.9)	(7.57)	(20.1)			

T-ratio in parentheses, ** Significant at 5%.(>1.96) * Significant at 10 % (>1.64).

Table 2.7
Estimated AR and GARCH Models of Real Interest Rate

	AR process				GARCH(p, q) process			Kurt-	Skew-	Jarque-
Country	φ_0	φ_1	φ_2	φ_3	ϖ	α_1	γ_1	osis	ness	Bera
Algeria	0.19	-0.12**	-	-	0.008**	0.01**	0.93**	7.4	-0.64	14.81
	(1.25)	(-2.3)	-	-	(19.7)	(7.5)	(26)			
Egypt	0.23	-0.09	0.14**	-	0.54**	0.33**	-	4.6	-0.52	43.8
	(1.2)	(-1.36)	(2.5)	-	(7.2)	(2.4)	-			
Indonesia	0.9*	0.36**	0.17*	0.13	0.012*	0.94**	-	3.7	-0.38	19.6
	(1.7)	(4.5)	(1.8)	(1.97)	(1.7)	(5.2)	-			
Iran	0.01**	0.12**	-	-	0.027	-0.04**	-	28.2	-4.5	57.9
	(1.94)	(1.98)	-	-	(1.1)	(-17.3)	-			
Israel	-0.14	0.39**	-	-	0.004	0.23**	0.4**	4.2	-0.42	51.2
	(-1.4)	(5.4)	-	-	(3.2)	(2.06)	(5.5)			
Kuwait	0.51	0.25*	-	-	1.2	0.15**	0.82**	5.8	0.52	77.2
	(1.17)	(1.7)	-	-	(0.69)	(4.1)	25.9)			
Tunisia	0.02*	-	-	-	5.4	0.12*	-	12.5	-0.28	39.2
	(1.85)	-	-	-	(3.5)	(1.74)	-			
Nigeria	0.15	0.42**	0.31**	0.14*	1.2	0.15**	0.68**	31.2	1.84	42.8
	(0.8)	(2.8)	(3.1)	(1.7)	(27.2)	(2.9)	(3.1)			
Qatar	0.12*	0.03**	0.12**	-	0.005	0.34*	0.61**	18.1	-0.47	29.9
	(1.85)	(3.2)	(5.4)	-	(12.5)	(1.89)	(2.3)			
Saudi Arabia	0.012	-	-	-	1.54	0.001*	-	27.4	-1.98	38.7
	(1.41)	-	-	-	(0.2)	(1.64)	-			
Syria	0.3 1	0.15**	0.08**	-	0.02	0.15**	0.84**	14.5	1.04	28.3
	(0.12)	(2.5)	(2.1)	-	(12.4)	(2.12)	(3.2)			
UAE	0.001	0.24**	0.17	0.11*	1.31	0.34**	0.59**	10.25	1.87	27.4
	(1.05)	(5.8)	(2.1)	(1.79)	(7.9)	(3.8)	(2.5)			
Venezuela	0.02	0.54**	0.3**	0.17*	0.001	0.64**	0.28**	28.1	-0.98	37.8
	(0.28)	(12.4)	(2.8)	(1.64)	(12.8)	(3.4)	(2.1)			

T-ratio in parentheses, ** Significant at 5%.(>1.96) * Significant at 10 % (>1.64)

Table 2.8
Estimated AR and GARCH Models of Log-difference of Credit

	AR process				GARCH(p, q) process			Kurt-	Skew-	Jarque-
Country	φ_0	φ_1	φ_2	φ_3	ϖ	α_1	γ_1	osis	ness	Bera
Algeria	0.011*	-0.15**	-0.17**	-	1.98**	0.34**	0.91**	19.1	0.75	22.4
	(1.91)	(-2.12)	(-3.9)	-	(1.9)	(2.3)	(5.3)			
Egypt	0.015	-0.11	0.06**	-	2.2**	0.44**	0.55**	7.8	1.2	27.8
	(1.1)	(-1.03)	(1.97)	-	(2.1)	(4.5)	(6.2)			
Indonesia	0.02	0.12**	0.11*	0.09**	1.8**	0.74**	0.25**	28.2	2.8	54.5
	(1.3)	(3.8)	(1.8)	(2.1)	(4.2)	(8.7)	(2.5)			
Iran	0.013	-0.44**	-	-	0.007	0.2**	0.8**	10.2	0.97	24.2
	(1.4)	(-5.13)	-	-	(0.93)	(2.4)	(7.4)			
Israel	0.016	0.13	0.09**	0.25*	2.9**	0.37**	0.6**	4.2	0.41	25.2
	(1.1)	(1.25)	(1.96)	(1.7)	(2.1)	(3.8)	(10.6)			
Kuwait	0.008	-0.02	0.05	-0.06	3.7**	0.15**	0.72**	3.8	1.4	41.4
	(2.1)	(-0.21)	(0.62)	(-2.8)	(2.4)	(4.7)	(10.4)			
Tunisia	0.021*	-	-	-	0.03**	0.11**	-	12.5	-0.57	38.5
	(1.77)	-	-	-	(21.9)	(2.6)	-			
Nigeria	0.01*	-0.21**	-0.2**	-	0.002	0.32*	0.67**	24.8	1.25	57.9
	(1.8)	(-3.4)	(-2.9)	-	(1.19)	(1.9)	(2.2)			
Qatar	-0.09	-0.4**	-	-	0.3**	0.16*	0.64**	10.8	1.74	28.2
	(-1.4)	(-4.8)	-	-	(3.1)	(1.87)	(5.4)			
Saudi Arabia	0.05	0.25**	-	-	88	0.07**	0.9**	15.8	-0.84	47.5
	(1.37)	(1.98)	-	-	(1.37)	(2.8)	(13.1)			
Syria	0.02*	-	-	-	0.002	0.44**	0.57**	34.2	2.97	59.5
	(1.88)	-	-	-	(1.3)	(6.1)	(9.3)			
UAE	0.01	-0.42**	-	-	0.007*	0.22**	0.79**	6.3	-0.94	14.3
	(1.24)	(-5.5)	-	-	(1.93)	(6.4)	(17.6)			
Venezuela	0.004*	0.21**	0.15**	0.08*	0.03	0.52**	0.34**	15.4	1.64	21.4
	(1.84)	(9.3)	(5.32)	(1.8)	(0.8)	(3.8)	(6.5)			

T-ratio in parentheses, ** Significant at 5%.(>1.96) * Significant at 10 % (>1.64)

Table 2.9
The Component GARCH Model of Oil Price

Data set	Permanent Component			Transitory Component	
	Ω	P	φ	A	γ
Kuwait Invasion August1990					
Oil prices 1974:1-2001:8	0.044	0.9981**	0.107**	0.351**	0.551**
(including the invasion)	(1.57)	(67.5)	(2.92)	(3.09)	(8.78)
Oil prices 1974:1-1990:7	0.094	0.9830**	0.061**	0.259**	0.522*
(excluding the invasion)	(0.259)	(80.4)	(2.69)	(7.93)	(1.92)
September 11, 2001					
Oil prices 1974:1-2003:3	0.052	0.9976**	0.019**	0.3169**	0.516**
(Including Sept 11 and excluding Iraqi war)	(.37)	(28.2)	(2.14)	(4.11)	(10.12)
Oil prices 1974:1-2001:8	0.044	0.9981**	0.107**	0.351**	0.551**
(Excluding Sept 11)	(1.57)	(67.5)	(2.92)	(3.09)	(8.78)
Iraqi war April 2003					
Oil prices 1974:1-2003:10	0.0581	0.9987**	0.035**	0.130**	0.55**
(Including Iraqi War)	(0.361)	(27.96)	(2.46)	(3.63)	(12.75)
Oil prices 1974:1-2003:3	0.052	0.9976**	0.019**	0.3169**	0.516**
(Excluding Iraqi War)	(.372)	(28.2)	(2.14)	(4.11)	(10.12)

T-ratio in parentheses. ** Significant at 5 %.(> 1.96) * Significant at 10 % (>1.64)

