The Twin Deficits Revisited:

A Cross-Country, Empirical Approach

Ethan Fleegler
Duke University
Durham, NC
2006

Honors thesis submitted in partial fulfillment of the requirements for Graduation with Distinction in Economics in Trinity College of Duke University.

The author would like to extend a heartfelt thanks to Professor Lori Leachman for her continued guidance, support, and inspiration throughout the research process.

Abstract

The twin deficit theory postulates that sustained fiscal deficits will result in current account deficits. This claim has been widely debated in the economic literature with most research focusing on its effects in developed economies. This paper attempts to further this discussion by examining the potential impacts of fiscal deficits on current account deficits for a cross-section of economies at different stages of development. The findings suggest that there may be multiple factors contributing to an economy's susceptibility to twin deficits. Specifically, a country's susceptibility is in part influenced by where the country is in the development process, who it trades with, and what it imports and exports.

Table of Contents

Introduction

Governments often incur fiscal deficits to grow their economies and provide certain services to the population. Friedman (2000) argues that when deficits are used correctly, they are key to financing growth and reducing unemployment. However, many economists argue against the presumed benefits of deficit spending and counter that increased deficit spending can only lead to higher inflation and a misallocation of resources. Additionally, as deficits grow and governments begin financing their budgets with capital from foreign markets capital inflow increases and liabilities to foreign investors and governments increase. Consequently, political autonomy may suffer.

Recently, the United States Government has pursued a strategy of increased fiscal deficits in an effort to finance expanding government programs while providing tax cuts. The St. Louis Fed reports that the United States Government budget deficit has grown from $158 billion in 2002 to $412 billion in 2004, a 160 percent increase in just two years. The recently increased federal deficits have been defended as a means to boost the American economy. For example, a column in the *Wall Street Journal* has applauded the Bush administration's tax cuts on financial dividends attributing the recent growth experienced by the United States' economy to this initiative. The column notes that "almost from the very day in May of 2003 when those tax reductions became law, the US has experienced a robust expansion driven by investment and productivity gains" ("The Tax Cut Expansion," p. A16, 2005).

During this period, the United States has also experienced ballooning current account deficits. Freund and Warnock (2005) note that the United States current account deficit was a record $668 billion in 2004, accounting for 5.7 percent of GDP. Summers

(2004) suggests that 5 percent of GDP is a traditional "danger point" for current account deficits and that deficits that exceed this critical value face an inevitable disorderly adjustment that can push up interest rates, depress growth, and cause a large depreciation of the currency. Is it merely a coincidence that expanding US current account deficits have accompanied expanding fiscal deficits?

Economic theory is somewhat conflicted over the true effects of fiscal deficits on the economy. One branch of the economic discussion opposed to growing deficits argues that fiscal deficits may stimulate trade deficits. This relationship is known as twin deficit phenomenon. Persistent trade deficits lead to fewer jobs and may limit any potential gains from the initial expansionary policy. If empirical evidence supports twin deficit theory, then gains in economic growth and employment resulting from fiscal deficits may be viewed as largely short-lived.

Therefore, additional empirical research is needed to uncover whether this twin deficit relationship exists; and, if so, what is the nature of that relationship and for whom. Recent studies have focused on developed economies to explore twin deficits. For example, Leachman and Francis (2002) examine the experience of the United States from 1948 to 1992. They find that trade deficits and fiscal deficits are statistically correlated during the more recent subperiod of the data sample. Specifically, they find that the system comprised of imports and exports as well as that comprised of government revenues and expenditures are each multicointegrated in the period immediately following World War II. However, in the more recent subperiod (1974-1992) these long-run relationships between current account variables and fiscal variables collapse. This finding enables them to test for a relationship between fiscal deficits and trade deficits in

the post 1974 period. They conclude that "th[e] evidence provides some support for the notion that more recently fiscal deficits may have contributed to external deficits" (p. 1121). As valuable as the findings of Leachman and Francis are, they only apply to the experience of one developed economy. To examine the more universal economic problems with deficit spending, it is worth considering a broader sample of economies at different stages of development.

By analyzing countries at different development stages, this paper hopes to build on the work of Leachman and Francis. Using a data set of one developed economy, two middle-market economies, and two developing economies, the paper found a degree of statistical correlation between trade deficits and fiscal deficits for each of the countries in the sample. To analyze the data the paper uses the multicointegration approach suggested by Granger and Lee (1989, 1990) and developed in Haldrup (1998) and Engsted et al. (1997) as well as standard cointegration analysis and linear regression.

An investigation of the data provides evidence that there are multiple factors influencing the susceptibility of an economy to the twin deficits dilemma. The findings indicate that a country's development status, trading regions, and the composition of its imports and exports all may influence the persistence of fiscal and current account deficits. These results suggest that the twin deficit phenomenon may be time-specific and influenced by multiple factors.

Section II presents a review of the relevant literature on internal and external debt. It begins with a discussion of the twin deficit theory and its controversy as it applies to developed economies. It then proceeds with a discussion of the effects of deficit spending on the developing economy and the potential implications that these budget

deficits have on trade balances. Section III outlines the theoretical framework underlying the empirical findings. Section IV presents the data and empirical methodology. Section V presents the empirical results and discussion. Section VI elaborates upon future research opportunities and concludes.

Literature Review

Economic research has recently begun to question what the true impacts of deficit spending and debt are on an economy. One of the primary concerns is the sustainability of the current account and capital account positions. According to twin deficit theory, large budget deficits can have negative implications for the stability of the current account.

