

**Portfolio Flows, Foreign Direct Investment, Crises
And Structural Breaks in Emerging Markets:
Evidence from Turkey**

by

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Abstract

The goal of the paper is to analyze how financial and economic crises affect the relation between capital flows and their determinants. We develop a model of foreign portfolio investment (FPI) and foreign direct investment (FDI), and apply it to Turkey using an endogenous break analysis and accounting for country risk. We identify two breakpoints that correspond to two crises dates. Our results show changes in the sign and/or coefficient of a number of determinants in both types of investment and thus suggest that analyses based on the assumption of parameter constancy may lead to misleading results.

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Introduction

The end of the last century saw a shift in developing and emerging countries' priorities towards attracting international capital flows, perceived to be complementary to the development process of the economies. As a result of this change, capital flows to these countries grew about 10 folds during the 1990s (World Economic Outlook). However, the distribution of the components of flows between foreign direct investment (FDI) and foreign portfolio investment (FPI), has been uneven. Many low-income countries have been unsuccessful in attracting FDI, but received a fair amount of short-term portfolio investment.

Most analysts now agree that FPI is often prone to *sudden stops* and, even worse, reversals, leading to financial crises such as in Mexico, Brazil, Russia, Asian countries, Turkey, Argentina, Uruguay (Calvo, 1998, Milesi-Ferretti and Razin, IMF, 1995, Claasens et al., 1995). In contrast, FDI is widely regarded as a stable development engine, crucial for a quick and fundamental take-off for industrialization.¹

In this study, we examine the factors affecting inflows of different types of capital. In particular, we analyze how financial and economic crises create structural changes that affect the relation between capital flows and their determinants, and apply the analysis to Turkey. In doing this, we assume that the number of breaks and the number of parameters affected by structural changes are unknown.

Despite a large volume of literature on capital flows, studies emphasizing the breakdown of the types of capital flows are relatively recent and mostly involve panel data. Although this approach provides valuable information about the broad determinants of flows, it does not allow identification of individual countries' idiosyncratic features. In particular, structural breaks due to domestic and international crises, which affect the sentiment of domestic and international investors, can change the relation between the fundamentals and the flows of capital. Such concerns are best addressed at the individual country level.

Turkey is a typical example of an emerging economy that followed successive liberalization policies but has not been able to substitute FDI for short-term borrowing to finance the economy. Weaknesses in the banking system together with high growth rates over the last two decades made the economy more dependent on foreign private capital, which consist mostly of FPI. Turkey exhibits most of the symptoms of a developing country

¹ See Lim (2001) for a survey of the literature on the relation between FDI and growth.

grappling with the problem of not being able to borrow in its own currency, referred to as the *original sin* (Eichengreen and Hausmann, 1997). This problem, in turn, leads to currency and maturity mismatch and creates a volatile and unstable environment prone to crises. For these reasons, flows are highly volatile in nature and remain low relative to East European and Latin American countries (Table 1).

In this paper, we develop a model to analyze capital flows, and examine it empirically. We decompose the flows and examine how the components are affected not only by fundamentals but also by country-specific risk reflecting political, financial and economic uncertainty, and crises faced by the country. In particular, we examine whether there is an asymmetric effect on FDI and FPI of crises and country risk as perceived by foreign investors in Turkey. With the largest 4th economy among the emerging markets (after Mexico, Argentina and Russia) listed by World Bank in the European, Central Asian and Latin American-Caribbean regions, the Turkish experience can provide insight into the FDI versus FPI debate, which would further our understanding of capital flows and crises in emerging markets.

Most of the literature on capital flows does not distinguish between different components of the flows, and to our knowledge, there is no attempt at examining the effect of structural changes on flows. This approach is particularly important for emerging markets because (i) they are constantly exposed to domestic and international crises and (ii) they often implement policies that lead to major structural changes in the economy. Further, it is important to determine the structural breaks endogenously. Choosing the break dates exogenously introduces arbitrariness in the analysis. Even if information on the timing of the structural changes were available, it is very hard to determine the exact timing of their effect on the variables.

Studies on capital flows specifically to Turkey are surprisingly scant, even though the subject is important for the development process of the country in particular, and other developing economies, in general. Thus, our analysis contributes to the literature on capital flows by showing how to approach multiple shifts caused by crises in a model of capital flows. We examine and compare the effects on portfolio flows with those on FDI flows. Our analysis thus offers an original approach to examining the case of a liberalized emerging economy that has not been successful in attracting foreign capital.

Our findings indicate that (i) the models perform poorly if they do not take account of breaks caused by crises; (ii) institutional factors, structural reforms and crises affect both components asymmetrically. FPI is vulnerable to regional contagion (Russian crisis) and responds negatively to financial risk, while FDI is sensitive to economic risk but is not affected by contagion. Both flows were hurt by the domestic banking crisis; crises introduce instability in the parameters of two of the determinants of FPI, while they create instability in the parameters of all determinants of FDI, except one.

The paper is organized as follows. After a brief summary of the literature on capital flows in Section 1, we overview the stylized facts depicting the Turkish economy since the 1980s. We develop an optimizing model to get reduced form equations for both types of investment in Section 3. In Section 4, we describe the methodology and the data, followed by the empirical results. We conclude in the last section.

I. Literature survey and economic background

Although capital flows in general and their individual components have been the subject of extensive research and policy discussions, just a handful of studies emphasized the different characteristics of types of financial flows (e.g., Sarno and Taylor, 1997, Bosworth and Collins, 1999, Reinhard and Talvi, 1998, Chuhan, Claessens and Mamingi, 1998, Ito, 1999, Wilkins, 1999). These studies, like the earlier literature analyzing aggregate or net flows, examined if *pull* (domestic) factors or *push* (external) factors affect the individual components of financial flows. Most results support both factors to varying degrees.

More recently, researches turned their attention to political economy variables that are likely to affect the flows, in particular FDI. Results show that a worsening of political and economic risk ratings (Lehmann, 1999) or corruption (Wei and Wu, 1990) reduce FDI relative to foreign loans, thereby increasing the risk of crisis. Alfaro, Kalemli-Ozcan and Volosovych (2003, 2004) find that institutional quality as well as sound domestic policies are important determinants of different types of capital flows.

Most of the literature on the Turkish economy since the 1980s revolves around liberalization. Besides economic liberalization, studies examined the impact of financial/capital account liberalization on factors as varied as investment (Guncavdi, Bleaney and McKay, 1998, Uctum, 1992), fiscal policy (Agenor, McDermott and Ucer, 1997),

exchange rate policy (Asikoglu and Uctum, 1992), currency substitution (Akçay, Alper, Karasulu, 1997). Few studies analyzed the role of FDI and liberalization (Balasubramanyam, 1996, Balkir 1993, Fry, 1993). Even a smaller number of studies examined the effect of FDI or capital flows on the Turkish economy. The main results are that although during the 1980s foreign capital helped economic growth (Rodrik, 1990), in the 1990s it contributed to financial fragility because it was channeled into financing private and public consumption instead of productive activity (Ulengin and Yenturk , 2001, Yenturk 1999).

Since the 1980s, The Turkish economy went through several structural changes and was affected by the socio-political conditions in the country. Government policies replaced the inward-oriented import substitution by the export-oriented development process and gradually liberalized the financial markets and the capital account. The positive effect of these reforms reflected in the increase of the FDI inflows to the country in the second half of the 1980s (Figure 1 top panel). However, despite this rise, the level of the flows remained low compared to other countries with a similar background.

During the 1990s and the early 2000s the Turkish economy weathered several crises. Delays in implementation of structural reforms the economy needed in the banking industry and in public finances played the role of catalyst for the crises. Successive governments failed to tackle the chronic high inflation, high public deficit that plagued the economy despite the liberalization efforts. At the beginning of the 1990s, inflow of capital, high inflation and a pegged exchange rate regime led to substantial loss in competitiveness. High interest spread caused by government's financing needs and low exchange rate risk led domestic banks to borrow from abroad and lend to the government. With a currency regime following a crawling-peg, banks' demand for foreign reserves soared. The resulting decline in central bank reserves induced a full-fledged attack on Turkish lira in the first quarter of 1994. This crisis was short lived and resulted in a relatively mild reversal in the flows (Figure 1). Both FDI and FPI continued in a relatively stable fashion until the end of the decade.