Figure 2.1
Conditional Standard Deviation of Inflation Rate

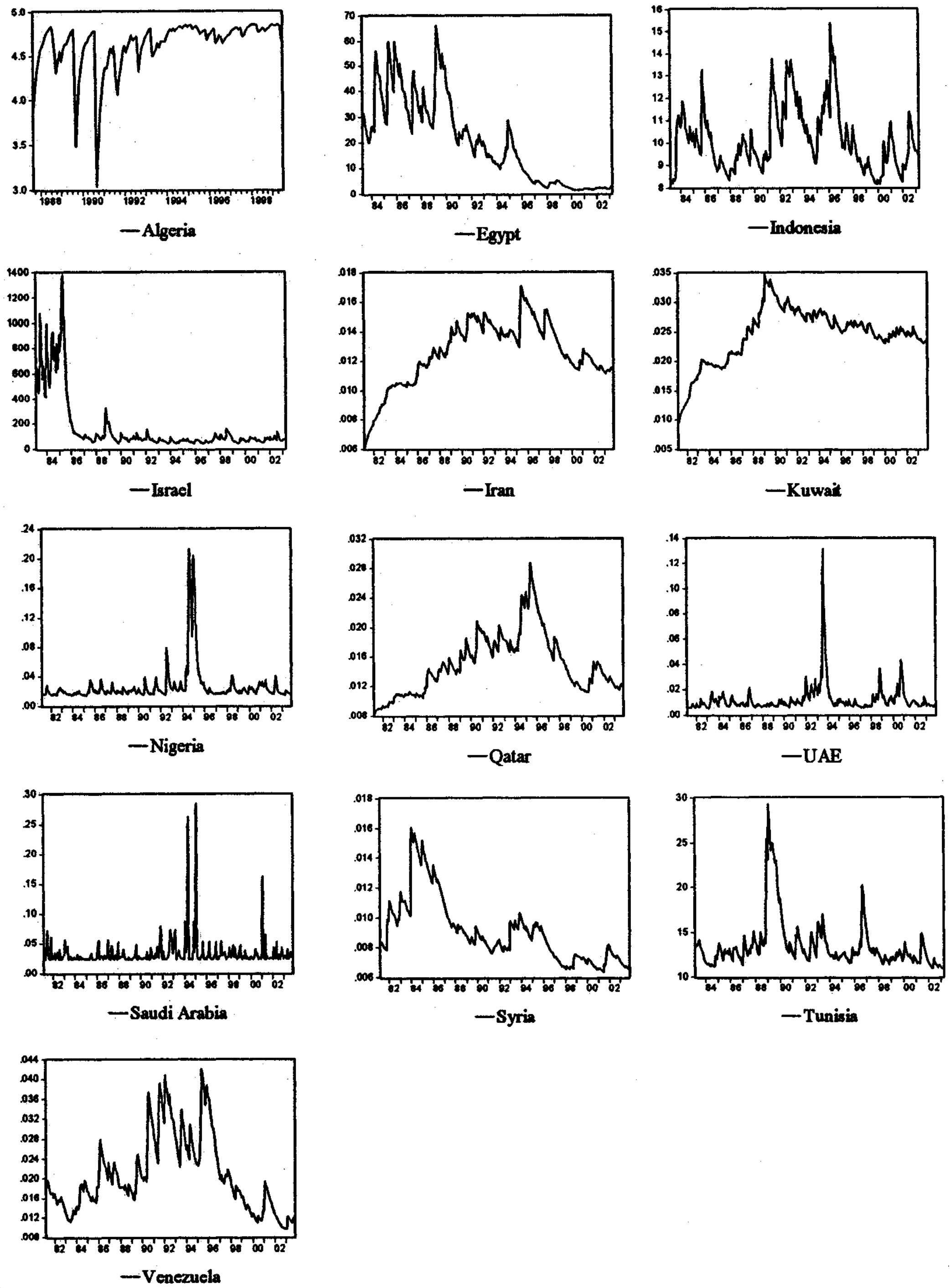


Figure 2.2
Conditional Standard Deviations of Exchange Rate

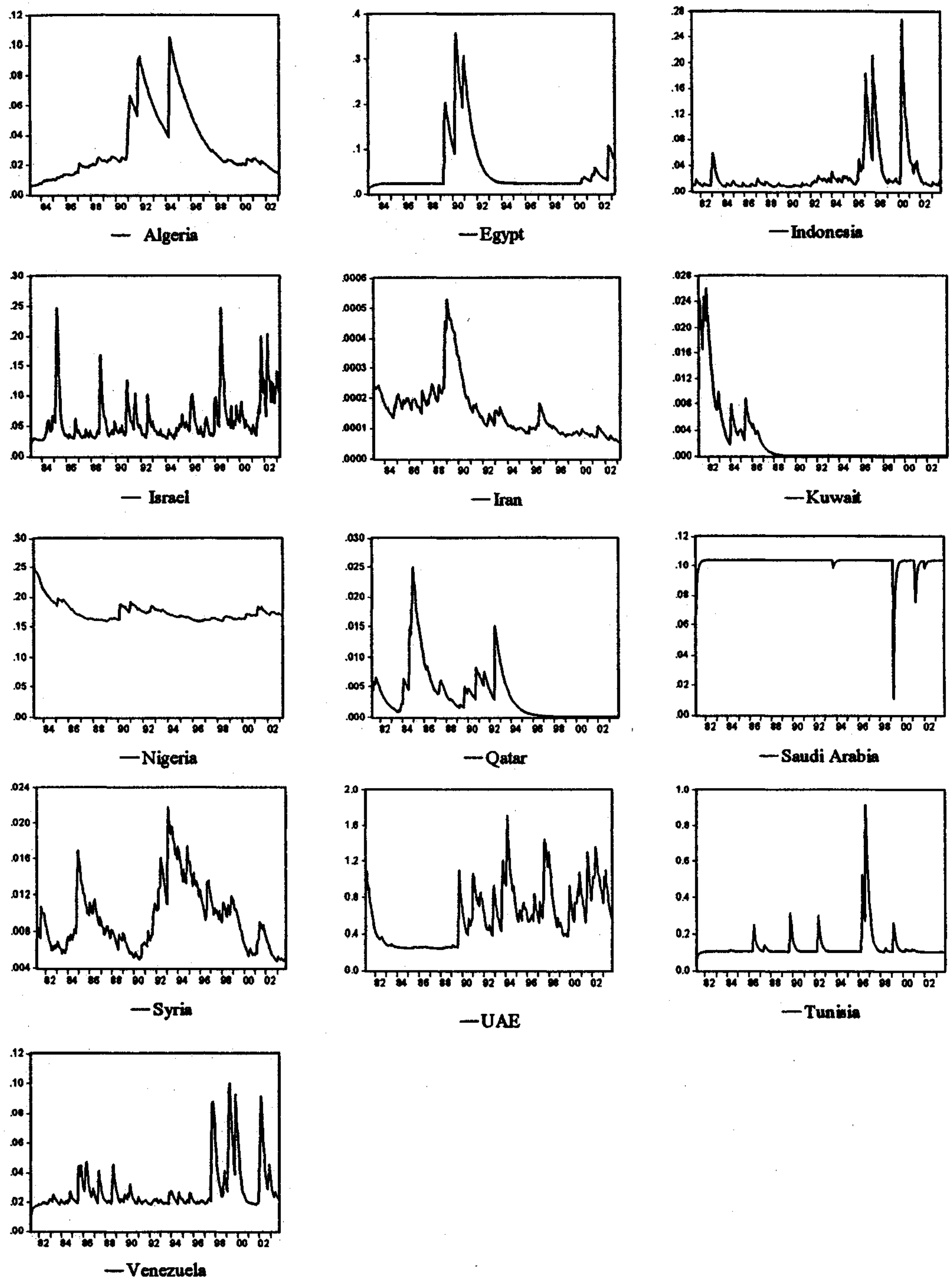


Figure 2.3
Conditional Standard Deviation of Real Interest Rate

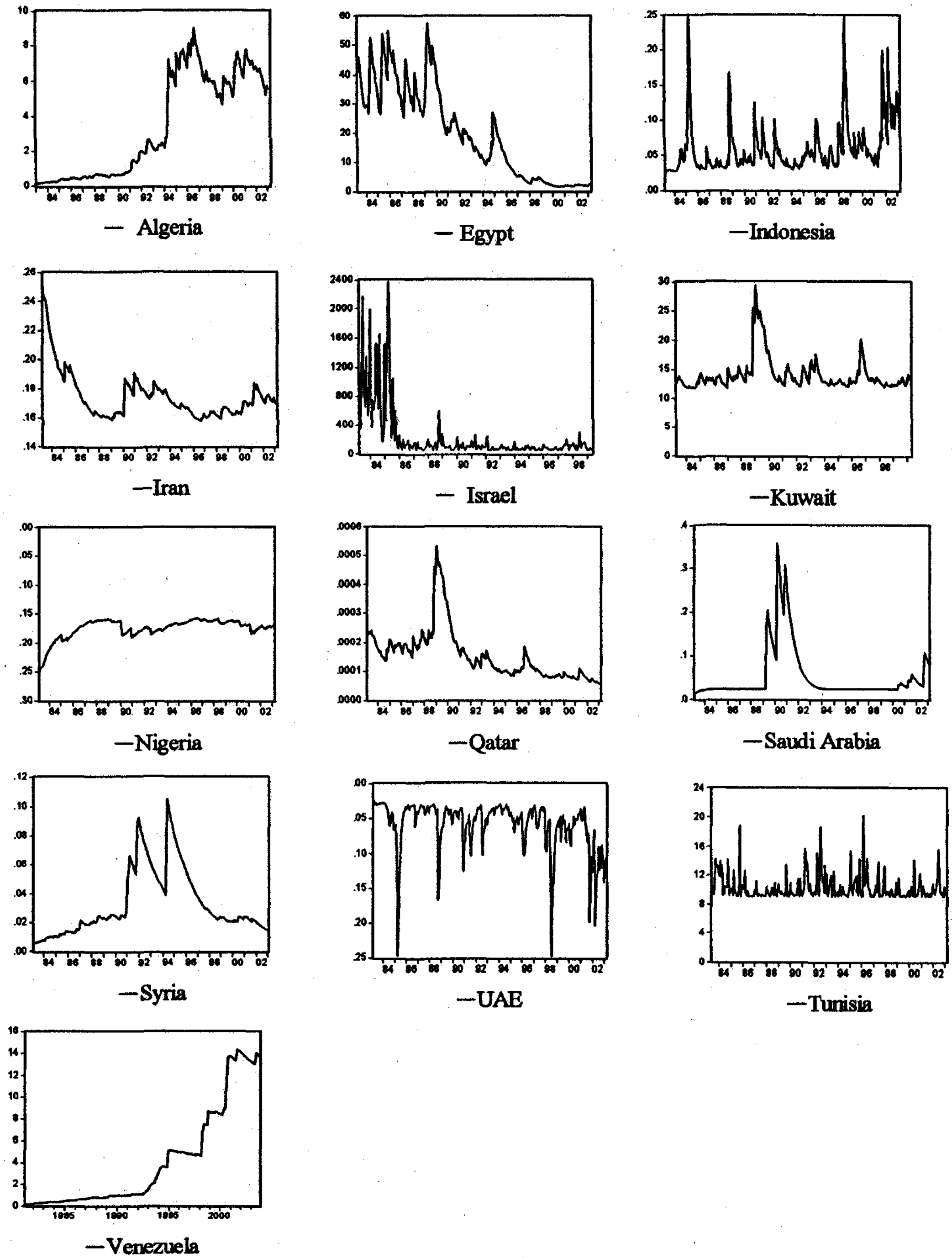


Figure 2.4
Conditional Standard Deviation of Credit

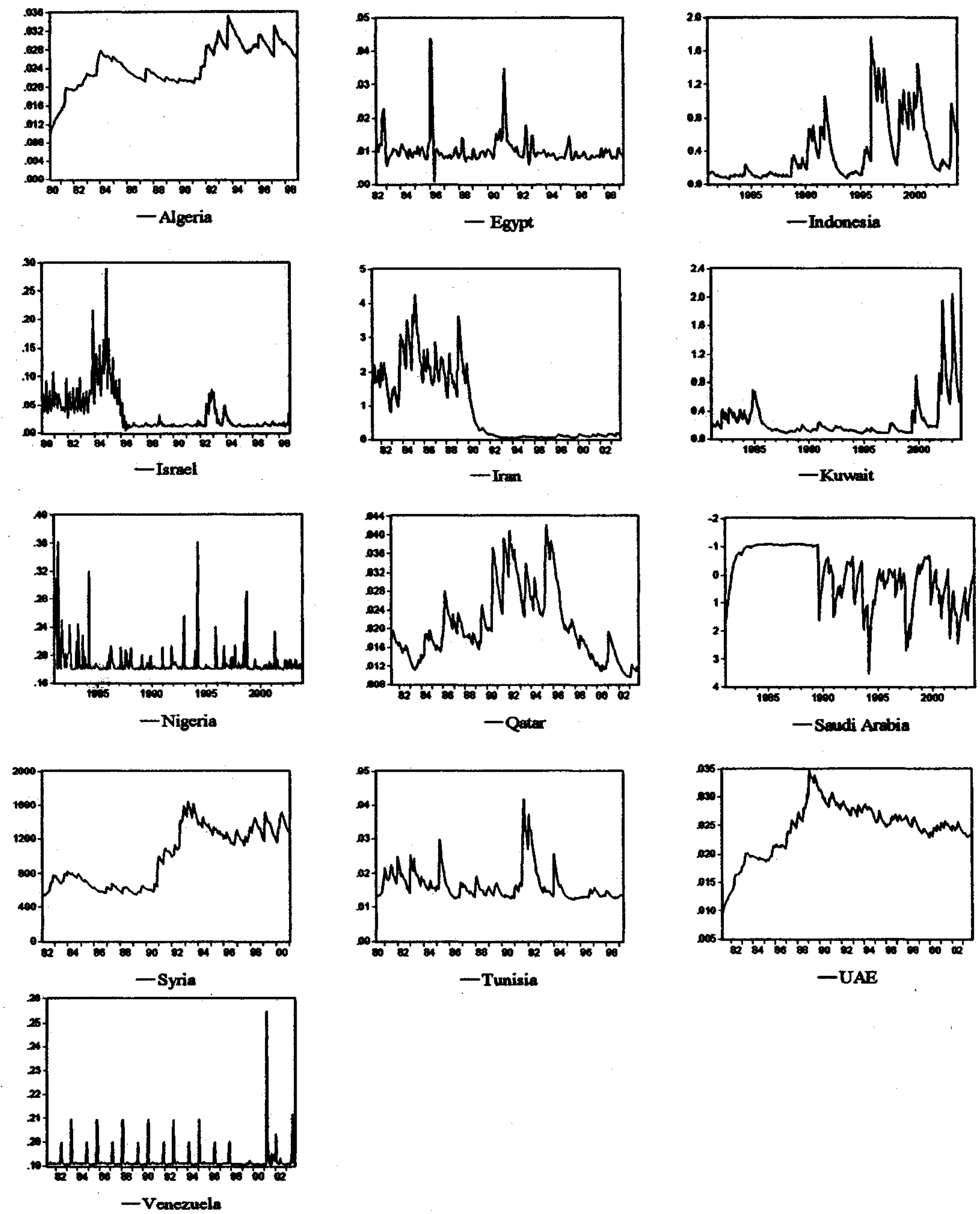


Figure 2.5
Conditional Standard Deviations for Oil Price

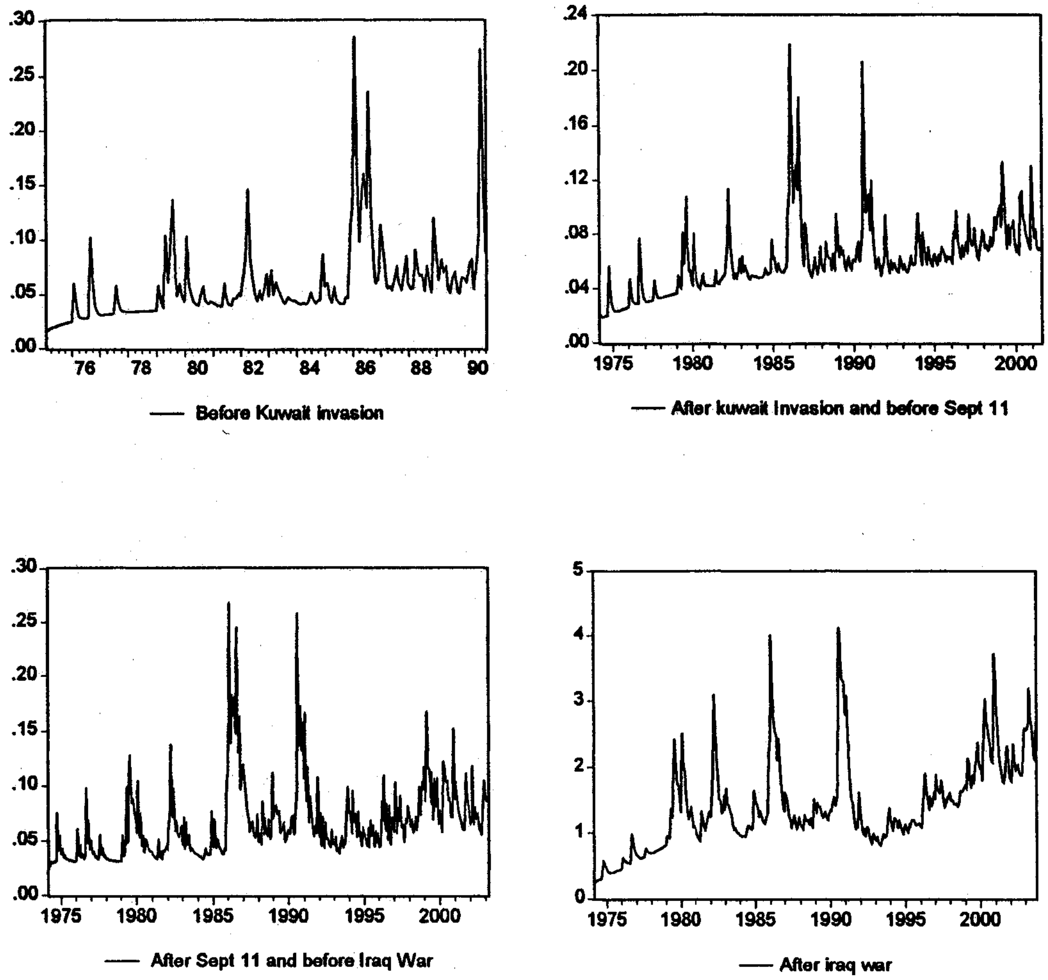


Table 3.1
Interactions Between Domestic Investment and Capital Inflows (System of GMM-3SLS) Domestic Investment and Capital Flows as a Share of GDP-Annual Data 1981-2003)

	I	FDI	FBL	FPI
Domestic investment, I	-------	-0.008* (-1.91)	-0.001 (-0.17)	-0.004 (-0.31)
Lagged Domestic Investment, I(-1)	0.576*** (3.1)	--------	--------	--------
Foreign direct Investment, FDI	0.5*** (3.5)	-------	-------	-------
Lagged Foreign direct Investment, FDI	0.88*** (3.8)	0.58*** (13.3)	-------	-------
Foreign Bank Loans, FBL	0.13* (2.73)	-------	-------	-------
Lagged Foreign Bank Loans, FBL	0.27*** (3.2)	--------	0.78*** (17.7)	-------
Foreign Portfolio Investment, FPI	0.24*** (1.2)	--------	-------	-------