Presently, the economic literature remains conflicted regarding the validity of twin deficits, with researchers showing empirical evidence both in support of and against this theory. To date, these studies have dealt almost exclusively with the experience of developed economies. Consequently, there has been little research produced on twin deficit theory as it applies to developing economies. This paper attempts to fill this void by exploring the twin deficit phenomenon as it relates to a cross-section of economies at different stages of development. Because of the limited discussion of twin deficits in developing economies, it is necessary to separate the discussion of the current literature into two parts. First, the paper will address the literature with respect to the stability of current account deficits, thereby establishing the potential consequences of twin deficits. This is followed by a discussion of twin deficit theory and how it relates to developed economies. The second section is devoted to deficit spending in developing economies and the potential implications of this deficit spending on the twin deficit theory.

Sustained imbalances in the current account of many advanced and emerging economies has led to increased concern from domestic and international financial markets and policymakers. Makin (2004) notes that in deficit countries, including the United States, where current account deficits have recently reached 5 percent of GDP, there have been trends towards protectionist measures such as import restrictions and export subsidies.

Additionally, Obstfeld and Rogoff (2004) suggest additional consequences from persistent current account deficits. They note that correcting for this deficit may result in a collapse of the domestic currency which would significantly retard growth. Further, they note that in order for domestic current account deficits to close, faster growth abroad needs to be concentrated in nontradeable goods. For developed economies like the United States, this condition for foreign economies can be difficult to achieve as growth in these economies is often motivated by trade and tradeable goods production. The authors also warn that the private savings needed to close the current account deficit would result in a negative demand shock sparking a recession. Thus, a sustained current account deficit would likely lead to economic problems in the medium and long term.

There has been much debate in the economic literature regarding the validity of twin deficits. In the literature supporting twin deficit theory, researchers suggest two mechanisms through which a causal relationship exists. The Fleming – Mundell (Fleming, 1962; Mundell, 1963) model offers an exchange-rate approach to analyzing how budget and trade deficits are related. As a government borrows to finance its deficit, it drives up borrowing costs or the interest rate. A higher interest rate makes domestic securities more attractive and leads to an increased demand for the domestic currency

causing an appreciation of the domestic currency due to the capital inflows. As the currency appreciates, domestic goods seem more expensive relative to foreign goods leading citizens to increase imports; thereby increasing the trade deficit.

The exchange rate model proposed by Mundell and Fleming offers a framework reiterated by Martin Feldstein in the 1980s. Feldstein employs the exchange rate mechanism to argue that, "with a lower level of current and expected future government borrowing, real interest rates would decline and the dollar would come down with them…A lower budget deficit would thus reduce the trade deficit" (as quoted in Reynolds, 2004). Thus, the exchange rate mechanism for twin deficits has had a prominent position in government discussion regarding the relationship between budget and trade deficits.

A second voice in the economic literature in support of the twin deficit theory uses the national accounting identities to explain the twin deficit phenomenon. Ball and Mankiw (1995) show that by algebraic rearrangement of national accounting equations one can demonstrate that with a decline in national savings either investment or net exports or both must decrease. Orszag, Rubin, and Sinai (2004) recall this relationship as they note how the present current account deficit is due to decreased national savings resulting from large budget deficits. They argue that the only way to reverse the trends in the current account is to promote national savings via a more conscious effort to avoid substantial, ongoing budget deficits.

Until recently, there have been few empirical studies that have searched for twin deficit relationships. The theoretical work by Fleming and Mundell (Fleming 1962, Mundell 1963), Ball and Mankiw (1995), and Orszag, Rubin, and Sinai (2005) was

supported by the empirical findings of Leachman and Francis (2002); a study which utilized econometric analysis to search for twin deficits in the US economy from 1948 to 1992. Leachman and Francis separate this time-period into two subperiods and find that in the period from 1948-1975 revenues and expenditures as well as imports and exports were multicointegrated; ruling out a twin deficit relationship between government and trade accounts. From 1976-1992, a period of floating exchange rates that marked the end of Bretton-Woods, Leachman and Francis verify that neither of the series are cointegrated or multicointegrated. After further analysis, they find a causal relationship during this period between fiscal and trade accounts with causation running from government deficits to foreign sector deficits. The positive coefficient of cointegration produced in these empirical findings is consistent with the theoretical model proposed by Fleming and Mundell which depends on floating exchange rates in order for fiscal deficits to affect the trade deficit. While the empirical work of Leachman and Francis has important implications for the validity of the twin deficit theory, it fails to suggest a universal nature to the theory because it is limited to the experience of one country.

At the same time, many economists have questioned the findings of those who support the twin deficit theory. Specifically, these economists question the fundamental assumptions of twin deficit theorists. Eisner (1994) proposes that because national savings is composed of private (personal) and public (government) savings, a decrease in government savings reflected in budget deficits is often offset by increased private savings in a Ricardian relationship[1]. Thus, the national savings rate would be unaffected by deficit spending; a drop in government savings is offset by an increase in personal

[1] Barro (1974) proposes Ricardian Equivalence which states that citizens will save tax refunds in expectation of future tax increases due to greater quantities of public debt.

savings. Empirically, Eisner finds no effect on the private national savings rate from deficit spending during the period 1972-1991. In fact, he suggests that with an expansion of the definition of national savings, one finds a reduced national savings rate with increased taxes[2]. His findings refute the connection between taxation and national savings rates discussed above in Ball and Mankiw (1995) and Orszag, Rubin, and Sinai (2005). Eisner's findings can therefore be taken as evidence against the twin deficit theory.