In 1998-2001, however, successive crises led to major reversals in both components of capital flows. Despite surviving the Asian crisis in 1997 unscathed, Turkey was badly hit by the emerging market crisis following the Russian default in 1998. While massive flight of short-term capital put a squeeze on domestic financial markets, the export markets collapsed and hurt the economic activity.

The twin crises of 2000-01, in turn, are caused by internal factors and bear some resemblance to the 1994 crisis. As a result of wrong policy incentives and a deficient corporate governance system, banks continued to borrow short from abroad in foreign currency and invest in high yielding government bonds with relatively longer maturities. By 2000, the banking system had increased its exchange rate exposure dangerously and faced significant maturity mismatch and liquidity risk. Delays in banking sector reforms, lax fiscal policy and a currency appreciating in real terms severely weakened the banking system, created an unsustainable current account deficit and, eventually, caused an outflow of portfolio investment depreciating the Turkish lira. Capital outflows contributed to further depreciation of the currency and anxiety in the markets, which triggered a banking crisis at the end of 2000. The real interest rates shot up following the liquidity squeeze, and the Turkish lira was floated in January 2001. Against the background of distress in the financial markets, a political spat between politicians in the first quarter of 2001 triggered a run on the currency, which lost its value by 36 percent, and a financial crisis.

Can the traditional financial and macroeconomic factors explain fluctuations in FDI and FPI? As a preamble to the model we develop below, we plot four macroeconomic variables representing mainly *pull* factors (we introduce the *push* factors in the empirical section): real interest rate, real price of capital, tax rate, unit labor cost, and real exchange rate. In addition, we also consider three risk measures (political, financial and economic) developed by the *International Country Risk Group (ICRG)*, which we use as a proxy to assess the risk perception of the market participants. Although it is unlikely that eyeballing the data will provide a clear relation between the capital flow variables and the independent variables, it is informative to give a sense of the direction the economy took for the last two decades.

II. Overview of the data

Figure 2 relates the capital flows, the macroeconomic and risk variables. Everything else being constant, we expect a negative relation between the real interest rate and portfolio flows. This negative correlation becomes noticeable in the second half of the sample. The Treasury-bill rate, adjusted for inflation, was relatively stable until 1990, with a positive trend in 1990-94. It skyrocketed in 1994 as a result of Central Bank's effort to fight capital outflows reacting to the crisis. During the second half of the 1990s, the real rate fluctuated around a higher mean, and

declined precipitously at the end of the decade as a result of a decline in the risk premium. After 2000, the real rates climbed up, reflecting tight credit conditions in the domestic markets and a scarcity of foreign capital ensuing the twin crises, and then declined as confidence was restored and capital flows resumed. The negative relation is broadly consistent with the subperiod averages of 0.29, -0.03 for portfolio investment, and 0.57, 0.54 for real interest rates during 1984.1-1998.1 and 1998.2-2004.1, respectively.

The real capital price is a factor price that is expected to affect FDI negatively. It exhibits a positive trend until the end of the 1990s, and a negative trend, thereafter. An examination of the period averages reveals that the trends confirm this negative relation. Before and after the Russian crisis, the sample averages are 77.8, 64.4 for real capital price, and 0.12, 0.20 for FDI.

The exchange rate can affect capital flows through various channels, and the effect is ambiguous *a priori*. Several studies find a positive relation between the value of a currency and capital inflows (Froot and Stein, 1991, Klein and Rosengren, 1994). The argument for a positive relation goes as follows. A depreciation of host country's currency reduces costs in host country for the foreign investor, and stimulates foreign direct investment (Cushman, 1985, Barrell and Pain, 1999, Blonigen, 1997). Another justification comes from wealth effect. In an environment with incomplete markets, a systematic depreciation of a currency lowers domestic residents wealth and lead foreign acquisition of domestic assets (Froot and Stein, 1991).

However, other studies find no significant effect (Goldberg and Klein, 1998, Carlson and Hernandez, 2002). This result can be justified on the grounds that what matters for an international investor is not the price of foreign assets, and therefore the current level of the exchange rate, but the rate of return of these assets. In our model we show that a second channel of ambiguity arises due to valuation effect versus cost effect.

Throughout the 1980s Turkey has been following a crawling peg. The effective real exchange rate appreciated until the 1990s due to high inflation rate. Since then, the authorities managed to stabilize it by matching the crawl rate with the inflation rate. The two exceptions are the two crises (1994 and 2000-01) where the currency devalued substantially after the speculative attacks. If we look at the subsamples 1991-1998 and 1998-2003, which excludes the initial drastic appreciation, the period averages for real exchange rate and FDI are 500, 532

and 0.12, 0.20, respectively. This is broadly consistent with the view that the exchange rate and FDI are positively correlated.

The tax rate on financial transactions and labor cost are two factors that are likely to affect the FDI but also the FPI via the production channel. Both factors affect the profits of companies investing in the host country but also domestic companies that borrow from abroad. Thus, an increase in both the unit labor cost (ulc) and the tax rate puts a downward pressure on capital inflows. After the coup d'état of the 1980-83, restrictions on political and union activities continued until the second half of the 1980s. This decreased real wages and the ulc until 1988. In 1988-92, the competition between political parties and removal of restrictions on political activities set off populist policies, which allowed more than 100 percent increases in real wages. This increase, however, did not affect the inflows of capital, presumably because even with higher wages, labor still remains a relatively cheap factor in Turkey. During the following decade, the ulc does not exhibit any trend. The tax rate, computed as corporate tax over GDP, is expressed as a differential (relative to the corporate tax rate in foreign countries). It declines until 1990 but expands in the first half of the 1990s before decreasing again in mid 1990s. It has been on a new rising trend since the mid 1990s.

The bottom panel displays the three country-risk measures. An increase (decrease) in each measure depicts a worsening (improvement) of risk, meaning the country becomes less (more) risky for the international investor.² The risk profile of the country deteriorated until the end of the 1980s as a result of political tensions and the inability of the government to control high inflation. With the liberalization efforts that took place throughout the 1980s, and the removal of political uncertainty after the general elections in 1991, all risk categories show a marked improvement in the early 1990s.

The situation, however, worsened again at the onset of the 1994 crisis. The political unrest in the country together with weak governments worsened the political risk until a new coalition government came to power at the end of the 1990s. The financial risk took a turn for the worse when Standard and Poor downgraded Turkey's foreign debt from B+ to B and stock prices tumbled down. It deteriorated further from fear of contagion during the Russian crisis in 1998.

² The ICRG risk measure shows the decrease in risk, or improvement in the riskiness of the country. To make the series compatible with country risk, we redefine the series as $1 - risk_i$, with i =financial, economic, political risk.

A disinflationary program initiated by the government in 1998 and then again in 1999, backed by the IMF with a substantial credit line in a stand-by agreement, improved both the economic and financial risk. All risk measures show an immediate but brief deterioration following the twin-crises in 2000-01. The recovery is partly due to vigorous structural reforms implemented by the government, tightening of monetary and fiscal policies, floating of the Turkish lira and a new IMF support package. Next, we develop an optimizing model to see the theoretical relations between capital flows and the independent variables we just described.

III. Model

We assume that the host country is a small open economy where two distinct monopolistic firms operate using a domestic factor of production, L , and a factor that requires foreign capital, with production functions exhibiting diminishing marginal product and constant returns to scale. The representative domestic firm produces according to the production function:

$$(1) \quad Q^d = Q^d(B, L^d)$$

where B are inputs financed by means of foreign borrowing, and L^d is the local factor of production. The foreign firm that is operating in the domestic market is producing both in the host country and in its country of origin. In the host country, it uses the local factor of production L^f , and brings in foreign capital F , as foreign direct investment (FDI). Its production function in the host country is:

$$(2) \quad Q^f = Q^f(F, L^f)$$

(i) Optimization of the domestic firm.