Lagged Foreign Portfolio Investment, FPI	0.25**- (1.98)	--------	-------	0.13*** (22.9)
GDP Growth, GGDP	10.4** (2.9)	1.86*** (5.4)	2.4*** (2.2)	2.82 (1.04)
Lagged GDP Growth, GGDP(-1)	5.8** (1.96)	2.2*** (5.1)	4.7*** (3.5)	14.3*** (5.8)
Domestic Credit, DC	0.042*** (2.9)	-------	0.011** (-2.9)	0.003 (1.24)
Real Interest Rate (RR)	-0.02 (-1.2)	---------	-------	------
Relative Price of Capital (RPK)	-0.14* (-1.84)	---------	-------	------
Government Expenditure, G	0.09*** (2.1)	0.003 (0.7)	-------	------
Taxes, T	-0.19*** (-6.3)	-0.001 (-0.27)	-------	------

Table 3.1 – Continued

	I	FDI	FBL	FPI
World Interest Rate, WI	--------	---------	-0.05*** (-2.2)	0.2** (2.48)
Exchange Rate Uncertainty, EXU	-0.19* (-1.94)	-0.002* (-1.94)	-0.43 (-1.42)	-0.39 (-1.37)
Inflation Uncertainty, INFU	-3.3*** (-4.6)	-.53*** (-4.7)	-2.1 (-1.26)	-6.3* (-1.84)
Real Interest Rate Uncertainty, RRU	-6.8*** (-3.8)	-0.27 (-1.2)	-2.2 (-0.27)	0.31 (0.9)
Credit Uncertainty, CU	-0.09*** (-6.3)	-0.02 (-1.01)	-0.05*** (-2.2)	0.014 (1.5)
Short Run oil price Uncertainty, SROILU	-84.1*** (-3.3)	-20.4*** (-3.6)	0.8*** (2.03)	-27*** (-3.7)
Long Run oil price Uncertainty, LROILU	-34.3* (-1.96)	15.9*** (2.6)	-18.9*** (-3.6)	-17*** (-11.4)