Empirical data and analysis of fiscal and trade deficits has also been used to counter twin deficit theory. Reynolds (2004) observes that Japan has sustained budget deficits at a significant level of 7 percent of GDP in recent years. However, this situation has not resulted in higher interest rates, an appreciation of the currency, or a current account deficit. Further, Reynolds finds that Japan's private savings rate remained exceptionally high during periods of large budget deficits which generally is inconsistent with the assumptions made by twin deficit theorists. This study additionally argues that recent decreases in private savings amongst citizens in Japan is largely due to the "near-zero" rate of return on stocks, bonds, and bank deposits and does not have a very strong correlation with government deficits. Another interesting feature of the Japanese case is that large fiscal deficits did *not* result in high interest rates, a fundamental causality in the model proposed by Fleming and Mundell. Reynolds also finds similar trends in the developed economies of Australia and the UK. Because Reynolds looks at multiple developed economies, he perhaps gives a more complete picture of the relationship

[2] Eisner expands the definition of savings to private investment and consumption of durable goods by households as well as business, government, and university expenditures on education as opposed to the conventional definition which looks at solely business investment in plants and equipment.

between budget deficits and trade deficits than Leachman and Francis. However, his research is still narrowly focused on developed economies.

The current research into the twin deficit phenomenon is limited in scope to developed economies. It therefore becomes an interesting question to examine the phenomenon – budget deficits vis-à-vis trade deficits – in developing economies. When it comes to developing economies, there is a gap in the literature with respect to the effects of budget deficits on trade. However, there is some work concentrating on fiscal deficits and debt and their impacts on the economy.

Developing Economies and Fiscal Deficits

Patillo, Poirson, and Ricci (2004) argue that low deficit levels are essential in order for developing countries to finance infrastructure development and education. However, high deficits and the debt that results can create significant problems for a developing economy. Specifically, these authors point to the reactions of global investors to increasing levels of debt. As a developing country's debt reaches around 35-40 percent of GDP, foreign investors worry about default and/or inflation which results from the government printing money to pay back debt. As investors exit the country's assets, the currency depreciates. While Patillo, Poirson, and Ricci find such results, they do not take the next step in their analysis which is to trace out the potential effects on trade.

Baumol and Blinder (2006) state that as a country's currency depreciates the demand for its exported goods and services will necessarily go up as rational agents will demand more goods at reduced prices. A propensity towards deficits and debt in a developing nation will lead to a decreased willingness to hold that country's assets which induces currency devaluation as noted in Patillo, Poirson, and Ricci leading to a

reduction in a country's trade deficit as the world demands the exports of a country with a devalued currency. Interestingly, if the developing economy has a fixed exchange rate, exit by global investors from the country's assets will lead to a real appreciation in the currency. Thus, the impact of large levels of government debt on the trade deficit in developing economies may be intimately linked to the nature of the exchange rate regime.

Hunt and Rebucci (2003) find that compared to developing countries, investors have a reduced perception of risk in US assets because of the strength of the economy and the fact that the United States has never defaulted on debt. Consequently, developed economies can potentially sustain higher debt levels because of exogenous factors influencing investors' willingness to hold assets. Because investors are still willing to hold the assets of developed economies with heightened levels of debt, the currency depreciation proposed in Patillo, Poirson, and Ricci does not occur and there is no positive shock to exports. These observations suggest that the twin deficit phenomenon may be more pronounced in developed economies.

Theoretical Framework

In order to examine the theoretical framework underlying the twin deficit phenomenon this paper develops a model of government and external budget constraints derived from simple accounting identities. First, the paper will look at a government's budget constraint where revenues are generated from taxes and issuance of debt. Following this analysis, the paper inspects the impact of capital raised in the international markets through international borrowing via the capital account.

The Fiscal Budget Constraint

Fiscal or budget deficits occur when government spends more than it receives in revenues from taxation. They are calculated by subtracting the dollar-amount of national government expenditure from the dollar-amount of tax receipts. Funding for these current deficits are typically generated through the issuance of debt.[3] The government budget constraint is expressed as:

$$G_t + (1 + i)*Bd_{t-1} = R_t + Bd_t \qquad (1)$$

Where G_t = government spending on goods and services as well as transfers, i = the sovereign interest rate, Bd_t = government bonds of one period maturity and R = total government revenues received from taxes. Rearranging equation (1) yields:

$$(G_t + i*Bd_{t-1}) - R_t = Bd_t - Bd_{t-1} = \Delta Bd \qquad (1')$$

This equation illustrates the fact that whenever government expenditure on goods, services, transfers, and debt servicing exceed current period revenues there is a positive change in government debt.

Bohn (1995) develops policies for a sustainable government budget. He finds that government debt must be backed by future surpluses negating a Ponzi scheme whereby a government continually issues new debt to pay off previous debt holders.[4] In addition to this restriction on sustained deficits, Bohn finds that systematic deficits require governments to offer higher rates of interest on debt. These higher rates are necessary to attract lenders and keep others in the market as the debt level rises and perception of risk increases. Eventually, in such a scenario interest rates on the debt will exceed growth rates in the GDP. When this occurs the real burden of debt becomes problematic

[3] Although a government could also print money and inflate away the debt.
[4] See Bohn 1995 for proofs

(Leachman, Bester, Rosas, and Lange, 2005) as the real gains from growth are being diverted to paying off debt instead of providing services to the population.

One policy response to avoid this problem is for the government to actively pursue budget surpluses either by increasing taxes or reducing expenditures. From equation (1′), the paper can infer that the level of debt decreases when such a policy is implemented. Given a world of globally integrated capital markets, in the short-term government has a third option, that of borrowing in the international market.

Raising Capital in International Markets

A country's balance of payments (BP) measures the flow of money into and out of the economy by tracing the current account (CA) and capital account (KA). The long-run equilibrium of the balance of payments can be expressed as:

$$BP_t = CA_t + KA_t = 0 \qquad (2)$$

Where:

$CA_t = EX_t - M_t$ net exports

$KA_t = A_{F\,t} - A_{Dt}$

Where:

A_{Ft} is domestic assets held by foreigners.