In this section we derive the demand for inputs by means of foreign borrowing and its determinants (B). The domestic firm maximizes its profit denominated in domestic currency:

$$(3) \quad \Pi^d = (1 - t)P^d(X^d)X^d - TC^d(\theta, Q^d)$$

subject to the constraint that sales are equal to production, and where X^d is the domestic sales and it is function of the domestic price index P and income Y , P^d is the price of the firm's product in the domestic economy, t is the corporate tax rate on domestic firms, TC is the total

cost of production faced by the domestic firm, and θ is a vector of production costs including labor (W), and cost of borrowing (R^*).

We get from the first-order conditions:

$$(4) \quad P^d = \frac{M(P, Y)}{(1-t)} MC(\theta, Q).$$

Equation (4) shows that the firm's price is a markup over its marginal cost of production, with the markup $M = \left(1 - \frac{1}{\varepsilon(P, Y)}\right)^{-1}$ being based on the price elasticity of the domestic firm in the domestic market. The markup changes with the value of the elasticity, which in turn varies with the product price and income.

A constant-elasticity demand curve implies a zero price-elasticity of markups ($M_p = 0$). This is a constant markup. Any convex or linear demand curve yields a negative relation between prices and markups ($M_p < 0$), which is a variable markup. The sign of M_y depends on the sign of ε_y . Homothetic preferences or a linear demand curve imply a zero or a positive elasticity of markups, respectively. Thus, the sign of the income elasticity of the markup can be positive, negative or zero. Quasi-concave production function implies that, for given factor cost, the sign of $MC_Q \geq 0$.

Totally differentiating the FOC in equation (4) and assuming for simplicity that the firm's price is equal to domestic price, we get:

$$dP = (1-t)^{-1} MC (M_p dP + M_y dY) + (1-t)^{-1} M (MC_Q dQ + MC_\theta d\theta) + ((1-t)^{-2} M.MC) dt$$

and thus :

$$(5) \quad Q = Q(P, Y, \theta, t)$$

$$\text{where } Q_p = \frac{(1-t) - M_p MC}{M.MC_Q} \geq 0$$

$$Q_y = -\frac{M_y MC}{M.MC_Q} \geq 0 \text{ because } M_y \geq 0$$

$$Q_\theta = -\frac{MC_\theta}{MC_Q} \text{ and } \text{sgn } Q_\theta = \text{sgn } MC_\theta$$

$$Q_t = -\frac{MC}{(1-t)MC_Q} \leq 0$$

From the cost minimization problem, using the envelope theorem, marginal cost is equal to the Lagrange multiplier λ , so $\partial\lambda / \partial W = MC_W = L_Q$, and $\partial\lambda / \partial R = MC_{R^*} = B_Q$.

From the envelope theorem we also get the factor demand functions (Shephard's lemma). Among these demand functions, we are particularly interested in B, the demand for foreign funds:

$$B = \frac{\partial TC(W, R, Q)}{\partial R}, \text{ and hence:}$$

$$(6) \quad B = B(W, R^f, Q)$$

The sufficient second-order conditions for cost minimization give the direct effects of production cost on B as $B_w > 0$ and $B_{R^f} < 0$ but an ambiguous output effect, $B_Q > 0$ or < 0 .

However, adopting the reasonable assumption that B and L are normal, we can expect $B_Q > 0$ and $L_Q > 0$. This result also holds using the second-order conditions for constrained minimization and the assumption that the production function is homogeneous of degree 1. Thus, $Q_W < 0$ and $Q_R < 0$ by the normality assumption of factors of production.

$$\text{Replacing (5) into (6), } B = B(W, R^f, Q(P, Y, W, R, t)).$$

Now $B_\theta = B_\theta + B_Q Q_\theta$. The first term is the direct effect and the second term is the indirect effect, through output. Normalizing with P, we get the reduced form of demand for foreign funds:

$$(7) \quad B = B(w, r^f, Y, t)$$

where the first two terms represent the real cost of labor, and of borrowing. This equation says that if labor is expensive, then firms substitute for an input financed by foreign borrowing (direct cost effect). An increase in the labor cost also decreases output and hence reduces the demand for all factors of production (indirect output effect). Thus the net effect of a rise in wages is ambiguous.

A rise in the cost of borrowing has an unambiguous effect. The direct cost effect and the output effect both reduce the demand for foreign funds. The income effect comes in through the demand side of the firm's profit maximization and the sign is unknown since it depends on the income elasticity of the markup. A rise in taxes reduces production and therefore the demand for foreign funds.

(ii) *Optimization of the foreign firm.* In this section we derive the FDI and its determinants. The foreign firm is a discriminating monopolist that produces at home (in the country of origin) and in the host country. It maximizes its nominal profits denominated in its own currency:

$$(8) \quad \Pi^f = (1 - \tau)SP^f(X^f)X^f + (1 - \tau^h)P^h(X^h) - TC^f(\phi, Q^f, Q^h)$$

where S is the nominal exchange rate and is defined as the investor's home currency units in terms of the host currency units, P^f and P^h are the price of the product the foreign firm sells at host country and the country of origin, respectively; τ and τ^h are the tax rates on the subsidiary's profits and the tax paid in the country of origin. X^f , X^h are total sales of foreign firm's product in the host country and the country of origin, and they are function of price and income in each country. TC^f is the total cost faced by the foreign firm for its production activity both at home and abroad, and ϕ is a vector of costs of production both in the host country and the country of origin, including labor (W, W^h), and cost of capital (ρ, ρ^h).

From the first-order maximization conditions, the marginal revenue of the foreign firm is equal to its marginal cost of production ($MR^f = MC^f$) and:

$$(9) \quad SP^f = \frac{N(P^f, Y)}{(1 - \tau)} MC(\phi, Q^f, Q^h)$$

Equation (9) shows that the firm's price is a markup over its marginal cost of production, with

the markup $N = \left(1 - \frac{1}{\varepsilon^f(P^f, Y)}\right)^{-1}$ being based on the price elasticity of the foreign firm in the

domestic market. The markup changes with the value of the elasticity, which in turn varies with the product price and income. As for the domestic firm, a constant markup occurs when the markup has zero price-elasticity $N_p = 0$, and a variable markup is when $N_p < 0$. The sign of N_y , the income elasticity of the markup can be positive, negative or zero, depending on the sign of ε_y^f . We assume that the foreign firm has a quasi-concave production function,

implying that $MC_{Q^f} \geq 0$.

Totally differentiating the FOC in equation (9):

$$(SdP^f + P^f dS)(1 - \tau) = MC(N_{p^f} dP^f + N_y dY) + N.(MC_{Q^f} dQ^f + MC_{Q^h} dQ^h + MC_{\phi} d\phi) + SP^f d\tau$$

where $\phi = \{SZ, Z^h\}$ and $Z = \{W, \rho\}$ and $Z^h = \{W^h, \rho^h\}$. Using $SP^f = \frac{N.MC}{1-\tau}$ we get

$$(10) \quad Q^f = Q^f(P^f, S, Y, \phi, \tau)$$

with:

$$Q_{P^f}^f = \frac{(1-\tau)S - N_{P^f} MC}{N.MC_{Q^f}} \geq 0; \quad Q_Y^f = -\frac{N_Y MC}{N.MC_{Q^f}} \geq 0 \text{ if } N_Y \geq 0;$$

$$Q_S^f = \frac{(1-\tau)P^f - N.Z.MC_Z}{N.MC_{Q^f}} > 0 \text{ if } \varepsilon_Z < 1 \text{ where } \varepsilon_Z = d \log MC / d \log Z;$$

$$Q_\tau^f = -\frac{MC}{(1-\tau)MC_{Q^f}} < 0$$

$$Q_\phi^f = -\frac{MC_\phi}{MC_{Q^f}} \text{ with } Q_{SZ}^f = -\frac{SMC_Z}{MC_{Q^f}} < 0 \text{ and } Q_{Z^h}^f = -\frac{MC_{Z^h}}{MC_{Q^f}} < 0;$$

The numerator of Q_P^f can be written as $S(1-\tau)(1-\eta^f)$, where η^f is the price elasticity of the foreign markup and is negative because of the convexity of demand. It is interesting to note that the last term, $1-\eta^f$ is equal to the inverse of the absolute value of the pass-through elasticity of exchange rate ($\partial \log P^f / \partial \log S$). If pass-through is complete, the foreign markup does not respond to prices ($\eta^f = 0$, which occurs with constant elasticity of demand), the exchange rate effect on the Turkish lira relative to the price of the foreign firm is zero, and $Q_P^f > 0$. When pass-through is incomplete, $\eta^f < 0$. Foreign firm's price P^f does not move proportionately and the firm is less able to pass the exchange rate changes to its price, the more elastic is the host country's demand. In this case Q_P^f is still positive but larger than the case of complete pass-through.