Notes: t-ratios (in brackets) are heteroskedasticity consistent. One (*), two (**), and three (***) stars denote statistical significance at 10, 5, and 1 percent level, respectively

Figure 3.1
Model Evaluation Using Static Deterministic Simulation: Domestic Investment

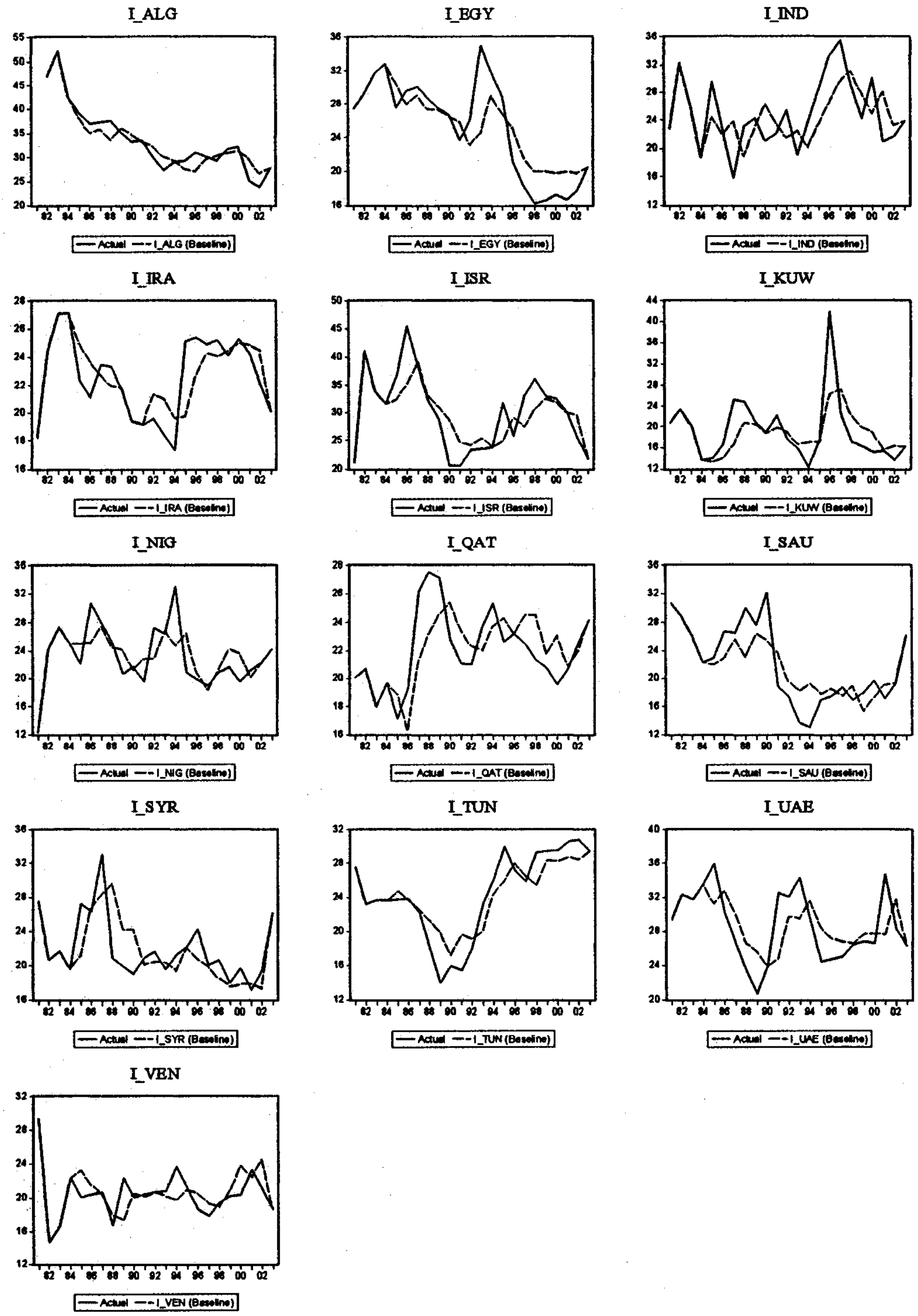


Figure 3.2
Model Evaluation Using Static Deterministic Simulation: Foreign Direct Investment

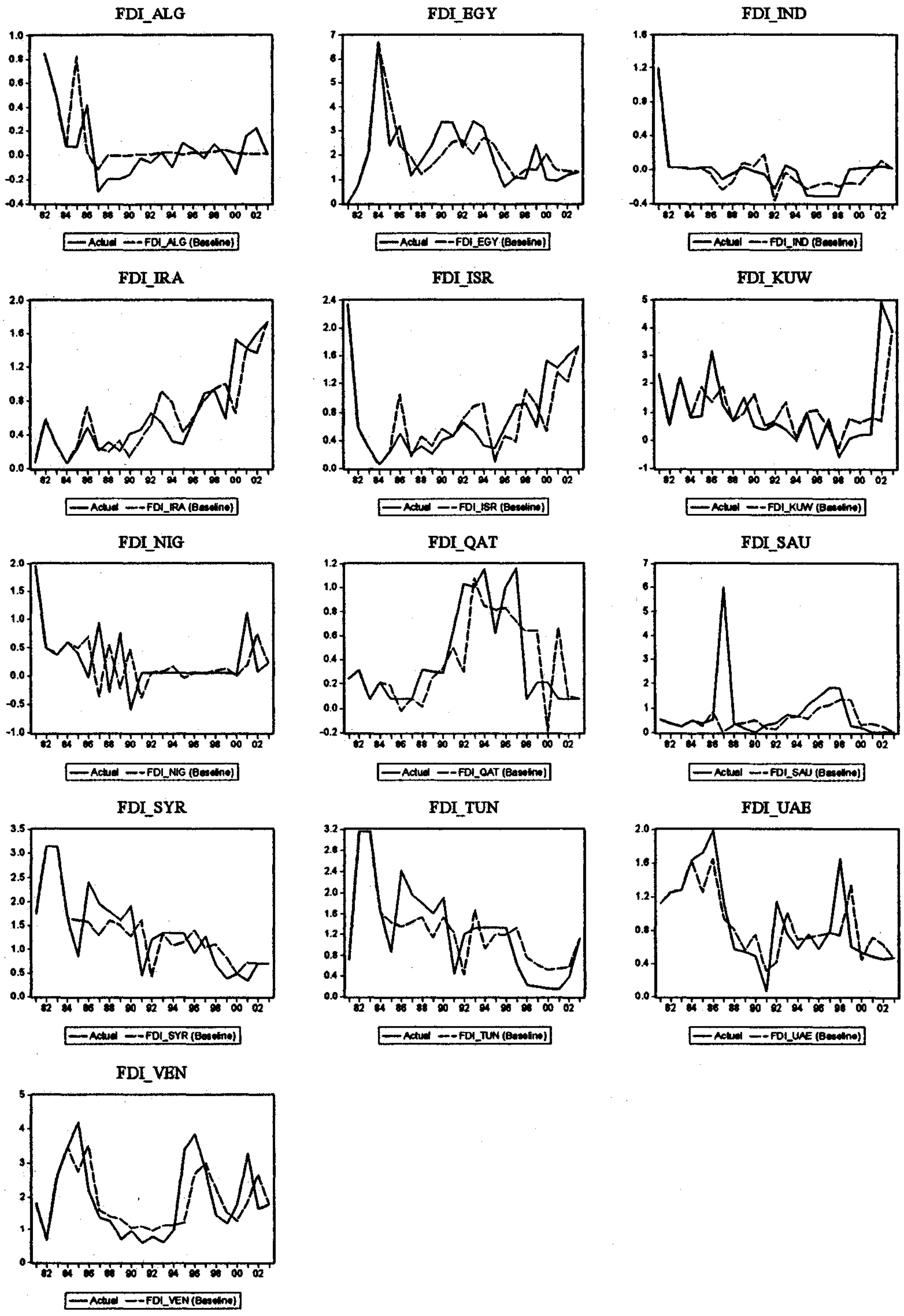


Figure 3.3
Model Evaluation Using Static Deterministic Simulation: Foreign Bank Loans