A_{Dt} is foreign assets held by domestic citizens.

From (2) we can rearrange the equation so that:

$$-CA_t = KA_t \quad \text{or} \quad M_t - EX_t = KA_t \qquad (2')$$

The capital account (KA) is a measure of the flow of money into and out of its economy as citizens seek investment opportunities abroad and/or foreigners seek

investment opportunities within the home country. The capital account can also be expressed in the following equation:

$$KA_t = (I_{Pt} - S_{Pt}) + DF_t \qquad (3)$$

Where I_p represents private investment and S_p represents private savings. Additionally, the factor DF_t equals $G_t - R_t$ or government deficits.

Since domestic, private savings provide capital for private investment, if private investment exceeds domestic savings the capital must come from abroad (driving up KA as money flows into the country). Under a regime where government allows foreign capital to finance deficits, a rise in government borrowing needs will lead to an increasing KA in order to satisfy equation (3). This observation is crucial to twin deficit theory as it has key implications for the balance on trade.

From (2′) it is true that if KA is rising, imports necessarily must be exceeding exports. Combining the results of equations (2′) and (3) results in a theoretical mechanism supporting the existence of twin deficits. Increased budget deficits and government borrowing increase KA [from (3)]. As KA increases, imports exceed exports driving a trade deficit [from (2′)]. Thus, twin deficit theory suggests that there should be a correlation between budget and trade deficits.

Yet, there exists the potential for ambiguity within this mechanism. Examination of equation (2) shows that if private investment remains constant, the capital account increases when the private savings rate, S_p, remains constant or declines during periods of government borrowing. However, there is debate in the economic community whether national savings declines during periods of budget deficits. The ambiguity lies in whether private savings (citizens' savings) compensates for the decline in government

savings. Ricardian equivalence theory suggests that this compensation will occur. The theory states that citizens will save tax refunds in anticipation of paying larger taxes in the future to retire large debts. If the assumption that private savings declines or stays constant breaks down, KA may not increase during periods of government deficits by the mechanism stated in (2). If this is the case, there will be no corresponding increase in imports suggested in (3) and twin deficits will not be realized. However, empirical research has found that private savings rates do *not* tend to increase during periods of declining public savings.

Leachman (1996) finds that Ricardian equivalence does not hold due to a short-sighted population. Rubin, Orszag, and Sinai (2004) argue that private savings decline markedly during deficit periods. Their claims are supported by statistics regarding the American saving rate in the past few years. Todorova (2005) notes that, as of September 2005, the average American saves 0.1 percent of his or her disposable income[5] which is significantly less than the recommended 10 percent. This low savings rate has occurred during a period of sustained budget deficits of the US Government.

As noted earlier, Reynolds (2004) empirically finds that Japanese savings rates declined during the recent period of large government deficits. He *does* argue that this decline is largely attributable to a lack of savings opportunities with significant returns which decreased incentives to save. Although this is an exogenous factor, the model suggested in this paper remains robust because as long as private savings decline or remain the same during periods of government borrowing, the model suggests that a trade deficit will exist.

[5] The author received her data from the Commerce Department's Bureau of Economic Analysis

Data

The data employed in this study are national accounts data received from the World Bank (WDI) and the International Monetary Fund (IMF). They are annual observations that have been expressed as percentages of GDP in order to control for price level increases and the size of the economy. The countries analyzed fall into three categories, the developed economy of the United States, the middle-market economies of South Korea and Mexico, and the developing economies of Peru and Costa Rica[6].

The United States is classified as a developed economy because it is a member of the G8 and in 2004 recorded a per capita GDP of $39,195.[7] South Korea is labeled as a middle market because it recorded a per capita GDP in 2004 of $12,743 and has risen to prominence as one of the Asian tigers. While Mexico's GDP per capita in 2004 was only $5,968 its recent inclusion in the OECD as well as its prominence in North American trade justifies its placement in the middle-market category. Peru and Costa Rica represent developing economies in Latin America. They recorded GDP per capita of $2,207 and $4,534 in 2004, respectively.

The World Bank defines exports (imports) to be the value of all goods and other market services provided (received from) the rest of the world. The values include merchandise, freight, insurance, transport, travel, royalties, license fees, other services such as communication, construction, financial, information, business, personal, and government services.

[6] United States' data spans the 1970-2004 period; Mexico's data includes the years from 1981-2004; South Korea's data spans the 1970-2000 period; Costa Rica's sample is 1970-2002; Peru's data sample is 1979-2004.
[7] All GDP amounts given are in constant $US (2000 = base year).

The International Monetary Fund defines government revenues as being comprised of all nonrepayable government receipts, whether requited or unrequited, other than grants. Revenue is shown net of refunds and other adjustment transactions. It defines government consumption as being comprised of all nonrepayable payments by government, whether requited or unrequited and whether for current or capital purposes.

Empirical Analysis

In order to test for a long-run equilibrium relationship between fiscal and trade accounts, this paper will perform a multi-step, multicointegration analysis similar to those performed by Bohn (1998) and Leachman and Francis (2002). Leachman, Bester, Rosas, and Lange (2005) note that some countries pursue appropriate policy response mechanisms to counteract large imbalances in trade or fiscal accounts. For example, a country that has run large budget deficits and accumulated a sizeable stock of debt will then reduce government expenditures and raise revenues to rid itself of deficits and reduce the accumulated debt. Such policy mechanisms in either the trade or fiscal account would rule out a twin deficit relationship. Empirically the presence of such mechanisms can be tested with multicointegration analysis. Therefore, this paper must first rule out multicointegrating relationships in the fiscal and trade accounts of each country before it can test for twin deficits.