The response of output in the host country to a change in the exchange rate depends on the relative strength of two effects. The first one is the income effect and it is positive. When the investor's currency depreciates, the revenues, and therefore the profit in own currency increases. However, depreciation also increases the cost of producing in the host country, which depresses profits. The net effect depends on the sensitivity of costs to currency fluctuations.

An increase in the tax rate reduces net marginal revenue and hence leads to lower output. A rise in factor costs (in host country or in country of origin) increases marginal cost in both countries assuming factors of production are normal.

From the cost minimization problem, using the envelope theorem, we get the factor demand functions, and among these, of particular interest is F, the FDI.

$$F = \frac{\partial TC^f(SZ, Z^h, Q^f, Q^h)}{\partial \rho}, \text{ and hence:}$$

$$(11) \quad F = F(SZ, Z^h, Q^f, Q^h), \text{ with } Z = \{W, \rho\} \text{ and } Z^h = \{W^h, \rho^h\}.$$

From the sufficient second order conditions for cost minimization, $F_w > 0$, $F_\rho < 0$, $F_{w^h} > 0$, $F_{\rho^h} > 0$, and from the normality assumption of the production factors, $F_{Q^f} > 0$, $F_{Q^h} > 0$.

Replacing (10) into (11), and normalizing with prices we get the reduced form for FDI:

$$(12) \quad \boxed{F = F\left(\underset{+/-}{w}, \underset{-}{w^h}, \underset{-}{\rho}, \underset{-}{\rho^h}, \underset{+/-}{s}, \underset{+/-}{Y}, \underset{-}{\tau} \right)}$$

where the first four terms represent the real costs of labor and capital in host country and country of origin respectively, and the third term is the real exchange rate. Here again the direct and the indirect effect of a rise in host country wages make the sign ambiguous. When wages increase, production becomes less labor intensive because the firm substitutes FDI for labor. An increase in labor cost also decreases output and hence reduces the demand for all factors of production, including F.

A rise in the cost of capital in both countries unambiguously reduces demand for F because both direct cost effect and the output effect work in the same direction. A depreciation of the currency of the foreign investor (or appreciation of the host country's currency) has the same ambiguous effect as before. It increases the profit margin and hence output, and the demand for factors of production. The larger is the increase, the smaller is the pass-through of the exchange rate change to the product price. But it also increases the cost of producing in terms of the currency of the domestic investor. The income effect is ambiguous because it depends on the income elasticity of the markup. A rise in FDI tax reduces production and therefore the demand for F.

IV. Data and Methodology

Most series are quarterly and run from 1986 to the end of 2004. The annual series have been converted to quarterly by linearly smoothing each annual observation to quarterly observations such that the last one matches the annual value. Foreign variables are computed as simple averages of the country of origin of foreign investors (France, Germany, Italy, Japan, the United Kingdom and the United States). Ideally these series should be a weighted average, with the weight being the relative share of each country in the total flows. Although we could find the breakdown of investing countries for FDI, we could not obtain a parallel weight for foreign portfolio investment. We, therefore, opted for simple averages.

The two capital flow components, portfolio investment and FDI to Turkey are from *Central Bank of Turkey's Electronic Data System*. Bilateral exchange rates and interest rates are from *International Financial Statistics*. The interest rate series used for Turkey is the three-month time deposits rate. The foreign interest rate is the lending rate in the investing countries. The only exception is the Italian rate, for which we used the money market rate because it is the best proxy for the lending rate (with a correlation coefficient of 0.98 and the longest data span). The economic, financial and political risk series are from the *International Country Risk Group*.

All the other variables except the risk variables are from the *OECD Economic Outlook*. These are GDP at market price --Turkish and foreign--, cyclically adjusted direct business taxes in Turkey and abroad, Turkish and foreign GDP deflator, Turkish and foreign total investment deflator (as a proxy for capital price). The unit labor cost series for Turkey do not exist, so we computed them as total salaries and wages over nominal GDP. Foreign unit labor cost is the average of unit labor costs in the countries of origin.

Our regression equations are:

$$(13) \quad b_t = \beta_0 + \beta_1 w_t + \beta_2 (r_t - r_t^*) + \beta_3 t + \beta_4 A(L)RISK_t^i + \beta_5 DUM_t + e_t^B,$$

$$(14) \quad f_t = \alpha_0 + \alpha_1 (w_t - w_t^h) + \alpha_2 (\rho_t - \rho_t^h) + \alpha_3 s + \alpha_4 \tau + \alpha_5 A(L)RISK_t^i + \alpha_6 DUM_t + e_t^F$$

where flows are expressed proportional to GDP with $b_t = B_t / Y_t$ and $f_t = F_t / Y_t$. Moreover, $\beta_1 > 0, \beta_2 < 0, \beta_3 < 0, \beta_4 < 0$, and $\alpha_1 > 0, \alpha_2 < 0, \alpha_3 > 0, \alpha_4 < 0, \alpha_5 < 0$; The superscript for RISK stands for i =economic, political or financial risk. The error terms e_t^B, e_t^F are assumed

normally and identically distributed, serially uncorrelated and with zero mean and constant variances.

To increase the regression sample size, we impose the restriction on FDI regression that w_t, ρ_t are expressed as deviations from the corresponding foreign variable. Since the domestic firm that needs to borrow funds is likely to make an arbitrage between the cost of borrowing domestically and abroad, we follow a parallel approach to FPI and express r_t^* as deviation from the domestic rate. For both real rates and cost of capital, we assume that the domestic variable's effect dominates that of the foreign variable.

The real interest rate is calculated as the nominal rate adjusted for year-over-year percentage change in the GDP deflator. Following Barrell and Pain (1996), we compute the cost of capital as $\frac{P\rho}{P_K} = i - \Delta_n \log(P_K / S) \Rightarrow \rho = \frac{P_K}{P} (i - \Delta_n \log(P_K / S))$, where Δ_n is the change over n periods. The term in parentheses is the nominal interest rate adjusted for inflation in domestic currency denominated capital prices. We proxy P_K with the price of investment in OECD. The variable RISK is determined with a simultaneous decision process, which involves choosing the type of risk and the optimal lag following the Akaike and Schwartz information criteria (AIC and SC) and the minimized sum of squared residuals (SSR) criterion.

We first check the order of integration of the variables. We then proceed testing for cointegration between variables integrated of order 1 based on the Maximum Likelihood Test by Johansen (1991). As we observed in Figure 1, FPI and FDI series show strong fluctuations during 1998-2001 and 2000-02. These turbulences following structural breaks most likely created instability in the estimates of coefficients whether it affects the long-run relation or not. To test the presence of breaks in the functional relations between each investment type and its determinants, we allow one or more change in one or more dates, reflecting structural breaks. Since these dates are unknown, we estimate them together with the model parameters.

Two common approaches to estimating breakpoints endogenously are (i) instability test-based approach (Andrews, 1992) and (ii) regression-based approach (Bai, 1997a, b and Bai and Perron, 1998). Although the first test is applicable to nonlinear models, its two major drawbacks are that it can only select one breakpoint endogenously and the asymptotic distributions of the F-type test statistics are constructed for non-trending regressors. It cannot be used to test parameter instability in equations (fpi) and (fdi), which contain regressors with

deterministic trends. We, therefore, adopt the regression-based approach developed by Bai, Bai and Perron (BBP), which is compatible with such regressors and allows us to find multiple breaks. These breaks can be estimated either with the global minimizers algorithm described in Perron (1997), or sequential methodology of BBP. We adopt the latter methodology because it is more robust to the wrong choice of the number of breaks and computationally less costly.