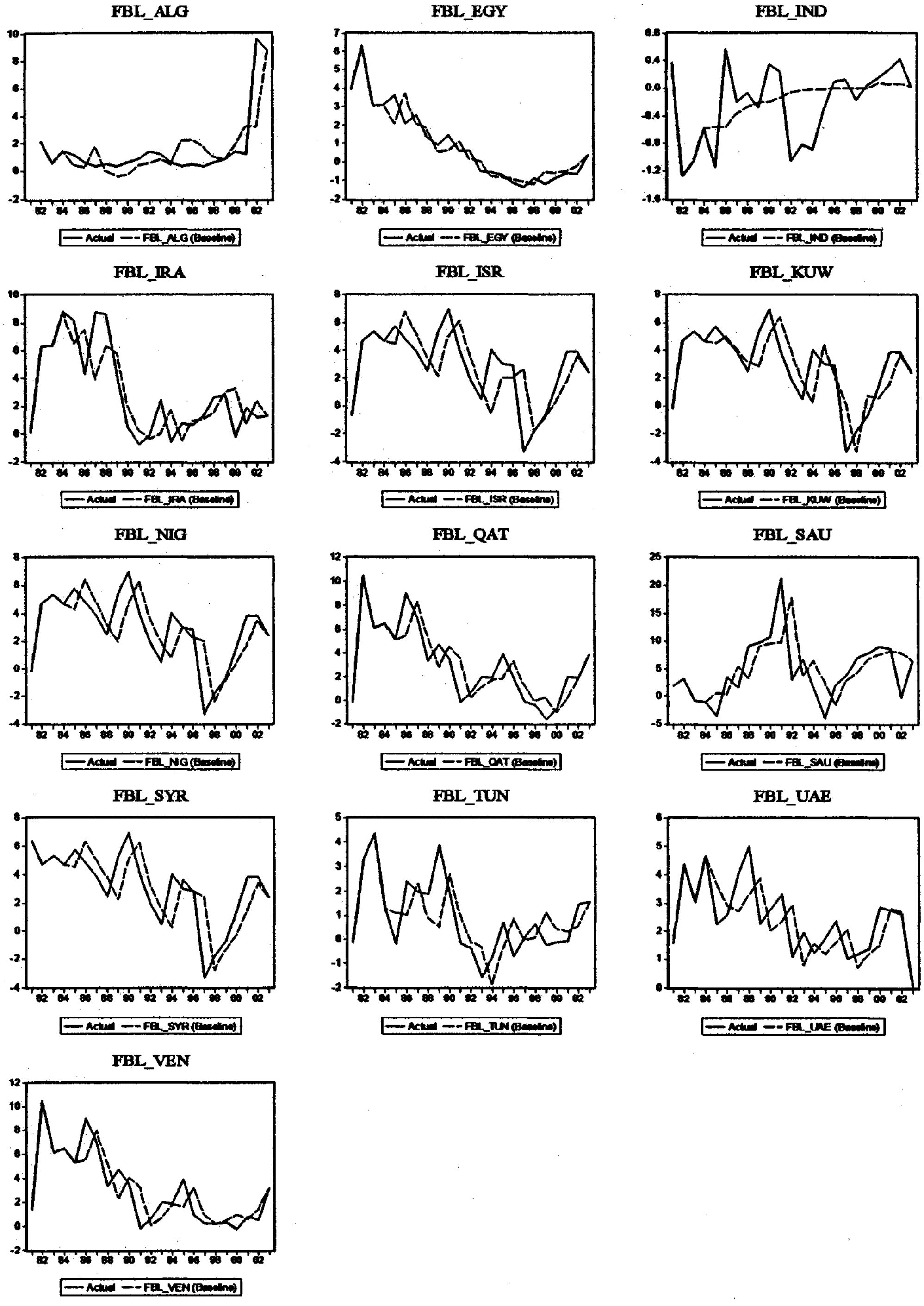


Figure 3.4
Model Evaluation Using Static Deterministic Simulation: Foreign Portfolio Investment

