The Relationship Between Capital Flows and Current Deficit : Evidence from Turkey

** Yusuf Ekrem Akbas*
*** Mehmet Senturk*
**** Canan Sancar*

Abstract

The present paper analyzed the relationship between current account deficit and capital flows in Turkey over the period from 1990-2011. Augmented Dickey Fuller and Dickey Fuller-Generalized Least Squares unit root tests were used to analyze the stability of current deficit (CA) and capital flows (CF) series. Then, autoregressive distributed lag (ARDL) bound test was used in order to check if there is cointegration between the series according to the results obtained from the ARDL test. To conclude, the study revealed that is a cointegration relationship between current deficit and capital flows in Turkey.

Keywords: **current deficit, capital flows, ARDL bound test, co-integration, Turkey**

JEL Classification: E22, F21, F32

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Current account balance is one of the most significant indicators of macroeconomic performance. Some developed countries as well as developing countries have been facing current deficit problems for many years. Developing countries have to import the required technology, products, and investment goods so that they can sustain their economic development as it is impossible for them - excluding the ones which export oil- to cover their import issues by financing the same through their export incomes. Therefore, developing countries should finance their development by external deficit. High rated and long term current deficits in developing countries may cause serious problems in their economies. In the long term, the existence of this deficit can lead to an increase in the domestic interest rates , and therefore, can lead to a reduction in the welfare level for the next generations due to the increasing debt levels. What is important at this point is the question : Whether the current deficit should exist or not and should it be allowed to exist for a long while, and what are the possible ways of financing it ?

There are many ways to finance the current deficit in an economy where financial flows are free. One of these ways is to consult official reserves. However, this option is not chosen very often. Official reserves are, in character, an economy's main capital. So, financing current deficit in reserves implies a decrease in wealth. Besides, flexible rate regime economies do not need to have too many currency reserves. Banks' obligation to keep currency rate flexes is because currency rates are determined in free markets according to the currency demands.

* *Assistant Professor,* Department of Economics, Faculty of Economics and Administrative Sciences, Dr. Adiyaman University, Altinsehir Mah. 3005 Sok. No:13, 02040, Adiyaman, Turkey. E-mail : akbasyea@gmail.com
***Assistant Professor,* Department of International Trade and Logistics, Faculty of Economics and Administrative Sciences, Dr. Kilis 7 Aralik University, Mehmet Sanli Mah. Dogan Gures Pasa Bul. No:134, 79000. Kilis, Turkey.
E-mail : sen-turkmehmet@hotmail.com
****Assistant Professor,* Kelkit Aydin Dogan Vocational High School, Department of Accounting and Tax Applications, Dr. Gumushane University, Ataturk Mah. 17 Subat Bul. 29600, Kelkit-Gumushane, Turkey. E-mail : canansancar@gumushane.edu.tr

This is the reason why central banks don't need to have too many currency reserves. Another way of financing current deficit is to get a loan. However, this option may not always be possible. Financial corporations or institutions want clients to follow some criteria ; the procedure and formalities involved in getting a loan are quite cumbersome and time consuming. Hence, financing a loan immediately is a difficult process. There is a possibility to finance the current deficit by consulting net errors and omissions. The foreign currency income resulting from incorrect and insufficient registered transactions as well as foreign currency incomes entering the economies through unregistered ways is registered into net errors and omissions. In Turkey, especially since the last few years, this method has been used to finance the current deficit when other options proved to be inefficient. Although the increase in net errors and omissions is significant for financing current deficit, it also ends up increasing unregistered trade and wrong accounts in corresponding countries. Hence, this is not the best option for financing current deficit for it reduces the efficiency of the community. Another option to finance the current deficit is to tempt capital flows. Capital flows are the most convenient (though not the best) solution among all the alternatives to finance the current deficit.

In Turkey, after the year 2000, the maintainability of current deficit acquired a new dimension. In 2000, Turkey experienced two economic crises consecutively. These economic crises gave rise to many reforms - like the Turkey central bank became independent, banking arrangement and inspection was founded, and flexible currency came into effect instead of fixed currency rate. All these reforms affected the financial market significantly.

There are a lot of empirical studies that have showed mixed results in the direction of cointegration between current deficit (CA) and capital flows (CF). Most of those are about the Far Eastern and American countries. Morande (1988) found unidirectional causality from CF to CA for Chile. Faroque and Veloce (1990) found bidirectional causality between CA and CF for Canada. Wong and Carranza (1999) found unidirectional causality from CF to CA for Argentina and Mexico, and found bidirectional causality for Philippines and Thailand. Yan (2007) found evidence of unidirectional causality running from CF to CA for Korea. Edwards (2007) found unidirectional causality from CA to CF. Kim and Kim (2010) found evidence of bidirectional causality for Korea using unit root tests, co-integration tests, vector auto regression (VAR) model, and Granger's causality tests. There are few works about the causality between CF and CA for Turkey. Kaya (1998) researched the relationship between CF and CA and found unidirectional causality from CA to CF. Cosgun (2006) researched the causality between CF and CA of developing countries and found unidirectional causality from CF to CA. Bozok (2008) researched unidirectional causality from CA to CF using the VAR model. The condition of CF, when the CA increased, was also researched.

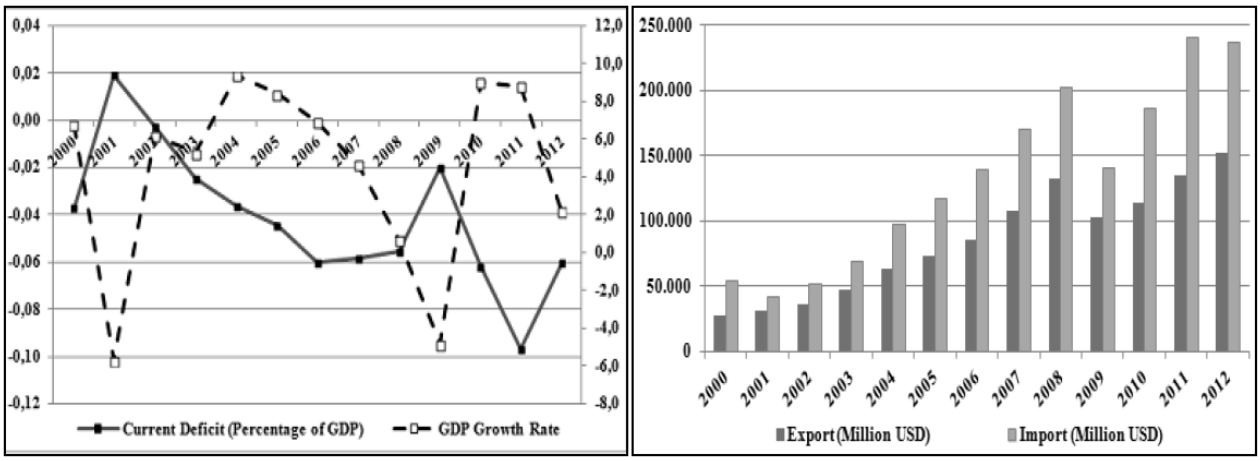
The purpose of the present study is to test if there is a relationship between current deficit and capital flows in the Turkish economy. The present study has examined how the relationship between current deficit and capital flows can be a result of different reasons.