If the number of breaks is known, the sequential methodology estimates the first breakpoint \hat{t}_1 such that $\hat{t}_1 = \arg \min_{t_1} S_T(t_1)$, where $S_T(t_1)$ is the sum of squared residuals (SSR) resulting from estimating the model over the entire period. Then the sample is partitioned into two sub-periods around \hat{t}_1 and a one-break model is estimated over each subsample, which identifies two additional potential breakpoints associated with a minimized SSR for each subsample. Among these points, the second breakpoint \hat{t}_2 is obtained by choosing the breakpoint that allows the largest reduction in the SSR over the whole sample. The same procedure is repeated sequentially until the predetermined number of breaks is reached.

If the number of breakpoints is unknown, the sequential estimation procedure outlined above is combined with a *sup F* type test suggested by Bai and Perron (1998), which consists in testing the null hypothesis of m versus $m+1$ breaks ($m=0,1,2,\dots$). A new breakpoint is then estimated if the null is rejected, and the number of breakpoints is obtained at the first value of m for which the null is not rejected. An alternative to this test procedure is to combine the sequential estimation method with the Bayesian Information Criteria BIC(m) of Yao (1988) and the modified Schwarz' criterion LWZ(m) of Liu, Wu and Zidek (1997). The optimal number of breakpoints m is then given when the minimum of these information criteria is reached. These criteria are appropriate with multiple break models because they introduce a penalty factor for additional breakpoints, which necessarily decrease the SSR.³

In our framework we cannot perform the sequential estimation with a known number of breaks since inspection of data does not indicate an obvious number of breaks. The *F*- test procedure for unknown number of breaks is not appropriate either because the underlying parameter constancy test requires stationarity of the regressors, a condition that our trended

³ See Perron (1997) for a comparison of the two information criteria.

debt series do not satisfy. We thus adopt the strategy of the sequential estimation with unknown number of breaks and information criteria (Perron, 1997).

Before implementing the BBP methodology, we estimate both investment equations by OLS. We then test for $m=1$ breaks in each model, which may be represented by a one-time change in the coefficient of 1 to all of the 5 variables in equation (13) and 1 to all of the 6 variables in equation (14). . Since we do not have information on identity nor the number of the coefficients affected by the break, we apply the methodology of BBP to each combination of parameters in each regression equation.⁴ For each equation, we chose the specification that minimizes the SSR over the whole sample period. After identifying a first breakpoint, we test for a second breakpoint among the unstable parameters determined in the first stage. We follow the same procedure until the m th (le nb de rupture est m) break when the $BIC(m)$ and $LWZ(m)$ criteria cannot be minimized further.⁵ Bai (1997b) shows that when all m breakpoints are estimated, a reestimation (or refinement) of the first $m-1$ break dates over the sample periods, bounded by successive estimated dates, improves the estimation results. In the case of two breakpoints, if \hat{t}_2 is located to the right of \hat{t}_1 ($\hat{t}_2 > \hat{t}_1$), then \hat{t}_1 should be reestimated over the period $[1, \hat{t}_2]$.

We also use the stationarity of the error term as an additional criterion for the number of breaks, which suggests that the model is well specified. To conduct the stationarity test, we perform a residual-based unit root test and use MacKinnon's (1991) all-sample estimated critical values. The stationarity of the residuals suggests that the number and location of the estimated breakpoints correspond to those of the « true » model. Finally, to evaluate the degree of estimation accuracy of each estimated breakpoint we construct a confidence interval at the 5% level following the methodology in Bai, 1997 (see Appendix B for technical details).

⁴ This translates into $\sum_{q=1}^6 C_q^6 = 63$ combinations for FDI and $\sum_{q=1}^5 C_q^5 = 31$ combinations for FPI

⁵ Bai (1997b) shows that when all m breakpoints are estimated, a reestimation (or refinement) of the first $m-1$ break dates over the sample periods, bounded by successive estimated dates, improves the estimation results. In the case of two breakpoints, if \hat{t}_2 is located to the right of \hat{t}_1 ($\hat{t}_2 > \hat{t}_1$), then \hat{t}_1 should be reestimated over the period $[1, \hat{t}_2]$.

V. Estimation Results

For the standard asymptotic theory to be valid, the variables used in the regression must be stationary or if they are integrated of order 1 or I(1), they should be cointegrated. The ADF test results (Dickey and Fuller, 1979) indicate that the independent variables are all I(1) while the dependent variables are stationary. In this case, if we find one or more cointegration relations between the I(1) variables, the error term of the regression will be stationary.

To test the cointegration between the nonstationary variables with the Johansen Maximum Likelihood (ML) test procedure, we used the AIC to determine optimally the test specification and the number of lags. The tests suggest a model with intercept, no trend and four lags for FPI and a model with intercept, trend and two lags for FDI. The Johansen test results show that there is one cointegrating relation for both portfolio investment and FDI over the full-sample period (Table 2, top and bottom panels, respectively).

Next, we turn to the estimation results for both flows (Tables 3 and 4). The first column presents the finding when the breaks are not accounted for, the second and third columns shows the results when one and two breaks are allowed for, respectively. Endogenous variables without subscript correspond to the regression equation with no break (column 1), and the ones with subscripts correspond to one or two breaks (columns 2 and 3). The last column are the regression results when the nonsignificatif variables have been omitted from the previous column. The t-statistics are derived from Newy-West heteroscedasticity and autocorrelation consistent covariances.

No Breaks

The first striking aspect of the results is that if we do not account for breaks due to crises, the explanatory power of the regressions is very low. The variations in the independent variables account for about 10 and 20 percent of the variations in FPI and FDI, respectively. The first column in Figure 3 explains this lackluster result. In both regressions, the fitted value (in red) tracks the actual value reasonably well, except at the end of the sample when the economy deals with the ramifications of the Russian crisis and the subsequent domestic banking crisis. The fit of FPI is particularly affected since the flows are hit by both crises while most fluctuations are missed in FDI during the domestic crisis.

The signs and the magnitudes of the coefficients are in general in line with the predictions of the theory. An increase in the real interest differential and financial risk reduce the inflows of portfolio flows. The negative sign of interest differential suggests that foreign and domestic borrowings are complements rather than substitutes. Tax rates are not a significant factor in determining FPI flows. We conducted the regressions with all three risk types and found that the financial risk is the risk category that matters most for foreign lenders and the relation is negative, as expected. Economic risk is insignificant in all model specifications and political risk is not robust to model specification. The labor cost affects FPI flows positively. This may suggest that the substitution effect dominates and that more expensive labor makes firms to substitute foreign capital for domestic labor. On the other hand, and more likely, this may simply be a spurious correlation caused by simultaneous increases in the labor cost in Turkey and variations in FPI.

An increase in the real cost of capital differential and taxes reduces FDI. Here also, a higher cost of labor affects the flows positively, for possibly the same reasons as in FPI. The coefficient of the real exchange rate is positive and significant, and consistent with the findings in the literature. It suggests that a depreciation of the Turkish lira increases the FDI because it reduces the cost of production in terms of foreign investor's currency by more than the decrease in the profit margins caused by valuation effect.

We tested for all three categories of country risk and found that the economic risk is the most relevant one for foreign direct investment. This is consistent with the view that the FDI is mainly affected by economic fundamentals and is less volatile. The positive sign indicates that as the risk increases, most investors revert to FDI and presumably pull out from portfolio investment. This is in line with the view that investors increase their shares in companies and, therefore, their control during uncertain times when economic risks rise.⁶

One Break

Using the methodology described above, we identify a first breakpoint for both investment equations at the start of the twin crises. The BIC and LWZ criteria suggest a break in 2000.3 for FPI and 2000.2 for FDI (see the minimum SSR, Figure 3, column 2). The BBP

⁶ There is a fair amount of evidence showing that foreign acquisitions increase during currency crises for a variety of reasons (see for example Froot and Stein, 1991, Blonigen, 1997, Aguiar and Gopinath, 2003, Desai, Foley and Forbes, 2004).

methodology determines that for FPI, the constant, the *ulc* and the risk variables are affected by the crisis and thus have unstable parameters (Table 3, second column). For FDI, the number of coefficients affected is larger and consists of the constant, labor and cost of capital differentials, the tax differential and the economic risk perceived by investors (Table 4, second column).