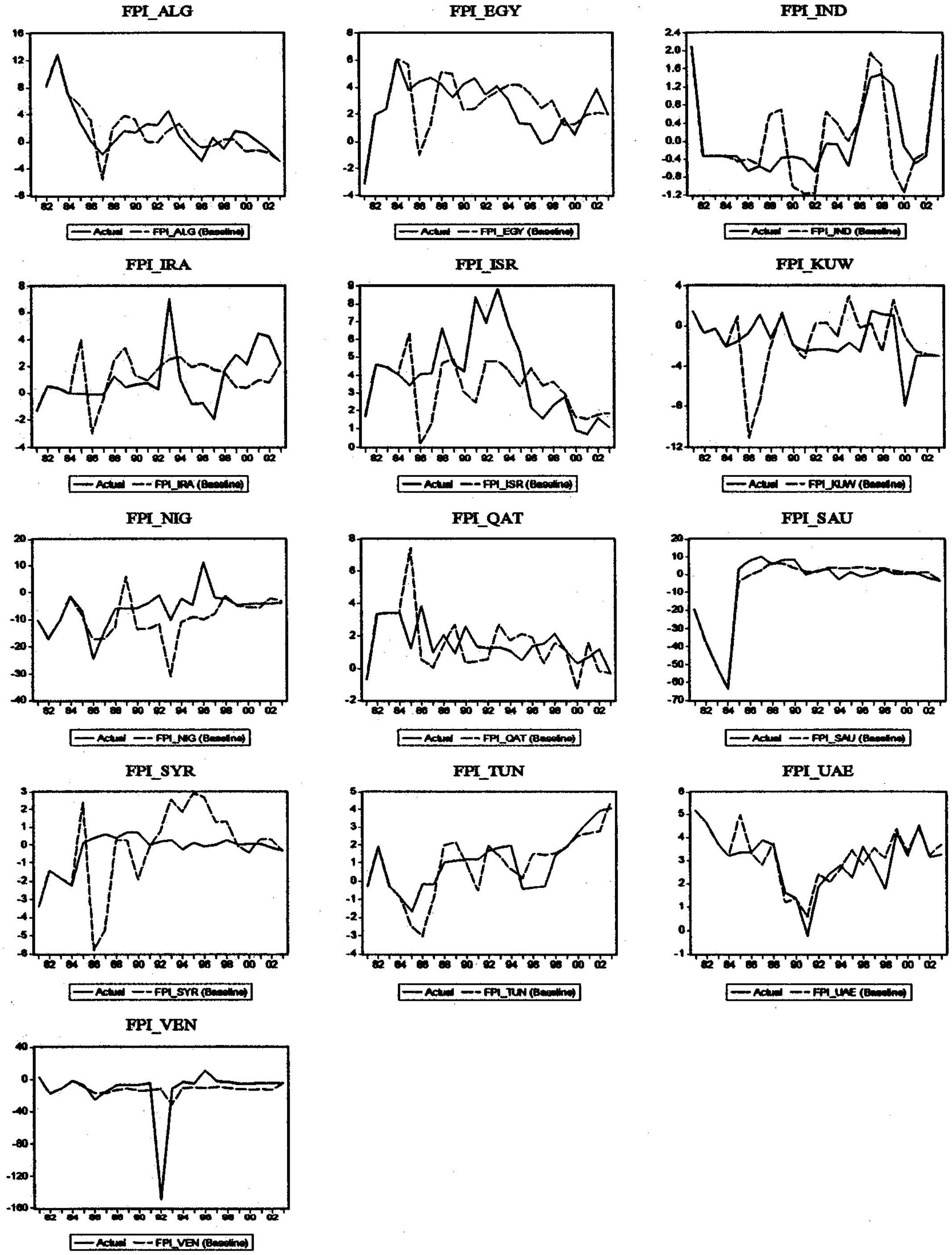


Figure 4.1
Out-of-Sample Forecast of Exogenous Variables

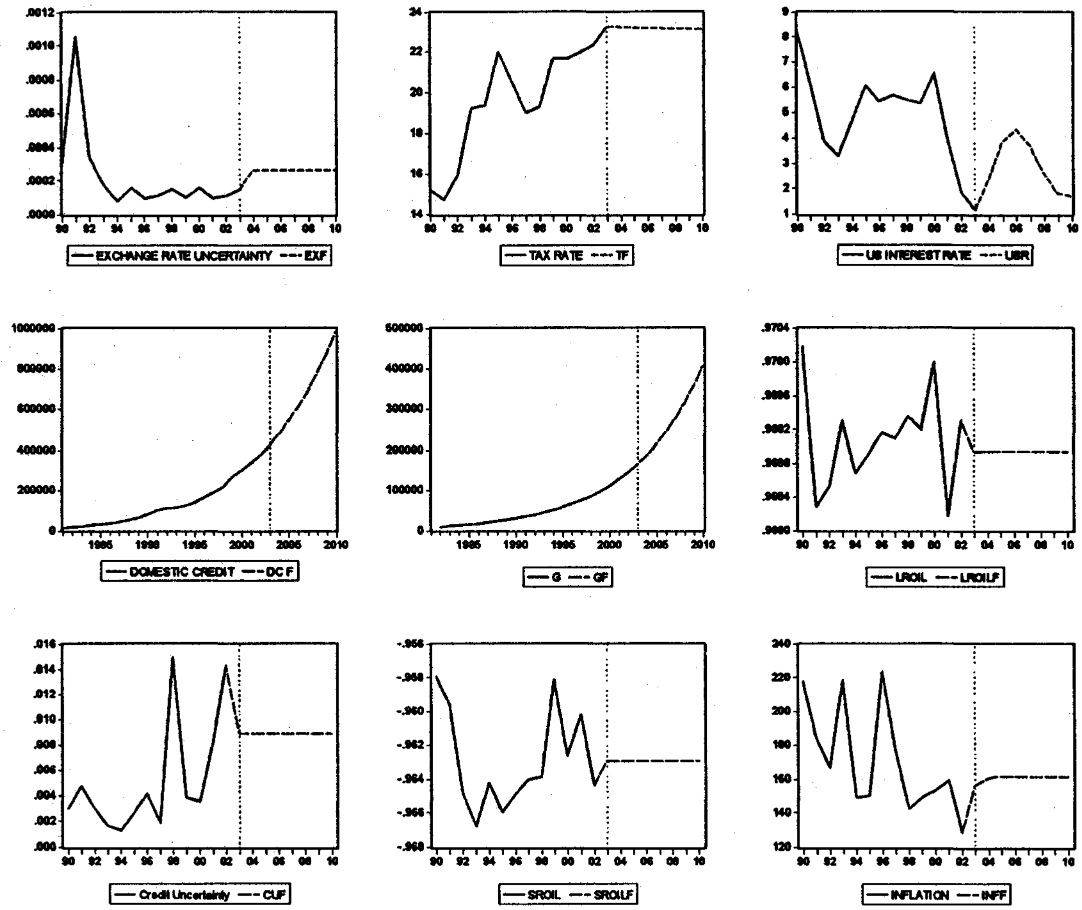


Figure 4.2
The Baseline Forecast of Endogenous Variables

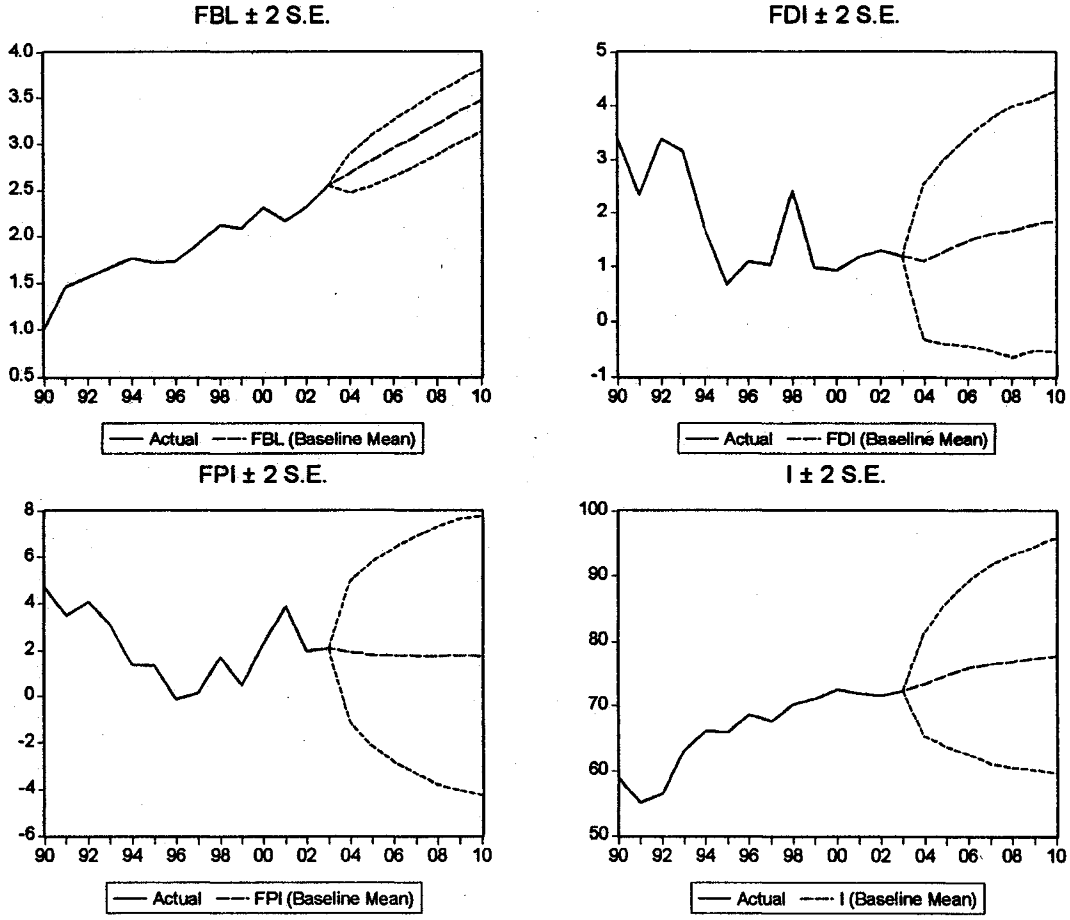


Figure 4.3
Scenario 1: Reducing Government Expenditure Growth by 5%

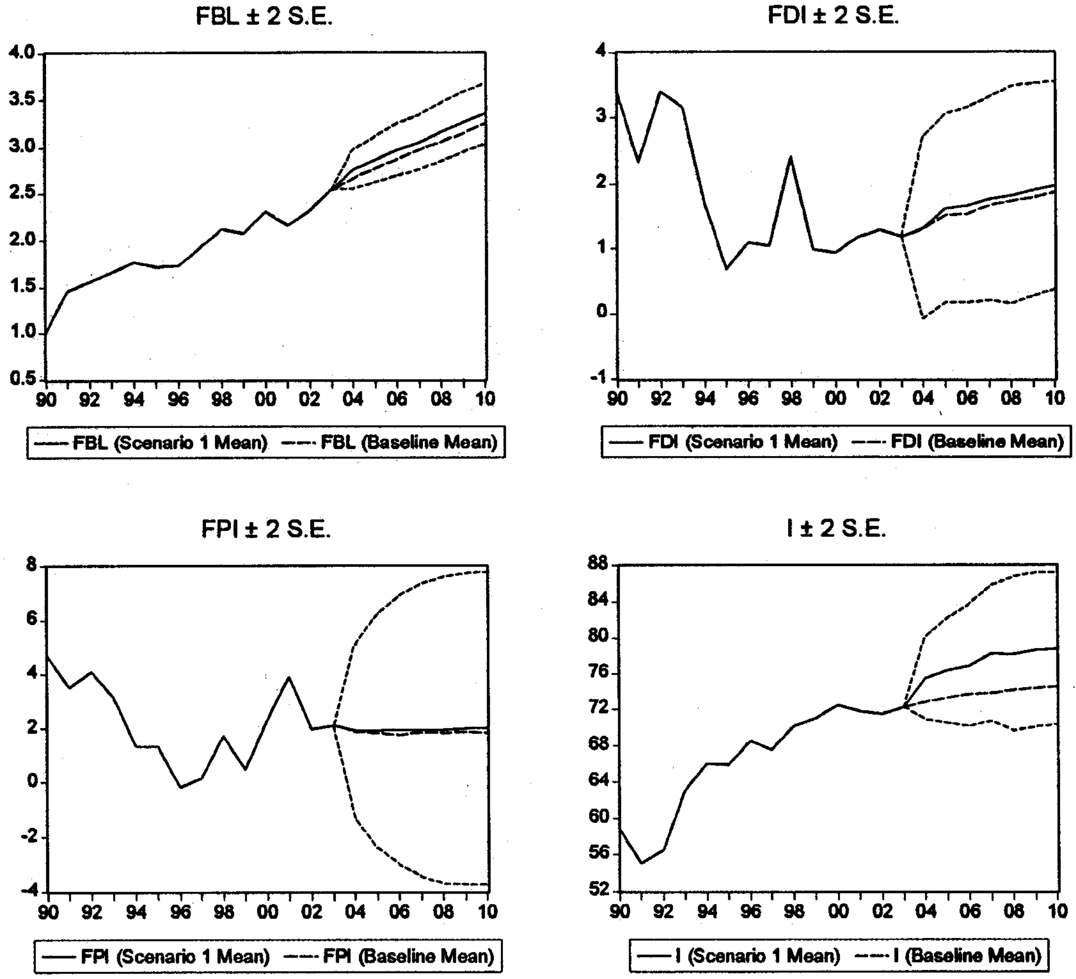


Figure 4.4
Scenario 2: Reducing Average Tax Rate by 5%