Standardization and Tests for Non-Stationarity

Inherent in the assumptions of standard regression analysis is the condition that the variables being tested are stationary. This condition is referred to as integration of order zero, or I(0). However, many macroeconomic time series variables are not stationary, instead they trend up or down over time. Trending implies that the data are

non-stationary, a condition known as integration of order one, or I(1). If a series is non-stationary, standard regression analysis produces biased standard errors of coefficient estimates. In such a situation, cointegration tests must be used to analyze if a statistical correlation between the system of variables exists. Cointegration testing assesses the long-run relationship between the variables comprising the system.

To test whether the data series are not stationary -- and therefore (multi)cointegration analysis is appropriate -- a Dickey-Fuller (DF) test on each data series is executed. The DF test is a statistical regression of a variable at time t on its value at time (t-1). If the DF test rejects stationarity (multi)cointegration analysis is warranted.

A multicointegrating relationship suggests a strong, long-run equilibrium relationship. If a system of variables is multicointegrated then it is bound together by two forces which move the variables toward their shared equilibrium path (as opposed to the single binding force present in the cointegrated systems). These two forces capture both a flow relationship and a stock-flow relationship which drive the system of variables toward the long-run equilibrium.

Testing for multicointegration and cointegration

In order to test for (multi)cointegration this paper will use an incremental approach. Initially, the most restrictive assumption of multicointegration is tested for. If the paper rejects multicointegration it will proceed to testing for a cointegrating relationship. If the paper rejects (multi)cointegration it is then in a position to assess the presence of a twin deficit relationship. To execute multicointegration testing the paper employs the procedure developed in Engstead, Gonzalo, and Haldrup (1997). Using this methodology, the paper first estimates the following regression:

$$\widetilde{M}_t = \beta_0 + \beta_1 * \widetilde{X} + \beta_2 * \hat{X}_t + trend_t + \varepsilon_t \qquad (4)$$

Where:

$\widetilde{M}_t = \sum_{i=1}^{t} \hat{M}i$, which is the incremental sum of imports over time and ~ I(2)

$\widetilde{X}_t = \sum_{i=1}^{t} \hat{X}i$, which is the incremental sum of exports over time and ~ I(2)

$\hat{X}_t$ = Exports for a given year and ~ I(1)

trend = a linear instrumental variable used to limit the coefficients' exposure to statistical inconsistency caused by omitted variable bias.

The paper then performs a DF test on the residual of the equation, ε_t to test for stationarity. However, if the critical tests statistics differ from the standard DF critical values that are drawn from the work of Haldrup (1998) the two series are said to share a multicointegrating relationship. If such a relationship is verified it automatically implies a particular form of cointegration. Thus, if a series is shown to have a multicointegrating relationship, tests for cointegration are unnecessary. Moreover, twin deficit tests are unnecessary as both internal and external deficits are "self" correcting.

In a stochastic environment, there are no a priori restrictions placed on the magnitude of β_1 or β_2, they can be greater than, equal to, or less than one. If β_1 is less than one it implies that the stock of exports tends to exceed the stock of imports and trade surpluses persist. If it equals one, then on average the current account is in balance. Finally, if this coefficient is more than one than the stock of imports exceeds that of exports and trade deficits are present. The optimal magnitude of β_2 is a function of the findings with regard to β_1. It captures the long-run relationship between the flow of exports (revenues) and the stock of debt.

If the paper rejects multicointegration, it then tests for cointegration between the two variables. The paper tests for a cointegration relationship by estimating a regression of imports (consumption) on exports (revenues):

$$\hat{M}_t = \beta_0 + \beta_1 * \hat{X}_t + \varepsilon_t \qquad (5)$$

Again, the residual, ε_t, is tested for stationarity using a DF test. Here critical values are draw from the work of Engsted, Gonzalo, and Haldrup (1997). Acceptance of stationarity of ε_t implies cointegration is present between the system of variables.

After multicointegration and cointegration tests are executed on both the fiscal variables and the trade variables the next step is to explore the interaction between these two accounts.

Testing for cointegration between fiscal accounts and trade accounts

To test for twin deficit relationships, the paper performs the following regression:

$$\hat{CA}_t = \beta_0 + \beta_1 * \hat{DF}_t + \varepsilon_t \qquad (6)$$

Where $\hat{CA}_t$ = the current account deficit in a given year and $\hat{DF}_t$ is the fiscal deficit in a given year.

Dickey-Fuller tests are then carried out on the residual, ε_t. If the null hypothesis is rejected, the residual series is stationary and the current account and fiscal account share a cointegrating relationship. Such a relationship would support the existence of twin deficits as a long-run equilibrium relationship.

Results and Interpretation

The paper first analyzes graphs of the data to look for trends within the series of interest. Graphs 1A-1C represent the series of interest for the US. Graph 1A exhibits upward trending in the import and export series of the United States. Additionally, this

graph also suggests a close relationship between imports and exports as the two series move in similar directions over time. Graph 1C indicates downward trending in both the current account and fiscal account. There is also a similar trending pattern between the balance of the fiscal and current account over the time period. Graphs 2A-2C present the corresponding data for Mexico. The import and export series trend upward over the time period as seen in Graph 2A. These series also trend together over the time period. Graph 2B exhibits a downward trend in the government consumption. There is no significant trending in the current or fiscal account series. However, Graph 2C indicates the presence of convergence in the balance of the fiscal and current accounts starting in 1994 and continuing through 2004. The South Korean series are represented in Graphs 3A-3C. They indicate upward trending in every South Korean series except government consumption which appears stationary. Additionally, these graphs indicate that the import and export series as well as the government consumption and revenue series all trend in the same direction. It is also interesting to note that South Korea is the only country in the sample that runs consistent budget surpluses over the time period as can be seen in Graph 3B. Graphs 4A-4C depict Costa Rica's data. Costa Rica exhibits upward trending in its import and export series as well as its current account series. Moreover, in each graph the pair of series trend in similar patterns over time. Finally, Graphs 5A-5C present the relevant data series of Peru. Graph 5A and Graph 5C indicate an upward trend in Peru's export series as well as its current account series, respectively. Peru's government consumption and revenues series trend together as can be seen in Graph 5B.