Theoretical Background

This section examines the problems related to the current deficit. It examines the evolution of current deficit and the developments related to capital movements. Furthermore, the study examines how current deficit and capital movements affect each other. Also, current deficit has been experienced for a long time in Turkey ; it is a structural problem that should be resolved. There are two main structural problems. These are economic development and dollarization.

↳ **Growth Rate and Current Deficit :** The pace of economic development in Turkey affects the calculation of the current deficit. This relationship is impacted due to increase in production, and production affects interim goods import. Furthermore, import of investment goods increases when investment increases. So, the current deficit increases with economic development. This condition is observed easily in the Figure 1. In the Figure 1, the production group is shown in both imports and exports in the first five in total. According to this, in exports, motor

Figure 1. Current Deficit - Economic Growth and Export-Import Lines in Turkey



Source : Central Bank of Republic of Turkey (CBRT) data.

Note: The figure on the left shows the route of the exports and imports in Turkey between 2000 and 2012. The data was evaluated annually and took USD into account. The figure on the right, on the other hand, shows the total quantity of current deficit and economic growth over the period from 2000 -2012.

Table 1. Sectional Export and Import Data of Turkey (Billion USD)

Export	Sections	2005	2006	2007	2008	2009	2010	2011
	Engine land vehicles	9 566	11 886	15 903	18 326	12 251	13 812	11 777
	Vessel: Machinery and Equipment	5 246	6 516	8 781	10 258	8 132	9 413	8 521
	Iron and Steel	4 973	6 273	8 372	14 946	7 641	8 740	8 390
	Knitted Clothing	6 590	6 938	8 022	7 826	6 925	7 731	6 437
	Electric Machines and Equipments	5 423	6 327	7 422	7 971	6 630	7 530	6 260
Imports	Mineral Fuels	21 255	28 859	33 883	48 281	29 905	38 497	39 267
	Vessel: Machinery and Equipment	16 400	18 998	22 570	22 539	17 131	21 266	20 473
	Iron and Steel	9 457	11 525	16 182	23 160	11 351	16 120	15 255
	Engine Land Devices	10 552	11 408	12 397	12 789	8 975	13 419	12 710
	Electric Machines and Equipments	9 663	10 881	13 295	13 892	12 243	14 641	12 594

Source: Turkish Statistical Institute (TurkStat) data

Note: The data were chosen from the highest volume sections.

vehicles are ranked first. Electronic devices, machines, and iron- steel products are placed after motor vehicles. Turkey does not have the required and sufficient raw material, interim goods, and investment goods. In this context, the import of products used in exports increases with goods exported by Turkey. This condition is observed in the Figure 1. So, Turkey needs imports for exports. In other words, for positive economic development, imports are crucial for the Turkish economy.

↳ **The Reversing Process of Dollarization and Current Deficit :** One of the common features in countries that experience macro economic inconsistency is that the national currency cannot function any longer. In this scenario, foreign currencies maintain their value, being used in marketing and shopping, and being a measurement unit. Turkey's economy faced these problems, especially until the crises of the year 2000. Reinhart, Rogoff, and Savastano (2003) developed a composite index to measure the dimension of dollarization. This index is calculated as the weighted mean of three variants. These variants are : the share of deposits as a foreign currency in the wide

described money demand, the ratio of national income to external debt, and the weighted mean of the things that are based on the currency index in the internal debt of public. These indexes have to be considered to evaluate the index of dollarization.

As seen in the Appendix Figure 1, the ratio of use of currency in the market decreased progressively. So, if we comment on Turkey in this classification, Turkey was initiated in the process of dollarization until the beginning of 2000, but this process has changed adversely.

↳ **Sustainability of Current Deficit :** As Turkey stepped into the 21st century, it started experiencing economic development simultaneously with the current deficit, and this situation gave rise to a new dimension. The fixed current deficit ratio for all countries and periods is not a valid proposal in terms of maintainability of current deficit. In order to evaluate the maintainability of the current deficit, evaluating only one factor is not sufficient. For this, currency rate policy, the ratio of openness to external markets, the levels of investment in external markets, and the consistency of financial systems are to be evaluated as well (Ferretti, Maria, & Razin, 1996).

As it is known, the current balance is the period of the equations to total investment in the economy and the difference of savings.

$$CA_t = (S_t - I_t) = (S^p_t - I^p_t) + (S^G_t - I^G_t) \quad (1)$$

In the equation, $(S^p_t - I^p_t)$ represents the investment deficit of the private sector and $(S^G_t - I^G_t)$ represents savings-investment deficit in the public sector. The part of the current balance which cannot be compensated with the capital and financial calculations is met with the reserve exchange (ΔR) or with the net errors and omissions.

$$CA_t + FA_t = \Delta R_t \quad (2)$$

The maintainability of current deficit and currency mechanism is not separate from the degree of financial deficit and the currency rate regime. The first conclusion that can be drawn from the above equations is that the current deficit can be maintained financially in an economy that is not involved in the international capital markets, but it is based on giving a deficit in the ratio of that economy. So, in this economic system, maintainability of the current deficit cannot be expected. At this point, the currency regime does not have any importance. In an economic system that is not involved in the international capital markets, and in the free currency rate regime, the currency rate has to adapt to the current deficit. The currency rate can function to compensate the price of the domestic market and external market only in exports of goods, which can happen only in closed markets (Taylor, 2002).