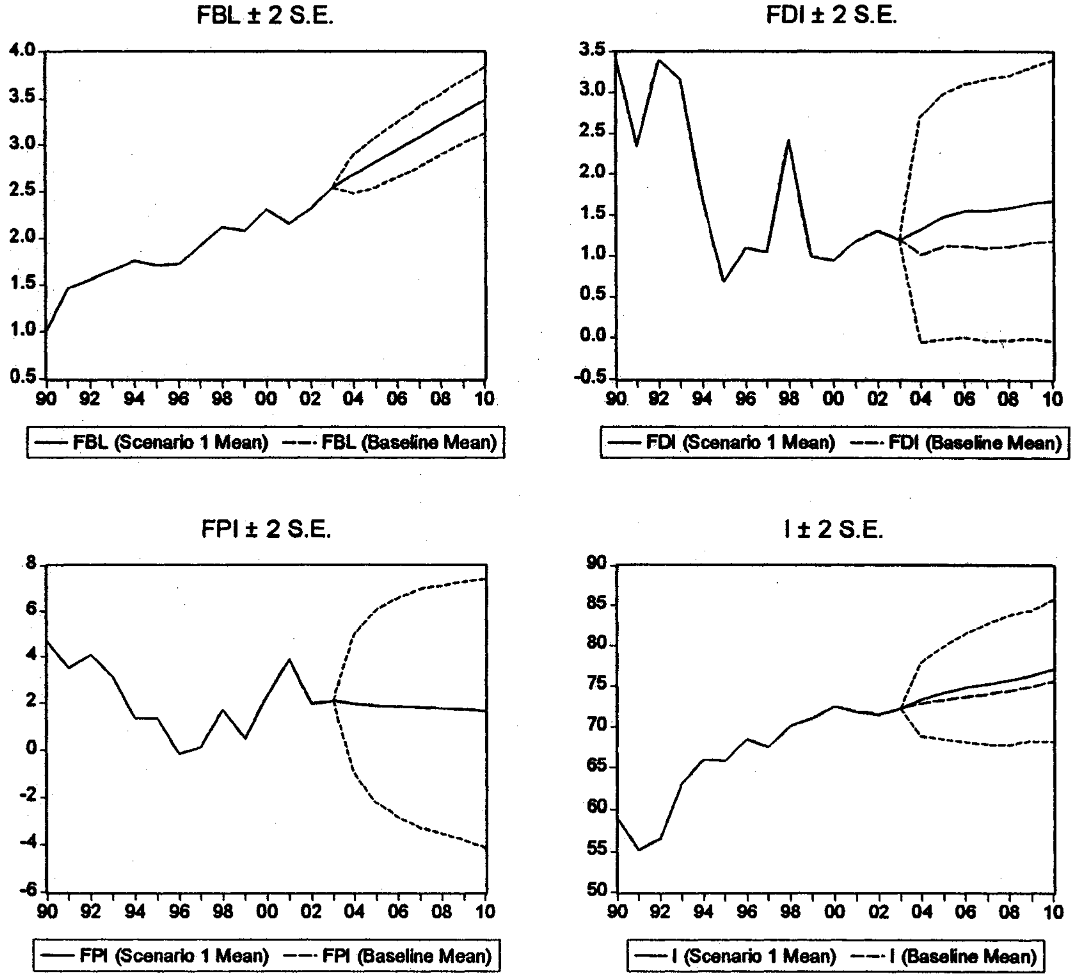


Figure 4.5
Scenario 3: Increasing Tax Rate by 5%

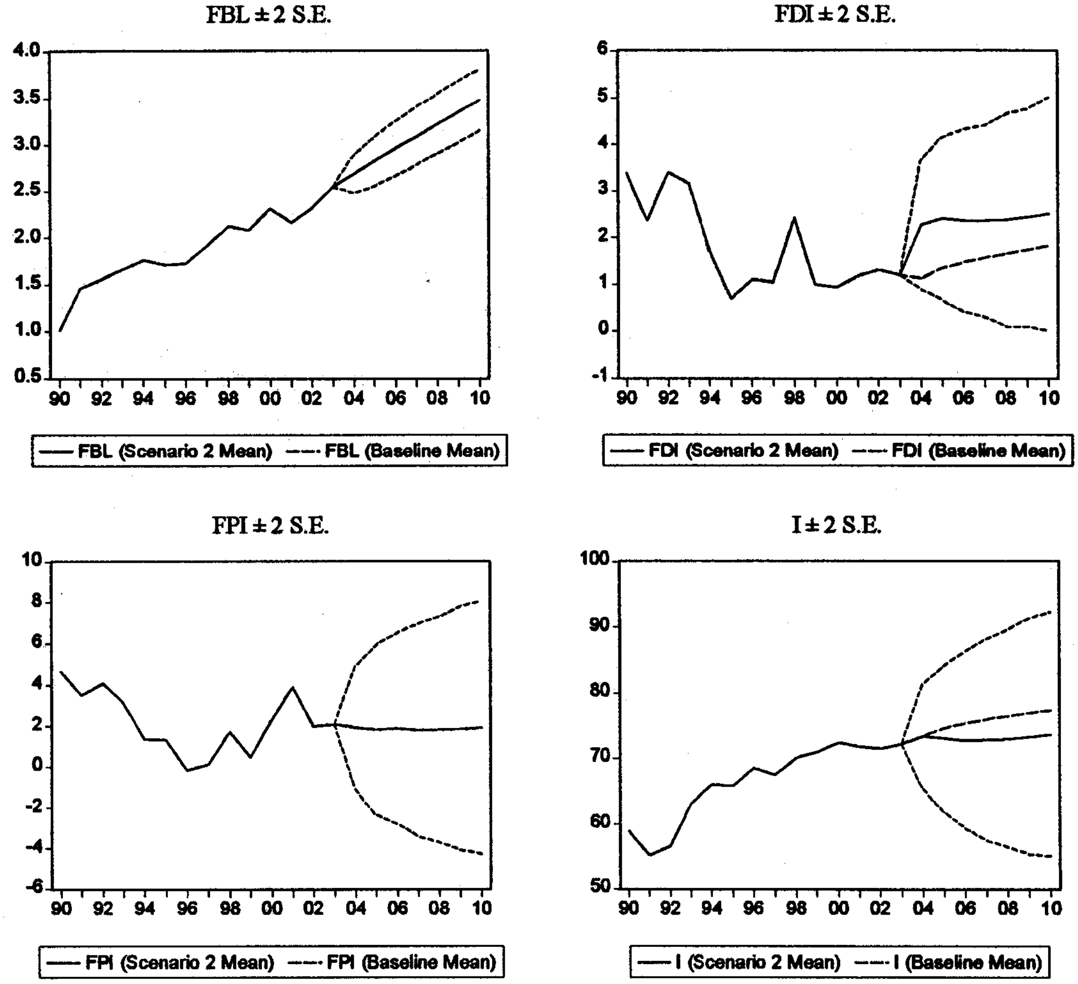


Figure 4.6
Scenario 4: Reducing Domestic Credit Growth by 5%

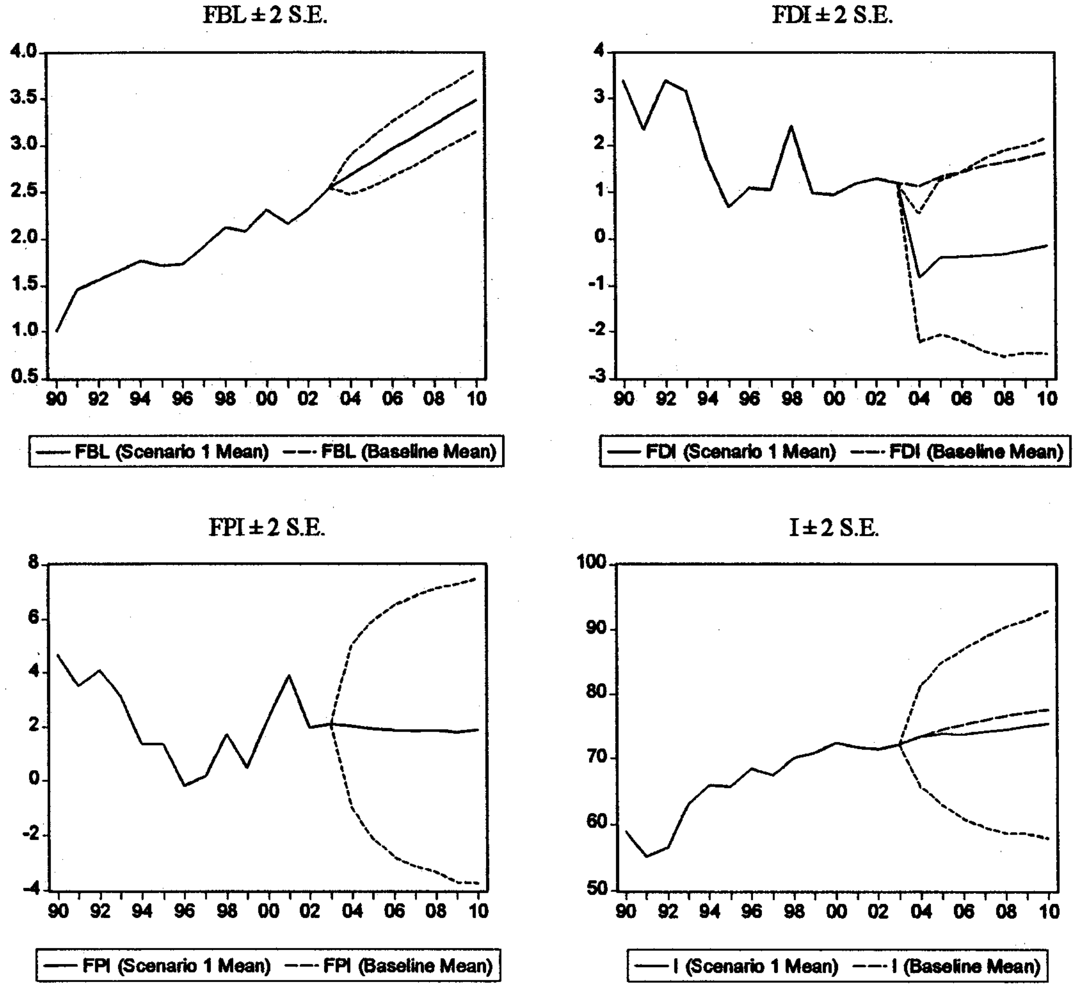


Figure 4.7
Scenario 5: Increasing World Interest Rate to Its Historical Mean Value 8%

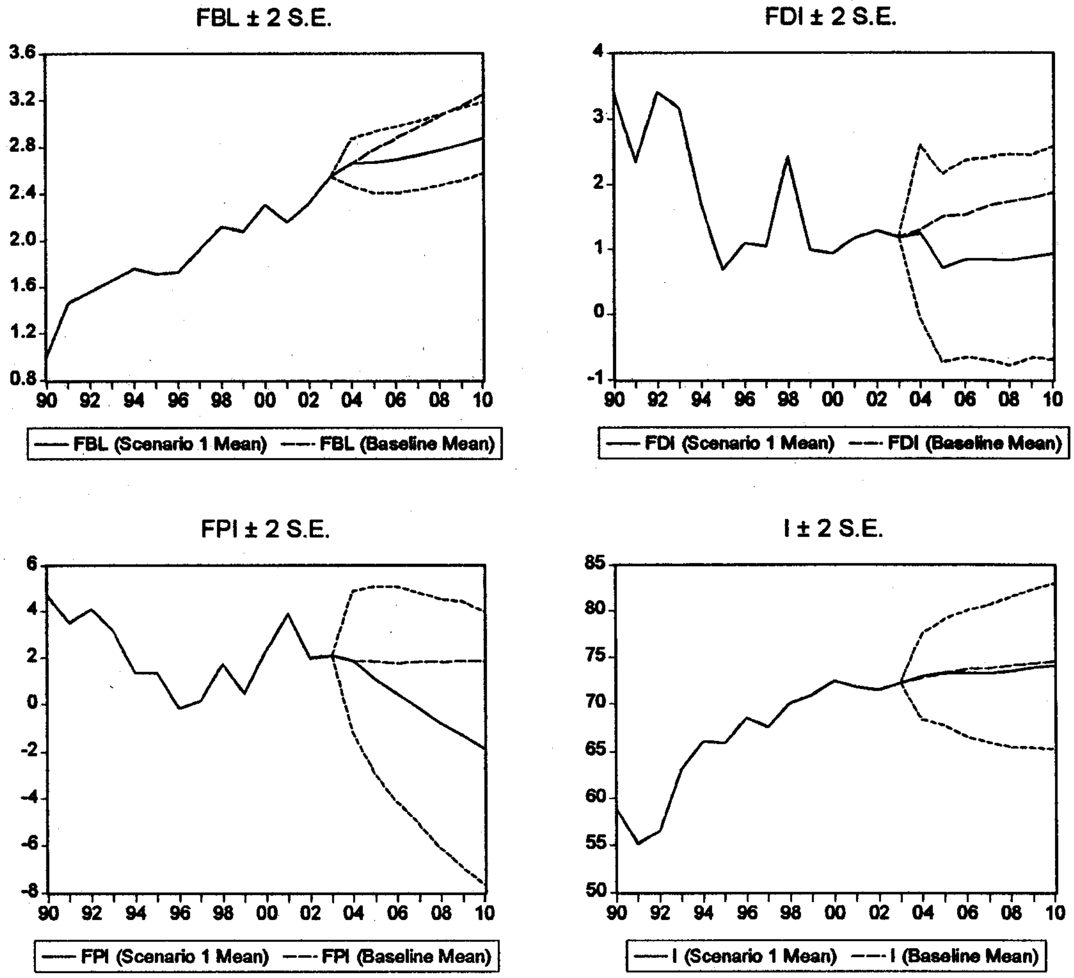


Figure 4.8
Scenario 6: Reducing Exchange Rate Uncertainty by 50% of the Mean of CSD