Accounting for the crisis considerably increases the explanatory power of the regressions, to more than 40 percent for FPI and a remarkable 80 percent for FDI. The breakpoint is estimated with high precision since the confidence interval is tight around the estimated date. The 95 percent interval is [2000:1, 2000:3] for FDI and [2000:2, 2000:4] for FPI. The fitted model now replicates well the effect of the banking crisis on both flows.

Before the break, the labor cost-FPI relation (the coefficient of ulc_1) is positive as it was in the first column, but it becomes negative after that: an increase in the *ulc* decreases foreign portfolio investment proportionally. The real interest differential and taxes still affect FPI as before, with no instability in the relation. A 1 percent rise in the interest spread reduces portfolio inflows by 0.02 percent, while a rise in taxes decreases the flows almost proportionately. A larger financial risk tended to depress FPI before the break. After the crisis, however, the relation becomes positive. This counterintuitive result can be attributed to the shortness of the second subsample. Inspection of the data reveals that following the financial crisis, the financial risk index was rising, reflecting markets nervousness, while FPI replaced partially a depressed FDI (Figure 2).

Turning to FDI, our findings indicate that the twin crises introduced instability in all coefficients, except in that of the real exchange rate. The positive relation between the exchange rate and the FDI inflows remains unchanged and suggests about 0.01 percent decline in inflows following 1 percent depreciation of the Turkish lira. The coefficients of three other variables, *ulc*, taxes, and economic risk, also preserve their sign before and after the crisis, but their magnitude becomes larger. In fact, while taxes were not a major factor determining FDI before the breakpoint, they become significant after that: a 1 percent increase in the relative tax rate depresses FDI more than proportionally. After 2000, FDI also responds more strongly to variations in the country risk factor. It is interesting to note that the sign of the risk coefficient remains positive before and after the crisis, but the magnitude increases substantially, lending further support to the view that foreign acquisitions increase during crises. Finally, omitting

the insignificant tax variable in the first subperiod does not affect the results (Table 4, last column).

Two Breaks

The fitted model of FPI suggests that although the model captures the dip in inflows during the banking crises, it is still missing the previous, larger plunge that took place during the Russian crisis (Figure 3). In principle, a search for the second break is conducted to the left and to the right of the initial breakpoint of 2000.2. However, the shortness of the sample after 2000 makes estimates unreliable. Moreover, the SSR is not minimized compared with the second breakpoint identified to the left of the first breakpoint and the criteria BIC and LWZ corresponding to the model with 2 breaks are minimized compared to the model 1 break. For these reasons, we concentrate on the breakpoint to the left of 2000.3.

The break tests identify 1998.2 as the second breakpoint, which corresponds to the Russian crisis. Accounting for both dates, the model captures the effect of both crises on FPI and the two slumps that occurred during these dates (Figure 3 third column). The 95 percent confidence interval around the estimated date is again tight, [1998:1, 1998:3], reflecting the reliability of the estimated date (Table 3, third column). The explanatory power of the regression increases by third to about 60 percent. Interestingly enough, the BIC and LWZ criteria are not minimized when we estimate a second break for FDI. As FDI is not affected by other crises, this is not surprising, since it is hard to improve the fit and the explanatory power of the regression equation with one break. We, therefore, keep the model with a single break.

Starting with the stable coefficients in FPI, introducing a second break preserves the sign but not the significance of real rate spread and tax differential (Table 3, column 3). Low significance of the spread is likely due to collinearity with the constants. Dropping the insignificant two constants helps improve the significance of the spread (last column). The positive relation between ulc and FPI changes to negative in the last subperiod, where a rise in labor cost reduces the inflows. There is weak evidence that financial risk still affects negatively the portfolio flows in the first two periods. The effect of the risk factor becomes significant and negative between the two crises, 1998-2000, when the constants are removed. It maintains its significance and sign of the one-break regressions after 2000. We end our break analysis for FPI at two breakpoints since we could not find a third break for FPI.

VI. Conclusion

There is almost a universal agreement on the importance of foreign capital in the economic development of an emerging or developing economy. These economies often go through structural reforms and are constantly challenged by international crises, which affect capital flows to these countries. Any crisis or major reform is likely to create structural breaks, which can induce instability in the estimated parameters of the capital flow models if the breaks are not controlled for. We show that this is indeed the case and that several parameters are affected by breaks. Thus, analyses based on the assumption of parameter constancy can be misleading because they would be based on biased results.

We develop a theoretical model describing portfolio and FDI flows, which we apply to Turkey and use an endogenous break analysis to determine the break dates and accounting for various country risk factors. We identify the Russian crisis of 1998 and the domestic banking crises of 2000 as endogenous breakpoints. We find that FPI was hit by contagion fears in 1998, while both flows were adversely affected by the domestic banking crisis. Our results show changes in the sign and/or coefficient of a number of determinants in both types of investment. Crises lead to structural breaks and affect the relation between FDI and cost of capital and labor, taxes and the economic risk profile of the country. Structural breaks introduce instability in the response of portfolio flows to labor cost and financial risk. Some coefficients remain stable. An increase in taxes depresses both flows, a rise in the spread decreases portfolio flows, while a depreciation of the currency encourages FDI. The portfolio investment decreases as the financial risk increases, while FDI is used as an outlet for foreign investors when the economic risk increases. Political risk does not seem to be a factor influencing capital inflows.

Table 1: Net Inward Foreign Direct Investment 2000-02 †

(billions of dollars)

	2000	2001	2002
All Developing Countries	160.6	171.7	143.0
Czech Republic	5	4.9	8.1
Hungary	1.6	2.4	1.0
Poland	9.3	5.7	4.1
Argentina	11.7	3.2	0.7
Brazil	32.8	22.6	16.6
Chile	3.6	4.5	1.7
Turkey	1.0	3.3	1.0

†*Source:* World Bank Publications and World Development Indicators.

Table 2: Johansen Maximum Likelihood Cointegration Test Results†

FPI (foreign portfolio investment) Equation				
Eigenvalue	Trace Statistics	# vectors	5% critical Value	p-value
0.33	56.87	None*	54.08	0.028
0.19	30.95	≤ 1	35.19	0.134
FDI (foreign direct investment) Equation				
Eigenvalue	Trace Statistics	# vectors	5% critical Value	p-value
0.37	80.12	None*	76.97	0.028
0.3	49.49	≤ 1	54.08	0.121

†The p-values are provided by MacKinnon, Haug and Michelis (1999) . A * indicates that the hypothesis is rejected at the 5% level.

Table 3. Estimation Results: Foreign Portfolio Investment And Endogenous Breaks †

Independent Variables and breakdates	Model with No break	Model with 1 Break	Model with 2 Breaks	
t_1^*		2000.3 [00.2, 00.4]	2000.3	2000.3
t_2^*			1998.2 [98.1, 98.3]	1998.2 [98.1, 98.3]
c	-0.00 (0.3)			
c_1		-0.01 (0.9)	0.00 (0.1)	
c_2		0.17 (5.4)	-0.09 (1.1)	
c_3			0.25 (2.5)	0.17 (5.2)
ulc	0.07 (1.8)			
ulc_1		0.11 (3.6)	0.04 (1.4)	0.03 (3.3)
ulc_2		-1.02 (6.7)	0.70 (2.7)	0.46 (3.9)
ulc_3			-0.94 (6.6)	-0.94 (6.4)
$r - r^*$	-0.01 (2.2)	-0.02 (3.4)	-0.01 (1.3)	-0.005 (1.7)
$tax - tax^*$	-0.92 (2.6)	-0.98 (2.3)	-0.15 (0.4)	
$riskfin_1$	-0.04 (2.8)	-0.04 (2.5)	-0.01 (0.9)	
$riskfin_2$		0.11 (4.6)	-0.15 (1.5)	-0.22 (3.6)
$riskfin_3$			0.08 (3.3)	0.08 (3.5)
\bar{R}^2	0.095	0.441	0.633	0.64
SSR	0.007	0.002	0.001	0.001
BIC		-9.965	-10.191	
LWZ		-9.568	-9.61	
DW	1.729	2.090	1.945	1.854
ADF			-7.9	

† Independent variables are defined as ulc =real unit labor cost, $r-r^*$ = real interest differential, $tax-tax^*$ =differential of tax rate, $riskfin$ =financial risk MA(4), subscripts correspond to the values of variables before and after the breakpoint(s). Figures in brackets below estimated breakdates are 5% confidence intervals. Figures in parentheses are absolute values of t-statistics based on Newey-West heteroscedasticity and autocorrelation consistent covariances. BIC and LWZ are Yao's (1988) and Liu, Wu and Zidek's (1997) information criteria depending on the number of breaks. ADF is the augmented Dickey-Fuller t-statistics. MacKinnon's (1991) size dependent asymptotic critical values for residual based unit root tests are -4.27 for the full sample (T=65) and -4.31 for the sub-sample (T=54).