This regime can be described as the power of purchasing parity of the balance currency rate. In this situation, financial deficit and the maintainability of current deficit financing become a consistent concept. Furthermore, in a free currency rate which has financial openness, the balance currency rate is not only determined as the power of purchasing parity, but is also determined by the international interest parity (Coakley, Fuertes, & Spagnolo, 2004). In a financially open economy, the resources of current deficit and the foundational structure being financed are important. At this point, the currency regime does not play an important role. If we evaluate this situation for Turkey, as mentioned before, the current deficit might come into play because of the export structure. This situation can be clearly observed from the Table 1.

In the Table 1, the first five product groups are shown in terms of the amount of imports and exports of Turkey. As Turkey cannot produce raw material, interim goods, and investment goods on its own, which are required for exports, both imports and exports increase at the same time. This situation is also depicted in the Figure 1. How the current deficit is financed in Turkey can be commented upon by having a look at the Appendix Figure 2. The Figure shows a change in current deficit and financial assets, and it shows reserves and the change in net errors and omissions. If the current deficit is observed, financial calculations, reserves, and net errors and omissions increase as well. This situation reflects how the current deficit is financed. In this context, the sustainability of the current deficit in Turkey ; the development of the economy of Turkey in a positive way with the current deficit in Turkey as

seen in the Figure 1 change the idea of financing the current deficit in short-term investment entry. Especially, remittance and exports of services are important factors for a sustainable CA for Turkey. In this way, the financial system will not give rise to a crisis.

Capital Flows

Investment transactions consist of another branch of payments' statement sheet, direct investments, short term investment movements, and other investments. Many factors cause investments. The factors which cause investment entry can be expressed as catching factors ; whereas, the factors which cause the investment output can be expressed as pushing factors.

↳ **Catching Factors :** The main reasons which facilitate and increase short term investment transactions are sudden and extreme rises in the interest rates of domestic personal assets, abolishment of restrictions in currency rate, and important changes expected or fulfilled in currency rate (Mc Kinnon, 1973). The factors which cause investment entries comprise of reform movements which are made to create an effective market economy. All changes regarding economic infrastructure and regulations for countries are encompassed within this factor. Macroeconomic consistency, the liberalization of financial markets, and quick economic development increase the investors' trust in an economy.

At the same time, price consistency is another important factor which causes short term investment entry. Price consistency is important both for foreign investors and national investors in the stage of planning their investments and making a decision regarding investment. If foreign investors consider the past price transactions, they are inclined to invest in countries which have price consistency. The other important issue for investors is the policy of currency rate. Investors will want to turn to either their own money or other currencies that have a convertibility value some time after converting the funds that they brought to the country where they will invest. So, investors give importance to the currency of the country where they have invested their money. Currency is converted to national money by considering the rate at the beginning of the period, which gains a high value interest and goes abroad as a currency, but while making a decision on investment, the investor has to be careful about the currency policy, the profit after deduction of taxes, or converting to money or not (Culha, 2006) .

The precautions taken for investors are factors which give rise to investment entries. Resolution of problems, solutions for public management, and the efficient running of the judicial system has an impact on foreign investment. Technology is also another factor that has a bearing on capital inflows, which has an impact on causing potential investors to invest in emerging markets. Except these factors, a regional treaty of commerce is a factor that leads capital movements to improving countries.

↳ **Reversing Factors :** The factors that cause a decrease in capital profits are examined in this category. Economic recession in a country is another factor that causes capital outflows. As this atmosphere is not acceptable to the market participants, capital movements can move to other countries that do not have an economic recession. Besides, drop in interest rates decreases the profit of foreign funds, so this causes foreign funds to head to other centers. The countries that have no change in market state will have an advantage and they will get a higher share of international capital movements. Political instability is a factor that causes insecurity among the investors, and this can be a factor that causes capital outflow. Capital outflows from developed countries can be seen as a reaction to short-term instability (Biçer & Yeldan, 2003). For determining the capital inflows, the conditions of the external world have a great importance. Economic recession can be seen as a factor that causes capital outflows, recession faced in other countries can be seen as capital inflow as funds will move to places where there is no recession (Dasgupta & Ratha, 2000).

When we examined the capital movements in Turkey, we observed that by 1980s, Turkey had financial autarky like other countries. Since the beginning of the 1980s, the process of liberalization all over the world eased the capital movement. However, we can say that the process of liberalization in Turkey started in the beginning of the

twenty first century. In Turkey, the fixed rate system was in place until many crises occurred in a row in 2000. After the crises in the year 2000, a flexible exchange rate, autonomy of the central bank, and the establishment of the Banking Regulation and Supervision Agency (BRSA) brought confidence to the financial market. With this confidence, the establishment of the Turkish Derivatives Exchange (TURKDEX) became one of the important factors for the financial markets. It can be said that the political and economic stability in the region since the beginning of 2000s encouraged capital inflows and turned Turkey into a secure financial harbour. Therefore, under these positive circumstances, the economy grew and received capital inflows.

The capital flows into Turkey point to a positive direction, with an exception being the year 2001 (as indicated in the Appendix Figure 3), thereby showing the situation of capital flows. Constant fluctuation was seen in reserves. Net errors and omissions generally pointed in a positive direction. Therefore, the situation indicated in Equation (1) is explained with visuals.

↳ **The Relationship between "Current Account" and "Capital Flows" :** We can write the Equation (1) by revising to re-see how current deficit is balanced.

$$0 = CA + FA + OSA = CA + (FDI + PI + OI) + OSA \quad (3)$$

This equation simply states that the sum of the current account *(CA)*, the financial account *(FA)*, and the official settlements account *(OSA)* must equal 0. Given *OSA*, when *CA* is in deficit (surplus), *FA* needs to be in surplus (deficit), which indicates that foreign capital flows in (out). In this era of free trade and free capital mobility, the volume of both international goods and asset transactions can be enormous, and thus, the *OSA* is usually regarded as a residual that balances the BOP account. As is made amply clear in this equation, in the financing of current deficit, capital flows or official reserves, or net errors and omissions are used (Yan, 2007). The interactive relation between capital flows and current deficit is shown in the above equation. However, a casual relation can occur between current deficit and capital flows for some reasons. These reasons are explained in the following paragraphs.

Capital inflows can cause nominal exchange rates to depreciate. After that, the foreign currency supply will increase, and the domestic currency will appreciate. Therefore, an overvalued domestic currency would produce a CA deficit that stems from export articles steadily increasing in cost, and merchandise imports becoming cheaper day by day. A decrease in world nominal interest rates causes a worsening of the current account balance in the domestic markets with an appreciation due to inflationary pressure. Thus, this situation causes capital flows into the domestic markets. The effect of current account deficit on capital inflows can show a tendency as is explained above.