To conduct the tests regarding the long run relationships between the variables of interest it is necessary to first assess whether each series is stationary. As noted above,

this is accomplished with Dickey Fuller (DF) tests to determine whether the series are stationary. In Table 1 the results of these tests are presented. All of the series of interest belonging to the United States, Mexico, and South Korea are not stationary implying that they are I(1). However, the test statistics from the DF test of Peru's import series and government consumption and revenues series as well as Costa Rica's government consumption series confirm that these series are stationary.

Additionally, tests for stationarity were performed on the current account and fiscal deficits (surpluses) of the countries in this study. Costa Rica and Peru both exhibit stationarity of their fiscal deficit series.

Next, where appropriate, the paper proceeds to testing for multicointegration between our systems to fiscal variables and current account variables. Results of this exercise are reported in Tables 2A and 3A. The one-equation test for multicointegration specified by equation (4) yields no test-statistics that exceeded their Engsted, et. al. (1997) critical values. Therefore, this study concludes that no multicointegrating relationships are present between the two systems of variables in any of the countries examined. Having rejected multicointegration for each system of variables, the paper proceeds to test for a cointegrating relationship between the fiscal and current account systems. Results of cointegration tests are presented in tables 2B and 3B. Cointegration is rejected for all systems of variables except Costa Rica's current account. Focusing on the Costa Rican results in Table 2B, one can see that over the sample period Costa Rica's exports have been approximately 58 percent of their imports. Thus while this system is cointegrated, persistent trade deficits have still been the norm.

Table 4A presents the tests for long-run equilibrium relationships between fiscal and current account deficits while Table 4B presents the results from simple regression analysis on the system of twin deficit variables. The data support a long-run relationship between the fiscal and the current account for the United States. This relationship is also apparent graphically, with the two accounts sharing similar trends over time. The coefficient on the fiscal deficit regressor for the US is -0.178 which indicates that for every 1 percent increase in the fiscal deficit (as a percentage of GDP) there is a corresponding 0.178 percent decrease in the current account deficit. This result is counterintuitive given that the twin deficit theory posits a direct relationship between fiscal and trade deficits. So what are likely explanations for the results presented here?

Graphically, 1975-77 and 1988-2000 reflect two time periods during which the balance of the US current account is dramatically opposite the balance of the fiscal. Thus, it is highly likely that these two periods exert a profound influence on the data. Recession in the United States during the mid-1970s (Darby, 1982, 738) led to lower incomes which decreased government tax revenues and stemmed imports. Lower tax revenues meant higher budget deficits but falling imports resulted in trade surpluses. The large budget surpluses accompanied by significant trade deficits in the 1990s likely reflects a more recent trend in America's propensity to import. Mann (1999) notes that the American income elasticity for imported goods and services surged to 2.36 in the latter half of the 1990s, compared to 1.00 from 1973-1987. Thus, while incomes were growing during the economic boom of the decade – leading to increased tax revenues and eventual budget surplus – Americans had an increased appetite for imported goods and services which fueled a growing trade deficit. Moreover, Ben Bernanke's (2005) analysis

of a "global savings glut" provides yet another rationale for these results. As pools of savings rise abroad, foreigners' appetite for relatively safe US assets increase irrespective of the level of real return on those assets. As these savings chase US assets, they motivate an increase in the capital account which, in turn, causes a current account deficit by (2′). Therefore, even in a period of fiscal surplus and low interest rates in the United States, there still may be a current account deficit driven by high savings levels abroad.

Not unlike the US results, the data from Mexico indicate a long-run equilibrium relationship between budget deficits and trade deficits. From the twin deficit regression, Mexico also exhibits a negative coefficient of cointegration. Its estimated value is -0.619. This implies that for every 1 percent increase in fiscal deficits (as a percent of GDP), the current account deficit declines by 0.619 percent of GDP. Here again, this finding is counterintuitive and may be explained by circumstances that are historically unique. The Mexican experience is dominated by a period from 1980-1990 where trade surpluses persisted while the fiscal account was in deficit. This period likely accounts for the negative relationship between these two accounts. It can be explained in large measure by oil-driven export revenue and limited fiscal responsibility. Fiscal reforms and a more diversified trade sector led to the later convergence of balances in these accounts that can be seen in the second half of Graph 2C.

South Korea also exhibits a long-run, causal relationship between the balance of the fiscal account and that of the trade account. However, unlike the first two countries, South Korea has experienced fiscal surpluses over most of the sample period and improving current account balances as it moves towards the present. The coefficient of cointegration for the twin relationship is 1.853. It indicates that for every 1 percent

increase in the fiscal deficit (surplus) there is a corresponding 1.853 percent increase in the current account deficit (surplus). This direct relationship is consistent with twin deficit theory. The magnitude of the coefficient indicates a strong sensitivity of the current account to the balance of the fiscal account. Moreover, it is interesting to note that only in the system where surpluses are the norm does the paper find a statistical relationship that is wholly consistent with traditional interpretations of the twin deficit relationship.