Table 4. Estimation Results: Foreign Direct Investment And Endogenous Breaks †

Independent Variables and Breakdates	Model with No break	Model with 1 Break	
t_1^*		2000.2 [00.1, 00.3]	2000.2 [00.1, 00.3]
c	0.01 (2.7)		
c_1		0.005 (5.3)	0.005 (5.3)
c_2		0.22 (6.4)	0.23 (6.5)
$(ulc - ulc^*)$	0.03 (3.4)		
$(ulc - ulc^*)_1$		0.02 (4.2)	0.02 (4.5)
$(ulc - ulc^*)_2$		1.01 (7.7)	1.01 (7.8)
$(ulc - ulc^*)_3$			
$(\rho - \rho^*)$	-0.01 (2.1)		
$(\rho - \rho^*)_1$		-0.01 (3.0)	-0.01 (3.0)
$(\rho - \rho^*)_2$		0.21 (9.8)	0.21 (9.8)
s	0.02 (2.7)	0.007 (2.9)	0.007 (2.9)
$(tax - tax^*)$	-0.01 (0.3)		
$(tax - tax^*)_1$		-0.01 (0.3)	
$(tax - tax^*)_2$		-1.38 (2.4)	-1.38 (2.4)
$riskeco_1$	0.01 (2.8)	0.005 (3.1)	0.005 (3.1)
$riskeco_2$		0.45 (7.2)	0.448 (7.3)
\bar{R}^2	0.23	0.81	0.81
SSR	0.11E-3	2.46E-5	2.46E-5
BIC		-14.09	
LWZ		-13.55	
DW	2.20	2.05	2.68
ADF		-11.72	

† See footnote to Table 3. $ulc - ulc^*$ =real unit labor cost differential, $\rho - \rho^*$ capital cost differential, s =real exchange rate, $tax - tax^*$ =differential of tax rate, $rskeco$ =economic risk MA(7). Both $\rho - \rho^*$ and s are scaled up by 1000.

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Figure 1: FDI and FPI as ratios to GDP

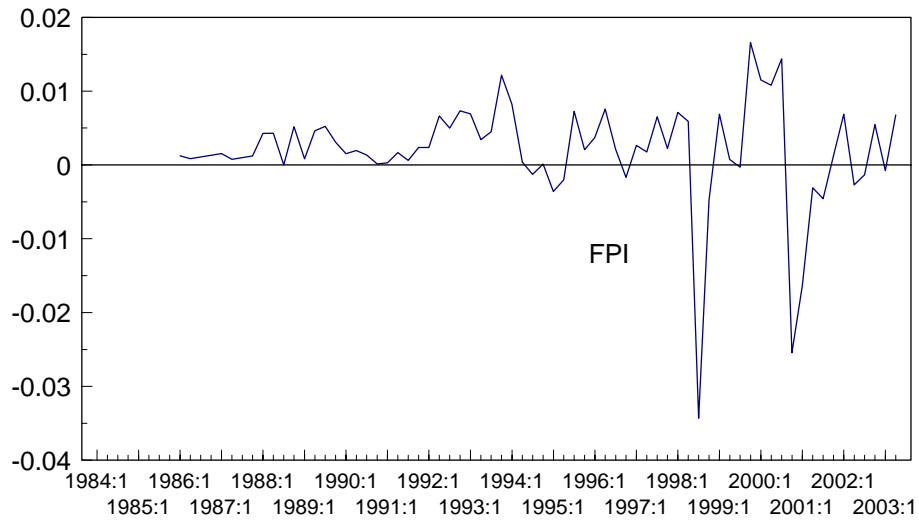
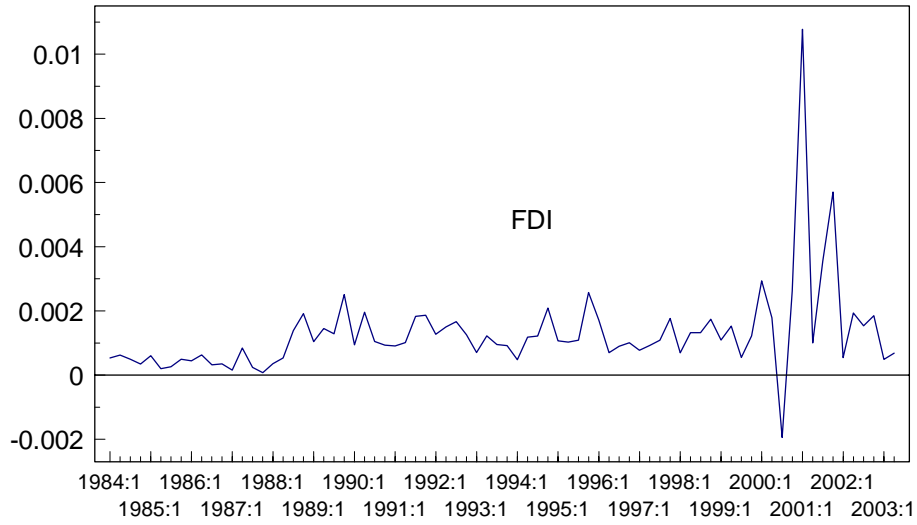