On the other hand, the current account deficit can have an effect on the capital flows as well vice -versa (the capital flows can affect the current account deficit). The revenue earned from selling exports means that countries have resources for purchasing imports. Without sufficient export sales, imports can be purchased only through foreign borrowing. The corresponding ratio of exports to imports is low in Turkey; this problem can be solved by capital flows. Under a flexible exchange rate regime to ensure the equivalence of balance of payments, current account in the calculation of the balance of payments can appear as equal at the same ratio of capital input. In this context, the current account deficit domestically in an economy can attract capital flows, and interest rates are increased. The higher are the national interest rates, the better are the domestic capital inflows. This shows that foreign capital may be a good solution for the current account deficit (Kim & Kim, 2010).

In addition, if the market structure is exogenous, foreign capital is vital for trade balance. If the market structure is endogenous, capital inflow can cause a welfare loss by reducing the cost of entry. Thereby, there may be a case for taxing the returns to foreign capital because they are extreme in their contribution to the economy. Other than that, capital inflows can cause a decrease in nominal exchange rates, thereby causing an appreciation in the nominal interest rates. After that, the foreign currency supply will increase, so imports will be cheaper. Therefore, the affordability of people goes up, and prosperity increases. So, bidirectional cointegration is also possible for both CA and CF, as they are affected by each other (Kim & Kim, 2010).

Empirical Methodology

In the present study, to test the stability of current deficit and capital flow series, the ADF and DF-GLS unit root tests were applied. ARDL Bound test was performed to detect whether there is a cointegration in these series.

Unit Root Tests : Recently, unit root testing models have been given extensive attention in the literature. Testing for the presence of a unit root in a time series has become a standard practice in empirical research using time series data. Unit root tests can be used to determine if trending data should be first differenced or regressed on deterministic functions of time to render the data stationary. In this research, the ADF and DF-GLS tests were used for the analysis.

The most widely used method of the unit root test is the Dickey-Fuller (ADF) unit root test, which has been used in this analysis as well. Stationarity of the series was tested according to the following equation :

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta Y_{t-i} + \varepsilon_t \qquad (4)$$

In the above equation, Y is the variable subject to the stationarity test, Δ is the first difference operator, and ε is the error term. There are two hypotheses established for the ADF unit root test H_0: $\alpha_1 = 0$ and H_1: $\alpha_1 < 0$. If H_0 is rejected, then Y is to be accepted as stationary.

The second stationary test used in the analysis is the Dickey Fuller (DF-GLS) test. The DF-GLS test is more efficient as compared to the ADF test (proposed by Elliott, Rothenberg, and Stock (ERS, 1996). The ERS is an efficient test for an autoregressive unit root. This test is similar to the ADF test, but it has the best overall performance in terms of small sample size and power, thereby dominating the ordinary ADF test. The test "has substantially improved power when an unknown mean or trend is present" (ERS, 1996, p. 813). The equation for the DF-GLS test is as follows:

$$\Delta y^d_t = \pi y^d_{t-1} + \sum_{i=1}^{p} \Psi_j \Delta y^d_{t-j} + \varepsilon_t \qquad (5)$$

ARDL Bound Tests : Testing the relation between the level of parameters and cointegration has gained importance since the essay of Engle-Granger (1987). Testing the existence of cointegration can be analyzed under two topics. These are two level approaches of Engle-Granger based on the remnants of regression and Johansen system approach based on reduced rank regression. Except that, there is Stock-Watson's (1988) scholastic common system approach that is based on the method of main constituent. The common features of all these approaches are that all variables worked on are assumed to be I (1). It brings some indefiniteness as it is compulsory that the parameters' union tests are conducted before cointegration analyses.

Based on Pesaran, Shin, and Smith's (2001) ARDL model, a new approach that enables the cointegration relation to be tested was developed. The new method is based on the parameters' level delay relevance Wald or F tests in ARDL model's error correction forms. It is shown that every two test ranges do not fit into the standard distribution independent form, being explanatory variables : I (0) or I (1) under the assumption that there is no relation between Pesaran et al's parameter levels.

In Pesaran et al.'s study, asymptotic critical values were obtained for two extreme situations. In the first situation, all explanatory variables were I (0), and in the second situation, all explanatory variables were I (1), which did not create asymptotic critical values. If the counted F statistics fall between these two critical values, the test has no result. When the explanatory variables are I (0), the F written on the left of the created critical rate or no relation of Wald statistic cointegration is the result. For the other situation, the F written on the right of I (1) created critical rate or relation of Wald statistic cointegratin is the conclusion.

ARDL models are advantageous as they offer both short term and long term relations at the same time. Another advantage of these models is that small samples give more accurate (robust) results as compared to other cointegration test results.

A (L), B (L), and *C (L)*, the delay processor polynomials are defined as follows :
Formed of 3 variables (y_t , x_{2t} , x_{3t}) and an ARDL (*p, q, m*) model respectively formed of *p*, *q*, and *m* degrees can be like the one below :

$$y_t = a + a_1 y_{t-1} + a_1 y_{t-2} + ... + a_p y_{t-p} + b_0 x_{2t} + b1\, x_{2t-1} + b_2\, x_{2t-2} + ... + b_q\, x_{2\,t-q} + c_0 x_{3t+1} c_0 x_{3t-1} + c_2 x_{3t-2} + ... + c_m\, x_{3t-m} + u_t \quad (6)$$

We can explain the ARDL model in this way by using delay processors multi-terms :

$$A(L)\, y_t = \alpha + B(L)\, X_{2t} + C(L)\, X_{3t} + u_t \qquad u_t \sim WN(0, \sigma^2) \quad (7)$$

Here, *A(L)*, *B(L),* and *C(L)* delay processor multi terms are defined as follows :

$A(L)=(1-a_1L-a_2L^2-\ldots\ldots-a_pL^p)$
$B(L)=(b_0+b_1L+b_2L^2+\ldots\ldots+b_qL^q)$
$C(L)=(c_0+c_1L+c_2L^2+\ldots\ldots+c_mL^m)$

Therefore, ARDL *(p, q, m)*

$A(L)y_t=\alpha+B(L)X_{2t}+C(L)X_{3t}+u_t$ model can be parameterized in this way:

$$\Delta y_t = \alpha + \sum_{i=1}^{p-1} \theta_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \delta_i \Delta X_{2t-i} + \sum_{i=0}^{m-1} \varphi_i \Delta X_{3t-i} + d_i y_{t-1} + d_2 X_{2t-1} + d_3 X_{3t-1} + u_t \quad (8)$$