Turning to the last two countries, Costa Rica and Peru, the paper finds that the fiscal deficit series is stationary for both countries. Therefore, simple regression is performed on Costa Rica's and Peru's current and fiscal account systems. Costa Rica's current account deficit series is I(1) while its fiscal deficit series is I(0) (as seen in Table 1). Therefore, in order to perform regression analysis, the paper adjusts the current account series by finding the difference in the current account between two consecutive periods. This first differencing operation transforms the series from I(1) to I(0). Regressed on its fiscal deficit, this adjusted series yields a coefficient of 0.955 on the fiscal deficit variable. It is significant indicating that a 1 percent increase in the fiscal deficit is associated with a 0.96 percent positive change in the trade deficit. While the relationship under simple regression cannot be interpreted as a truly causal relationship without further testing, the positive coefficient on the fiscal deficit supports a positive correlation between fiscal and current account deficits. Moreover, the simple regression captures 16 percent of the variability in the current account as indicated by the $\overline{R}^2$.

Like Costa Rica, Peru's fiscal deficit series is I(0) and its current account deficit series is I(1). Again, first differencing is performed on the current account series to allow

for regression analysis. Results produce a regression coefficient of 0.686 which was significant at the 10 percent level. The positive coefficient supports the presence of a positive correlation between fiscal and current account deficits but, here again, this relationship is weaker than that which is found in (multi)cointegration analysis in that it reflects the short-run correlation between the variables as opposed to a long-run equilibrium relationship.

It is interesting to note that certain patterns emerge from the analysis of the data. First, the United States and Mexico both exhibit an inverse relationship between the balance of the fiscal account and that of the current account. This result contradicts the conventional twin deficit theory derived from the Mundell-Fleming model (Fleming 1962, Mundell 1963). Perhaps this finding, in part, can be attributed to the strong trading relationship that these two economies share. Williamson (2002) notes that the United States continues to be the leading importer of Mexican goods, accounting for 84 percent of Mexico's exports. Graphs 1C and 2C show that in the mid 1990s, Mexico ran a significant current account surplus while the United States had a large current account deficit. During this same period, the balance of Mexico's fiscal account worsened while that of the United States dramatically improved. Moreover, these two countries are two of the more developed economies in the sample. Thus, the results could suggest that in developed economies the nature of the twin deficit phenomenon may be undergoing major changes. When we fold the South Korean results into the analysis, initially the array of findings appears even more confounding. However, as was noted earlier, South Korea has experienced fiscal surpluses and an improving trade balance over much of the

sample. Taken as a whole, these results could suggest that the nature of the twin deficit relationship varies according to whether the countries are persistent debtors or creditors.

The fact that both of the developing economies, Peru and Costa Rica, demonstrate stationary fiscal deficits also has interesting implications. Patillo, Poirson, and Ricci (2004) note that international investors are wary of investing in developing economies with large fiscal deficits due to fear of default. Costa Rica and Peru's stationary fiscal deficits indicate that they may be aware of the dangers of running larger and larger deficits. These results suggest that developing economies may be taking active measures to impose responsibility in the fiscal sector and avoid the issues discussed in the Patillo, Poirson, and Ricci piece. This trend of fiscal deficit stationarity limits the paper's ability to find a long-run equilibrium relationship between the balance of the fiscal and current accounts within these developing economies. However, the simple regressions on these accounts found statistically significant coefficients that do indicate a correlation between these two accounts. Additionally, the respective $\overline{R}^2$ statistics indicate that a significant amount of the variation in current account changes in Costa Rica and Peru is accounted for by variation in their fiscal accounts. While no causal link can be established through the regressions, correlation confirms a relationship between the accounts and suggests the importance of viewing potential policy aimed at one account for its effects on the other.

Conclusion and Suggestions for Further Research

These results suggest that there are multiple factors influencing a country's susceptibility to the twin deficits. For middle-market and developed economies the data indicate that there does exist a long-run, equilibrium relationship between the balance of fiscal and current accounts. However, the presence of a direct relationship between these

accounts is more ambiguous. The composition of imports and exports, the influence of trading partners, and the country's status as a net debtor or creditor seem to influence whether there exists a direct relationship between the balance of the current account and fiscal account. The results for the developing economies were less varied. Although the findings were not consistent with a causative mechanism, there was a significant positive correlation in both economies between the balances of the current and fiscal accounts. These findings indicate that an economy's susceptibility to the twin deficits may be time-specific and influenced by a variety of factors.

Ultimately, the twin deficit dilemma poses interesting policy challenges that warrant continued study. Future research may choose to include more countries for its data set as well as a longer time period to analyze. Moreover, to address the impact of development status on an economy's susceptibility to the twin deficits, analysis could focus on one country as it transitioned through different stages of development. Continued research and commentary into the twin deficits will help increase awareness of the issue and potentially result in the adoption of new policy measures with universal applications.

Reference List

Ball Laurence and N. Gregory Mankiw (1995). What do Budget Deficits Do? *National Bureau of Economic Research Working Paper Series*. Paper prepared for the Federal Reserve Bank of Kansas City Symposium on Budget Deficits and Debt, in Jackson Hole, Wyoming, on August 31-September 2, 1995.

Barro, Robert J. (1974). Are Government Bonds Net Wealth? *Journal of Political Economy,* 82, pp. 1095-1117.

Baumol, William J. and Alan S. Blinder (2006). *Economics: Principles and Policy*. ed. 10. Mason, OH: Thomson Higher Education.

Bernanke, Benjamin (2005). As referenced in The Great Thrift Shift. *The Economist*, 376, 8445, pp. 3-10.