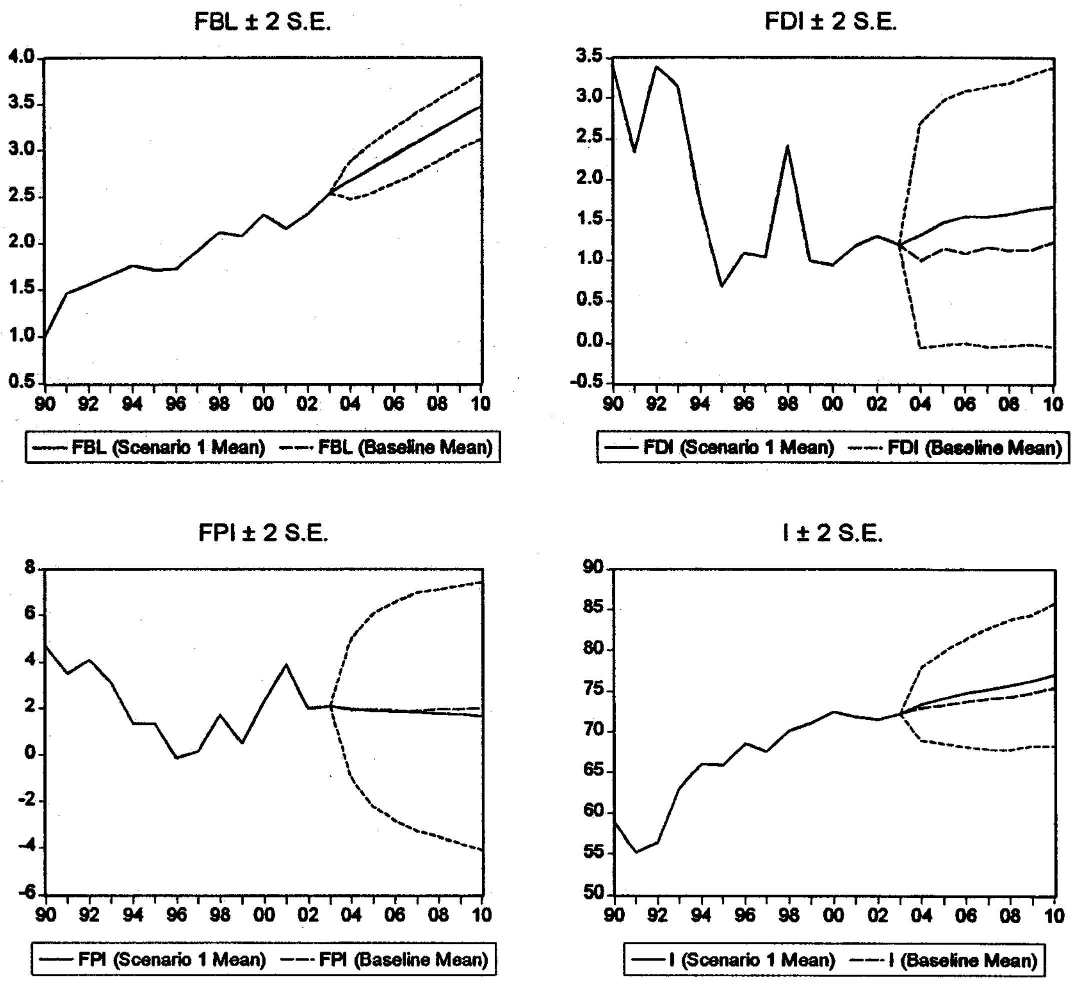


Figure 4.9
Scenario 7: Reducing Short-Run Oil Prices by 50% of the Mean of CSD

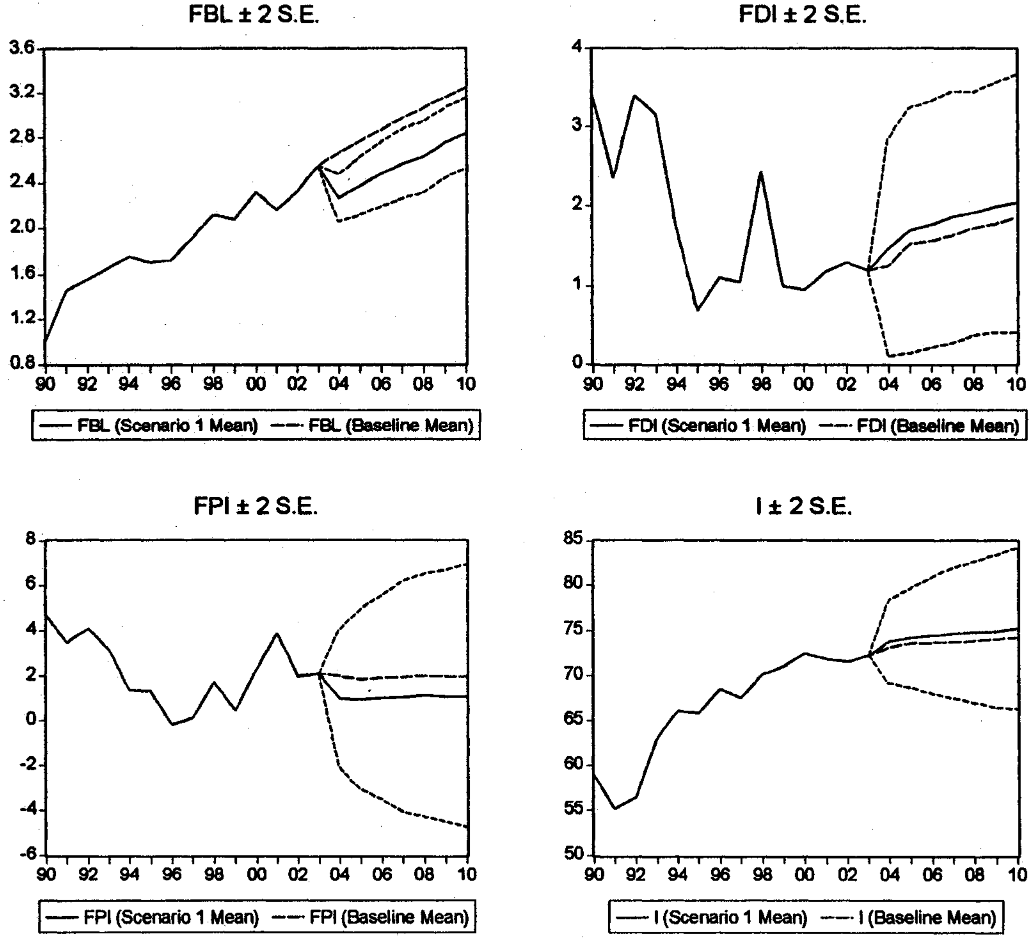
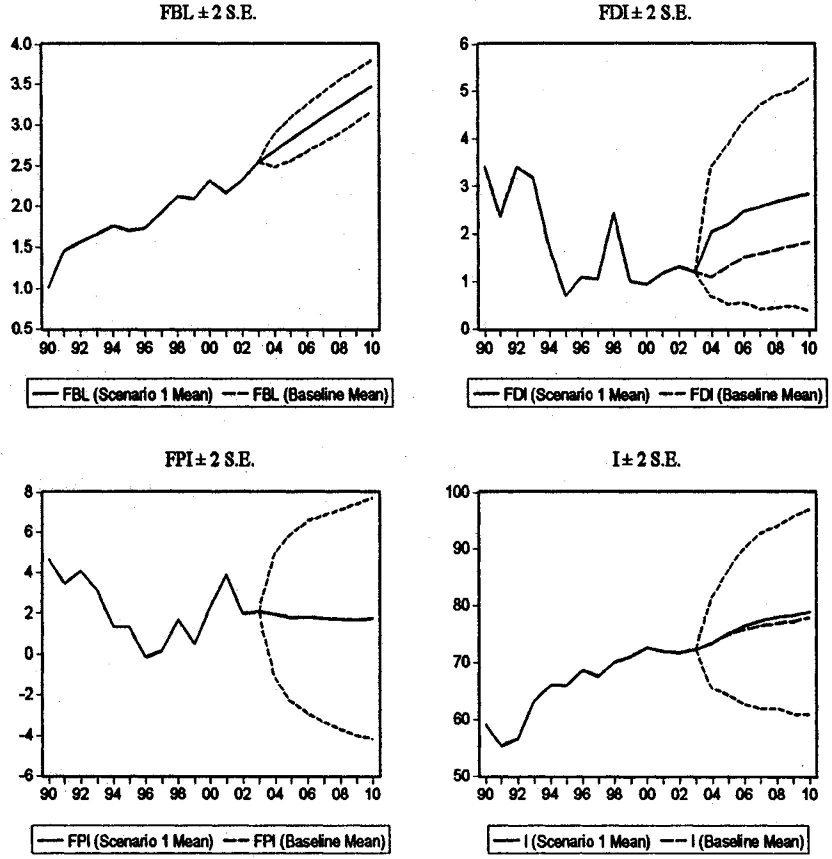


Figure 4.10
Scenario 8: Reducing Long-Run Oil Price Uncertainty by 50% of the Mean of CSD



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