*d*1, *d*2, *d*3 coefficient numbers above can be matched with ARDL coefficient numbers on this level in the following manner:

$d_1=(a_1+a_2+\ldots\ldots+a_p)-1$

$d_2=(b_0+b_1+b_2+\ldots\ldots+b_q)$

$d_3=(c_0+c_1+c_2+\ldots\ldots+c_m)$

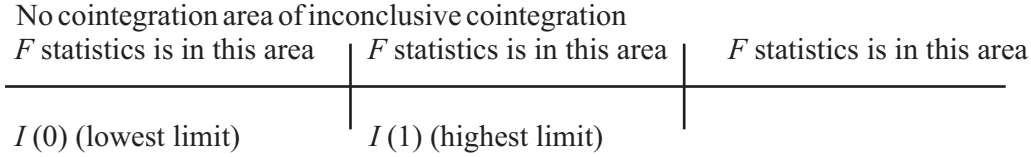
The hypothesis that there is no cointegration here can be tested as:

H_0: $d_1=d_2=d_3=0$; there is no cointegration.
H_A: At least one of them is different from 0; there is cointegration.

$$F = \frac{(RSSR_R - SS_{UR})/g}{RSS/_{UR}(T\_K)}$$

k = explanatory variable number,
g = constraint number,
K = parameter number.

After calculating the *F* statistic, we look at Pesaran et. al. 's (2001) table values. To be able to conduct the cointegration test, all the variable numbers don't have to be *I* (1). In other words, some of them can be *I* (0), some can be *I* (1). That is why there is a maximum limit and minimum limit in tests.



In the ARDL model, (if there is any) the cointegration relation is like the following :

$d_1 y_{t-1} + d_2 X_{2t-1} + d_3 X_{3t-1} = 0$. From that balance error,
$\varepsilon_{t-1} = d_1 y_{t-1} + d_2 X_{2t-1} + d_3 X_{3t-1}$ can be obtained.

In this situation, the model can be written as the error correction model (ECM), which is as follows:

$$\Delta y_t = \alpha + \sum_{i=1}^{p-1} \theta_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \delta_i \Delta X_{2t-i} + \sum_{i=0}^{m-1} \varphi_i \Delta X_{3t-i} + \lambda (d_1 y_{t-1} + d_2 X_{2t-1} + d_3 X_{3t-1}) + u_t \quad (9)$$

or

$$\Delta y_t = \alpha + \sum_{i=1}^{p-1} \theta_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \delta_i \Delta X_{2t-i} + \sum_{i=0}^{m-1} \varphi_i \Delta X_{3t-i} + \lambda (\varepsilon_{t-1}) + u_t \quad (10)$$

So, both short term and long term correlations can be obtained from the ARDL models. After presenting the ARDL model, the current deficit and capital flow models are as follows :

$$\Delta CA_t = \beta_0 + \beta_1 CA_{t-1} + \beta_2 KA_{t-1} + \sum_{j=1}^{m} \beta_{3,j} \Delta CA_{t-j} + \sum_{j=0}^{m} \beta_{4,j} \Delta KA_{t-j} + v_t \quad (11)$$

$$\Delta KA_t = \beta_0 + \beta_1 KA_{t-1} + \beta_2 CA_{t-1} + \sum_{j=1}^{n} \beta_{3,j} \Delta KA_{t-j} + \sum_{j=0}^{n} \beta_{4,j} \Delta CA_{t-j} + v_t \quad (12)$$

In equations (11) and (12), *CA* stands for current deficit, Δ stands for difference operator, *CF* stands for capital flow, *m* and *n* stand for optimal lag length. Optimal lag length mentioned as *m* in the model is determined using criteria such as AIC, SBC, HQC, and there should not be successive dependence problem in the error term so that the test gives correct results. If there is successive dependence in the lag length, giving the least AIC, SBC, and HQC values, the lag length giving the second least lag length is taken. If the successive dependence problem goes on, this procedure goes on till this problem is eliminated. The below mention hypotheses were framed in order to test the cointegration relationship:

$H_0 : \beta_1 = \beta_2 = 0$ $\quad H_0 : \beta_1 = 0$
$H_0 : \beta_1 \neq 0,\ \beta_2 \neq 0$ $\quad H_0 : \beta_1 \neq 0$

In order to determine the long or short term relationship among the series on which there has been a co-integration relationship, an ARDL is set up. In order to test the long term relationship, the ARDL model is predicted first. Therefore, the below - mentioned model was created:

$$CA_t = \beta_0 + \sum_{j=1}^{p} \beta_{1,j} CA_{t-j} + \sum_{j=0}^{q} \beta_{2,j} KA_{t-j} + \varepsilon_t \quad (13)$$

$$KA_t = \beta_0 + \sum_{j=1}^{p} \beta_{1,j} KA_{t-j} + \sum_{j=0}^{q} \beta_{2,j} CA_{t-j} + \varepsilon_t \quad (14)$$

In the equation, the optimal lag delays related to *p* and *q* variables are shown. In order to determine the lag lengths mentioned before, we used criteria such as AIC, SBC, and HQC. Then, optimal lag length of the dependent variable was determined, and after that, the lag length of the dependent variable is bound to the lag length of this variable which is already determined. The model predicted according to this is called ARDL *(p, q)*. The long term coefficient in the predicted ARDL model is calculated as below :

$$= \frac{\sum_{j=0}^{q} \beta_{2,j}}{1 - \sum_{j=1}^{p} \beta_{1,j}} \qquad (15)$$

By looking at the ( ) sign and the statistical meaning of the calculated long term coefficient, we made a unanimous decision about the long term relationship. In order to test the short term relationship amongst the series, an error correction model was created based on the ARDL method.

$$\Delta CA_t = \beta_0 + \beta_1 \varepsilon_{t-1} + \sum_{j=1}^{m} \beta_{2,j} \Delta CA_{t-j} + \sum_{j=0}^{n} \beta_{3,j} \Delta KA_{t-j} + \mu_t \qquad (16)$$

$$\Delta KA_t = \beta_0 + \beta_1 \varepsilon_{t-1} + \sum_{j=1}^{m} \beta_{2,j} \Delta KA_{t-j} + \sum_{j=0}^{n} \beta_{3,j} \Delta CA_{t-j} + \mu_t \qquad (17)$$

In the ARDL *(m, n)* model, which tests the short term relationship , *m* and *n* stand for the optimal lag length, and the definition of the lag length in the (13) and (14) models are used. The value of ε_{t-1} in the equation is the one-period-delayed value of error terms related to the Equation (13) , in which the long term relationship for Eq. (16) is researched. The value of ε_{t-1} is the one-period-delayed value of error terms related to the Equation (14) , in which the long term relationship for Equation (17) is researched. It is a must that the error correction coefficient (showing how much of the short term instability is corrected in the long term) is smaller than one and is negative and statistically correct.