Figure 2: Factors affecting capital flows

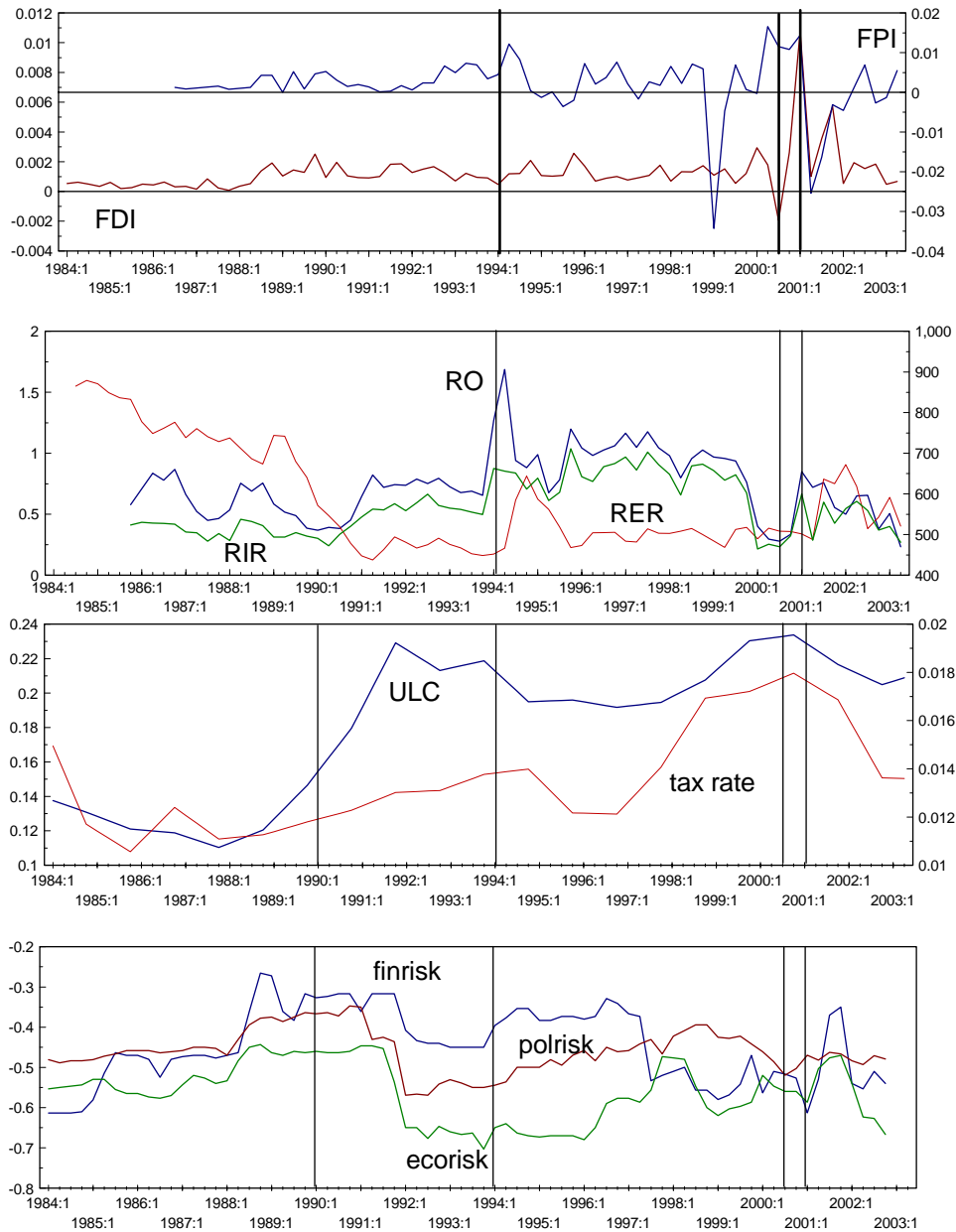
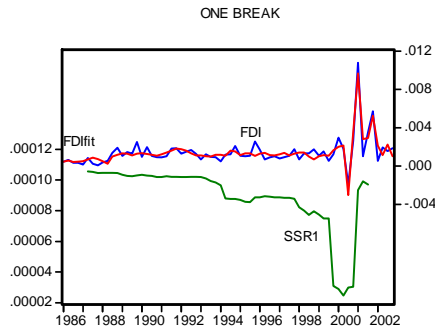
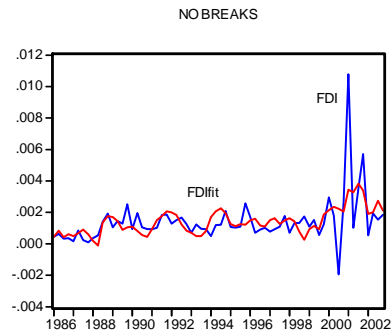
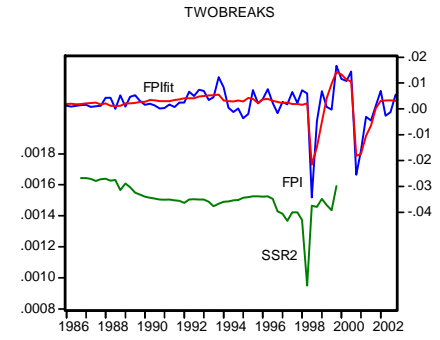
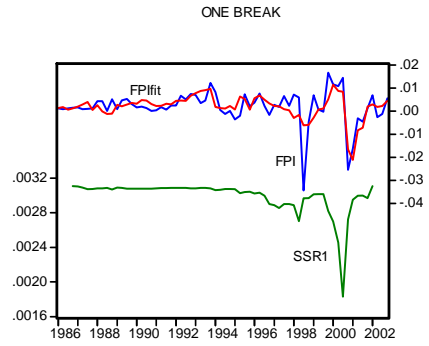
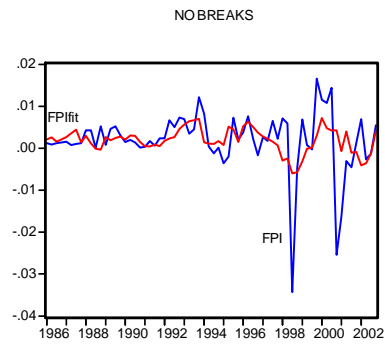


Figure 3: Actual and Fitted Regression Results With Endogenous Breaks



Appendix:
Investment flows with unknown multiple breaks (Bai (1997), Bai and Perron (1998))

Equations (13) and (14) with m ($m=0,1,2,\dots$) unknown breakpoints can be written as:

$$(B1) \quad y_t = \sum_{j=1}^{m+1} \alpha_j' z_t 1_{t \in I_j} + \beta' x_t + v_t$$

where y_t is the dependent variable B/GDP or F/GDP , z_t ($qx1$) and x_t ($px1$) are vectors of independent variables of which the parameters may or may not be subject to shift, respectively, I_j is the sub-period between break dates t_{j-1} and t_j , and $1_{t \in I_j}$ an indicator function such that $1_{t \in I_j} = 1$ for $t_{j-1} < t \leq t_j$ and 0 elsewhere (we set $t_0 = 1$ and $t_{m+1} = T$). The parameter vectors α_j and β and the disturbance term v_t are specific to the investment flow considered. α_j ($j=1,\dots, m+1$) are estimated over the sub-period I_j , while β is defined over the full sample. The constant term is included either in α_j or in β . When $m=0$, (B1) reduces to model (13) or (14)

The method of sequential least squares estimation consists in first, estimating (B1) for $m=1$, over the entire period and identifying the first breakpoint $\hat{t}_1 = \arg \min_{t_1} S_T(t_1)$, where $S_T(t_1)$ is the sum of squared residuals from the one-break model with the candidate break date t_1 . Bai and Perron (1998) show that \hat{t}_1 is consistent for the true single breakpoint. The sample is then split into two and a one-break model is estimated over each sub-sample $[1, \hat{t}_1]$ and $[\hat{t}_1, T]$, yielding two potential break dates, \hat{t}_1 and \hat{t}_2 , respectively. The second estimate $\hat{t}_2 = \hat{t}_1$ if $S_T(\hat{t}_1, \hat{t}_1) < S_T(\hat{t}_1, \hat{t}_2)$ and $\hat{t}_2 = \hat{t}_2$ otherwise, where for example $S_T(\hat{t}_1, \hat{t}_1)$ is the SSR from model (B1) for $m=2$ breakpoints \hat{t}_1 and \hat{t}_1 . Bai and Perron show that if t_1^* and t_2^* are the true breakpoints, then (\hat{t}_1, \hat{t}_2) is consistent for (t_1^*, t_2^*) . The sample is then partitioned into three and a one-break model is estimated over each sub-sample $[1, \hat{t}_1]$, $[\hat{t}_1, \hat{t}_2]$ and $[\hat{t}_2, T]$, and so forth.

We estimate the additional break dates until the BIC and LWZ information criteria are minimized and the residuals \hat{v}_t from (B1) are $I(0)$. For m breakpoints, these criteria are

$$BIC(m) = \log S_T(\hat{t}_1, \dots, \hat{t}_m) - \log T + (p^*/T) \log T \text{ and}$$

$$LWZ(m) = \log S_T(\hat{t}_1, \dots, \hat{t}_m) - \log(T - p^*) + c_0 (p^*/T) (\log T)^{c_1},$$

where $c_0 = 0.299$, $c_1 = 2.1$ and p^* , the penalty factor compensating the decrease in the SSR with each additional new break, is $(m+1)q + m + p$ (Perron 1998). Following Bai (1997b), a 95% confidence interval for the estimated break date \hat{t}_j in the case of trending regressors can be computed as $[\hat{t}_j - [c/\hat{L}_j] - 1, \hat{t}_j + [c/\hat{L}_j] + 1]$, where $[c/\hat{L}_j]$ is the integer part of c/\hat{L}_j , c the 97.5th quintile (computed from the symmetric case cdf formula as $c=11$), and $\hat{L}_j = \hat{\delta}' z_{\hat{t}_j}' z_{\hat{t}_j} \hat{\delta} / \hat{\sigma}_v^2$, a scale factor with $\hat{\delta} = \hat{\alpha}_{j+1} - \hat{\alpha}_j$ and $\hat{\sigma}_v^2$ defined as the magnitude of the shift in parameters due to the breakpoint \hat{t}_j , and the estimated variance of \hat{v}_t in (B1), respectively.