Data Analysis

In this study, the cointegration between the quarterly data of capital flows and current account deficit in Turkey, covering the time period from 1990Q1-2011Q4 was analyzed using the unit root and ARDL (bound) tests. In this context, we attempted to predict the direction of the relationship between the current account deficit and capital flows in the Turkish domestic markets during the time period mentioned above. In order to adjust the seasonality of the variables, we used Tramo/Seats program. Data was procured from the electronic databases of Turkey Statistical Institute and Central Bank of Turkish Republic . An explanation related to data is as follows :

- ➔ CA: USD based current deficit data of three months in Turkey from 1990 to 2011.
- ➔ CF: USD based capital flows data for three months in Turkey from 1990 to 2011.

Calculation of capital flow data, financial capital, and financial accounts were all taken into consideration.

Results and Discussion

The Table 2 and Table 3 report the results of the unit root test applied to determine the order of integration among the time series data. The ADF test and DF-GLS test were used at level and first difference under assumption of constant and trend.

According to the results of the test, CA contains unit root. The results of these tests show that the CA variable is not stationary on level, but it became stationary when its first difference was taken. That is, the degree of integration of this series is *I* (1). The CF variable is stationary on level, that is, the degree of integration appears as *I* (0). However, when we draw the graph of CF, this situation is controversial. Along with a CF series, it has included a trend as the CF series generally shows a fluctuation around the zero mean. That is to say, it seems to be stationary at level. Therefore, we have dealt with the CF series to be stationary at a level (Appendix Figure 3). In this case, the vector error correction model (VECM) and co-integration tests cannot be applied in order to test if

there is a short or long term relationship amongst the series. This problem can be eliminated by using the ARDL model developed by Pesaran et al. (2001).

According to the ARDL test results depicted in the Table 6, the *F*-statistics value (0.884) is small as compared to the critical values. Therefore, the *F* value is statistically meaningless. So there is no cointegration for model 11. This result can be inferred from the Table 5. The probability value of CA, dependent variable in model 11, is statistically meaningless. Therefore, the null hypothesis, that there is a cointegration between the two variables, cannot be accepted. In other words, capital flows in Turkey between 1990 and 2011 did not really affect the current deficit in the long term.

The Table 4 and Table 7 show that there is no serial correlation in model 11 and model 12. After this, the value of

Table 2. The ADF Unit Root Test Results of CA and CF

	Level		First Difference	
Variables	**Intercept**	**Trend and Intercept**	**Intercept**	**Trend and Intercept**
CA	0.7193 (7)	-0.86935 (7)	-6.647983 (6***)	-6.9252 (6)***
CF	-3.6235 (0)***	-5.0189(0)***	-6.732355 (4)	-6.80477 (4)

Note: The asterisks ***, **, and * represent the significance level at the 1%, 5%, and 10% levels. The figures in parentheses denote the number of lags in the tests that ensure white noise residuals. The values provided in the parentheses show the delay lengths according to SIC criteria. LM statistics for Current Deficit, asymptotic critical values for intercept at 1%, 5%, and 10% significance levels are -3.487550, -2.886509, and -3.149720 ; for trend and intercept, the values are -4.039075, -3.449020, and -3.149720. For Capital Flows, the LM statistics asymptotic critical values for intercept at 1%, 5%, and 10% significance levels are -3.484198, -2.885051, and -3.149720 ; for trend and intercept , the values are -4.034356, -3.446765, and -3.149720. The critical values for the ADF test were obtained from MacKinnon (1996).

Table 3. The DF-GLS Unit Root Test Results of CA and CF

	Level		First Difference	
Variables	**Intercept**	**Trend and Intercept**	**Intercept**	**Trend and Intercept**
CA	0.668612 (7)	-0.925452 (7)	-5.690524 (6)***	-3.45638(4)***
CF	-3.515758 (0)***	-4.756333 (0)***	-6.448736 (4)	-12.835 (0)

Note: The asterisks ***, **, and * represent the significance level at the 1%, 5%, and 10% levels. The figures in parentheses denote the number of lags in the tests that ensure white noise residuals. The values provided in the parentheses show the delay lengths according to the SIC criteria. LM statistics for Current Deficit, asymptotic critical values for intercept at 1%, 5% , and 10% significance levels are -2.585050, -1.943612, and -1.614897 ; for trend and intercept, the values are -3.560800, -3.014000, and -2.724000. For Capital Flows, the LM statistics asymptotic critical values for intercept at 1%, 5%, and 10% significance levels are -2.583898, -1.943449, and -1.614997 ; for trend and intercept, the values are -3.553600, -3.007000, and -2.724000. The critical values for DF-GLS test were obtained from MacKinnon (1996).

Table 4. Defining Optimal Length for Bound Test-Model 11

m	**AIC**	$\chi^2_{(1)}$	$\chi^2_{(4)}$
1	17.6863	2.1636	24.2984***
2	17.7248	5.3644**	22.0250***
3	17.5616	4.9612**	5.8232
4	**17.4897**	0.1068	3.4222

Note: $\chi^2_{(1)}$ is the first rate and $\chi^2_{(4)}$ is the fourth rate of the Lagrange Multiplier test statistics that tests for auto correlation. The test results are shown at the ** 5%, *** 10% significance levels, which also indicates that there is auto correlation in the residual series. The length lag (where there is no serial correlation) is 4, the optimal lag is adopted as 4 according to AIC criteria. The dependent variable is CA in Model 11.

Table 5. Error Correction Model Results Based on the ARDL Approach

Variable	Coefficient	*t* - Statistics	Prob.
C	-185.1111	-0.850795	0.3983
CA(-1)	-0.338173	-1.316556	**0.1931**
SA(-1)	-0.367430	-1.328593	0.1891
DCA(-1)	-0.360065	-1.608414	0.1131
DCA(-2)	-0.365419	-1.987052	0.0516
DCA(-3)	-0.345530	-2.311047	0.0243
DCA(-4)	0.280341	2.222407	0.0301
DCF	-0.546148	-8.818054	0.1000
DCF(-1)	-0.240441	-1.089265	0.2805
DCF(-2)	-0.256051	-1.456787	0.1505
DCF(-3)	-0.242341	-1.846225	0.0699
DCF(-4)	-0.002722	-0.028521	0.9773

Table 6. ARDL Test Results - Model 11 - Dependent Variable is CA

k	F_{CA}	t_{CA}	Critical Value of *F* Statistics		
			%1	% 5	% 10
1	**0.884738**	**0.4182**	6.26	7.30	9.63

Note: *k* gives the number of independent variables in model 11, which formed the equation 11. F_{CA} is the *F* statistical value of the model (11) and t_{CA} gives the parameter of the variable of CA_{t-1}, which implies that the *t* statistics belongs to β_1. The critical values of the *F* statistics were taken from Pesaran et al. (2001) (p.300, case III).

Table 7. Defining Optimal Length for Bound Test - Model 12

m	AIC	$\chi^2_{(1)}$	$\chi^2_{(4)}$
1	18.0959	2.6525	12.2381**
2	18.1273	3.5825***	0.6860
3	**18.0957**	0.8305	2.6737
4	18.1348	1.1879	1.9853

Note: $\chi^2_{(1)}$ is the first rate and $\chi^2_{(4)}$ is the fourth rate of the Lagrange Multiplier test statistics that tests for auto correlation. The test results are shown at the ** 5%, *** 10% significance levels, which also indicates that there is auto correlation in the residual series. The length lag (where there is no serial correlation) is 3, the optimal lag is adopted as 3 according to AIC criteria. The dependent variable is CF in Model 12.

F-statistics was calculated for the ARDL bound test. According to the test results, the current account deficit of capital flows has a correct cointegrating relationship. The value of *F* -statistics is 10.6326. The *F* -statistics value, when compared to the critical values of the table, for it is more than all upper critical values, shows that there is a cointegrating relationship between current account and capital flows. In other words, the capital flows affect the current account deficit. In addition, the second hypothesis states that the value of the dependent variable is level 1. The parameter is a significant delay between the CA and CF and is supported by cointegration. This result can be observed from the Table 8. The prob-value of CF, dependent variable in model 12, is statistically meaningful. Therefore, the null hypothesis (there is a cointegration between the two variables) can be accepted.

In the models created, since only *CF= f(CA)* is meaningful for Turkey, there is a one way relationship from CA to CF. Therefore, the ARDL model will be solved for *CF= f(CA)*. In the ARDL model that is created, a maximum lag of 3 is accepted. Therefore, it can be concluded that the ARDL (1,1) model is the optimal one according to the

Table 8. Error Correction Results Based on the ARDL Approach

Variable	Coefficient	*t* - Statistic	Prob.
C	-3.884251	-0.013162	0.9895
CF(-1)	-1.248974	-4.480974	**0.0000**
CA(-1)	-1.095334	-4.080139	0.0001
DCF(-1)	0.138427	0.605932	0.5468
DCF(-2)	-0.076524	-0.438501	0.6625
DCF(-3)	-0.194372	-1.582939	0.1185
DCA	-1.048175	-10.59104	0.0000
DCA(-1)	-0.144313	-0.590636	0.5569
DCA(-2)	-0.312503	-1.595625	0.1157
DCA(-3)	-0.378237	-2.507649	0.0148

Table 9. Bound Test Results - Model 12 - Dependent Variable is CF

k	F_{CF}	T_{CF}	Critical Value of *F* Statistics	
			%1	%5%10
1	**10.63269**	**0.0001**	5.59	6.568.74

Note: *k* gives the number of independent variables in model 11, which formed the equation 11. F_{CA} is the *F* statistical value of the model (11) and t_{CA} gives the parameter of the variable of CA_{t-1}, which implies that the *t* statistics belongs to β_1. The critical values of the *F* statistics were taken from Pesaran et al. (2001) (p.300, case III).

Table 10. ARDL (1,1) Results and Period Coefficient

Variable	Coefficient	*t*-Statistics	Prob.
C	-40.67852	-0.139171	0.8897
CF(-1)	-0.018539	-0.155228	0.8771
CA	-0.935642	-9.987514	0.0000
CA(-1)	-0.015993	-0.111342	0.9117
Chi-square	**F-statistic**	**Long-Term Coefficient**	**Prob.**
262.5510	**262.5510**	0.934313	**0.0000**

Note: Chi-square, F-statistic, Long-Term Coefficient and *p*- value were found at the end of Wald test.

AIC criteria for the model that has been composed out of the Equation(12). The same can be inferred from the Table 9.

As shown in the Table 10, the long term coefficient was found to be 0.9343 according to the ARDL test results. The *t* - statistics is 262.5510, which is significant at the 1% level of significance. Therefore the relationship between current deficit and capital flows is meaningful and positive. Therefore, when the current deficit increases, the capital flows also increase. The analysis results are analogous with the current deficit depicted in Equations (1) and (3). In addition, the analysis results confirm the evaluation of Appendix Figure 2.

Implications and Conclusion

The study investigated the relationship between current deficit and capital flows in Turkey over the period from 1990-2011. In the study, as a result of the unit root tests done in order to test the stability of current account (CA) and capital account (CF) series, it was observed that the CF series is stable at level when the first difference of CA

is taken into consideration. As a result of this, an ARDL bound test was done in order to test if there is cointegration between CF and CA and cointegration was found between CA and CF. Direction of the causation between CA and CF is found to be significant. If there is unidirectional causality running from CF to CA, then a CF liberalization policy could give way to a deterioration of CA balance. On the other hand, unidirectional cointegration running from CA to CF would indicate that capital liberalization policies could be implemented with little or no adverse effect on CA deficit.

According to Table 1 and Figure 1, we wish to reiterate that Turkey's exports depend on imports. In addition to these factors, low rate-high interest idea which has been applied in Turkey since 2000 has tempted both capital flows and has also made imports more desirable. It can be said that Turkey has an economic model which creates current deficit due to its economic structure. It is not possible to find a radical solution to the current deficit in a short period. Developing countries need a long period of time to have enough technology for imports and to create alternative energy sources. So, to finance current deficit, quick and cheap ways are chosen. Capital flows are most often used to finance the current deficit as capital goes to reliable and profitable economies, and we can say that Turkey is a reliable harbour for capital flows. When an economy gets bigger with current deficit, if capital flows also keep pace with a growing economy (that is, capital flows also increase), the current deficit will cease to be a problem. Therefore, the destructive effect of current deficit depends on capital flows. It is not a problem as long as capital gets into the economy. But if there is capital outflow, this might cause serious problems.

Eventually, the increase of capital accounts together with current deficit in Turkey showed that current deficit is financed by capital flows. Together with current deficit, capital flows also showed an increase (Appendix Figure 3), especially during the years between 2010 and 2011. Although in previous years, the capital flows were enough for current deficit, in recent years, the current deficit is larger than the capital flows. In this condition, net error and deficiencies close the gap between current deficit and capital flows. So, in recent years, in addition to capital flows, net errors and deficiencies have also been used to finance the current deficit .

Limitations of the Study and Scope for Further Research

The present study examined the relationship between current deficit and capital flows in Turkey over the period from 1990-2011 only. This study may be advanced in the future by using latest econometric analysis methods. In addition, the present paper considered the case of Turkey only. Future studies can expand the present study by considering a wide sample of countries, for example, many emerging economies can be taken as a sample to examine the relationship between current deficit and capital flows in these economies.

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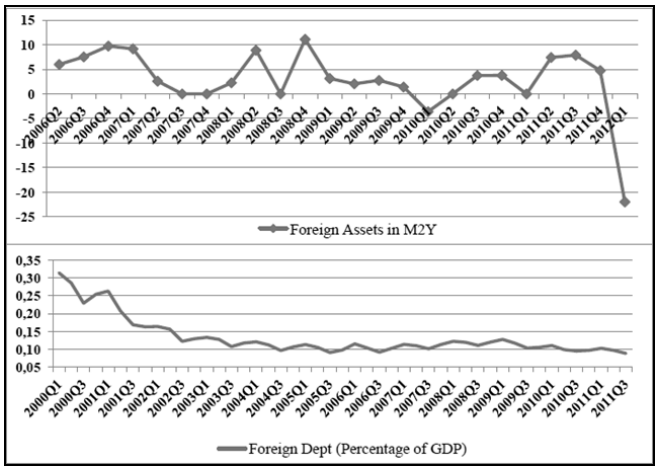
Appendices

Appendix Figure 1. Foreign Assets in M2Y and Foreign Debt (Percentage of GDP) in Turkey

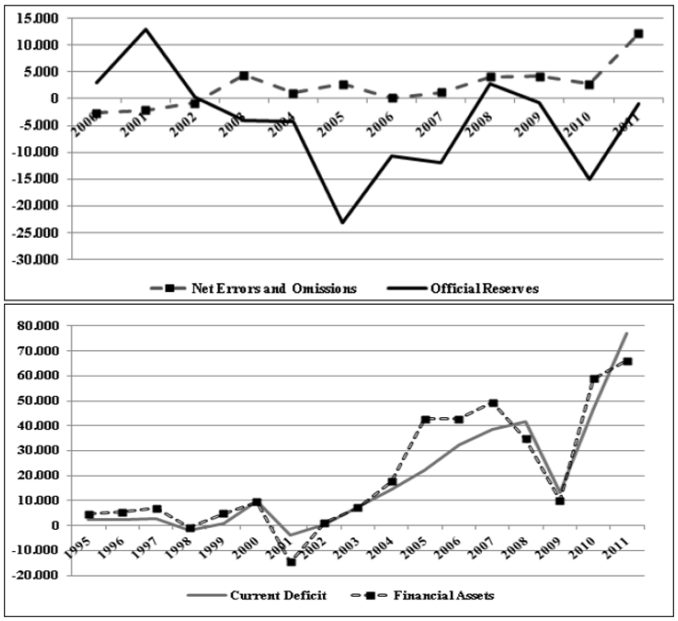


Source: Central Bank of Republic of Turkey (CBRT) data.

Note: The figure on the top shows the rate of foreign assets within M2Y between 2006 and 2011 in Turkey. M2Y consists of the sum of money in circulation, deposit accounts, demand deposits, and foreign exchange deposit accounts.

The figure below shows the rate of foreign debts due to change in GDP growth between 2000 and 2005. The below figure shows the rate of debt in terms of foreign exchange within governmental domestic debts between 2001 and 2005. All data is quarterly and shows the percentage changes.

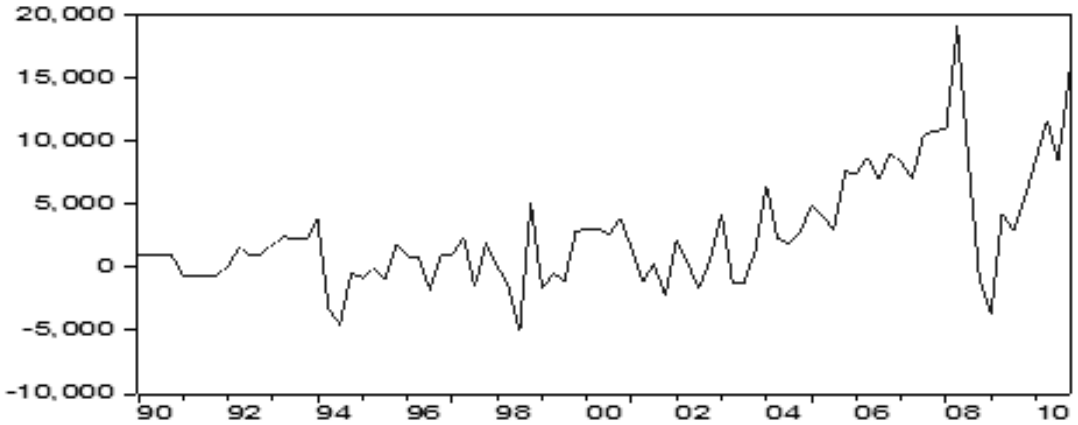
Appendix Figure 2. Current Deficit-Financial Assets and Official Reserves-Net Errors and Omissions Account in Turkey



Source: Central Bank of Republic of Turkey (CBRT) data

Note: The figure on the bottom shows the changes in the current deficit and financial assets in Turkey between 1995 and 2010. The data was evaluated annually by taking the US Dollar into account. The figure on the top shows the changes in net errors-omissions and official reserves in Turkey between 2000 and 2011.

Appendix Figure 3. Capital Flows in Turkey



Source: Central Bank of Republic of Turkey (CBRT).

Note: Data of the CF variable was evaluated annually by taking the U.S. Dollar into account between the period from 1990-2010 .