Bohn, Henning (1995). The Sustainability of Budget Deficits in a Stochastic Economy. *Journal of Money Credit and Banking*, 27, 257-71.

Bohn, Henning (1998). Risk Sharing in a Stochastic Overlapping Generations Model. University of California, Santa Barbara.

Darby, Michael (1982). The Price of Oil and World Inflation and Recession. *The American Economic Review*, 72, 4, 738-751.

Engle, Robert and Byung Yoo (1991). Cointegration of Economic Time Series: A Survey with New Results. *Long Run Economic Relations: Readings in Cointegration*. Oxford: Oxford University Press, pp. 237-66.

Engle, Robert and Clive Granger (1987). Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica*, 55, 1987, 251-271.

Engsted, Tom, Jesus Gonzalo, and Niels Haldrup (1997). Testing for Multicointegration. Economic Letters, 56, 259-66.

Eisner, Robert (1994). National Saving and Budget Deficits. *The Review of Economics and Statistics*, 76 (1), 181-186.

Fleming, Marcus J (1962). Domestic Financial Policies Under Fixed and Floating Exchange Rates. *IMF Staff Papers* 9, 369-379.

Friedman, Benjamin M (2000). What Have we Learned from the Reagan Deficits and Their Disappearance? *National Bureau of Economic Research Working Paper Series*.

Freund, Caroline and Frank Warnock (2005). Current Account Deficits in Industrial Countries: The Bigger They Are, the Harder They Fall? *National Bureau of Economic Research Working Paper Series.*

Granger, Clive and Tae-Hwy Lee (1990). Multicointegration, in Advances in Econometrics: Cointegration, Spurious Regression and Unit Roots. G.F. Rhodes Jr. and T.B. Fromby (eds) Ct.: JAI Press, Greenwich, pp. 71-84.

Haldrup, Niels (1998). An Econometric Analysis of I(2) variables. Journal of Econometric Surveys, 12, 595-650.

Hunt, Benjamin and Alessandro Rebucci (2003). The US Dollar and the Trade Deficit: What Accounts for the Late 1990s? *IMF Working Paper*.

Leachman, Lori L (1996). New Evidence on the Ricardian Equivalence Theorem: A Multicointegration Approach. *Journal of Applied Economics*, 28, 695-704.

Leachman, Lori, Alan Bester, Guillermo Rosas, and Peter Lange (2005). Multicointegration and Sustainability of Fiscal Practices. *Journal of Economic Inquiry*, 43 (2), 454-466.

Leachman, Lori and Bill Francis (2002). Twin deficits: Apparition or reality? *Journal of Applied Economics*, 34 (9), 1121-1133. Retrieved August 31, 2005, from http://infotrac.galegroup.com/itw/infomark

Makin, Anthony (2004). The Current Account, Fiscal Policy, and Medium-Run Income Determination. *Contemporary Economic Policy*, 22 (3), 309-316.

Mann, Catherine (1999). Is the US Trade Deficit Sustainable? *Institute for International Economics*.

Mundell, Robert A. (1963). Capital Mobility and Stabilization Policy Under Fixed and Flexible Exchange Rates. *Canadian Journal of Economics and Political Science* 29, 475-85.

Obstfeld, Maurice and Kenneth Rogoff. The Unsustainable Current Account Position Revisited. *National Bureau of Economic Research*.

Orszag, Peter R., Robert E. Rubin, and Allen Sinai (2004). Sustained Budget Deficits: Longer-Run US Economic Performance and the Risk of Financial and Fiscal Disarray. Paper presented at the AEA-NAEFA Joint Session, Allied Social Science Associations Annual Meeting, Sunday, January 4, 2004.

Patillo, Catherine, Hélène Poirson, and Luca Ricci (2004). What are the Channels Through Which External Debt Affects Growth? *IMF Working Paper*.

Reynolds, Alan (2004). The 'Conventional' Hypothesis: Deficit Estimates, Savings Rates, Twin Deficits and Yield Curves. *Publications of the US Treasury Department*. Paper presented at the Treasury's Roundtable on the Federal Budget, Taxes, and Economic Growth, February 12, 2004.

Summers, Lawrence H. (2004). The US Current Account Deficit and the Global Economy. The Per Jacobsson Lecture Series. Given Sunday, October 3, 2004. Washington, DC.

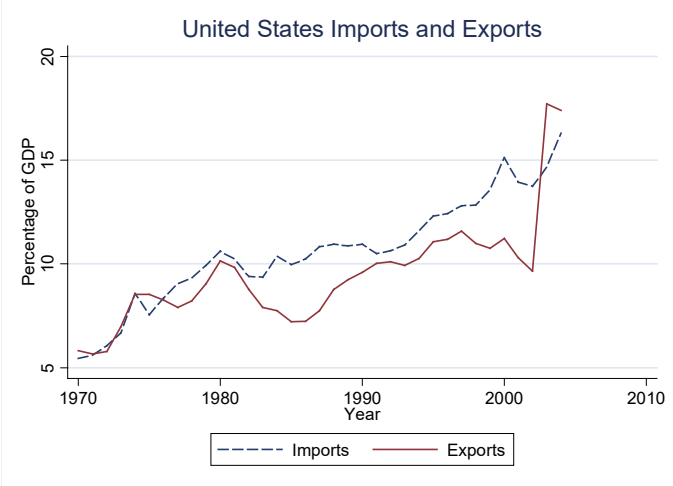
The Tax Cut Expansion (2005). *The Wall Street Journal*, p A16.

Todorova, Aleksandra. Cards That Help you Save (2005). *The Wall Street Journal Online*. Retrieved on Oct 28 2005 from online.wsj.com/article_print/SB113001277505676810

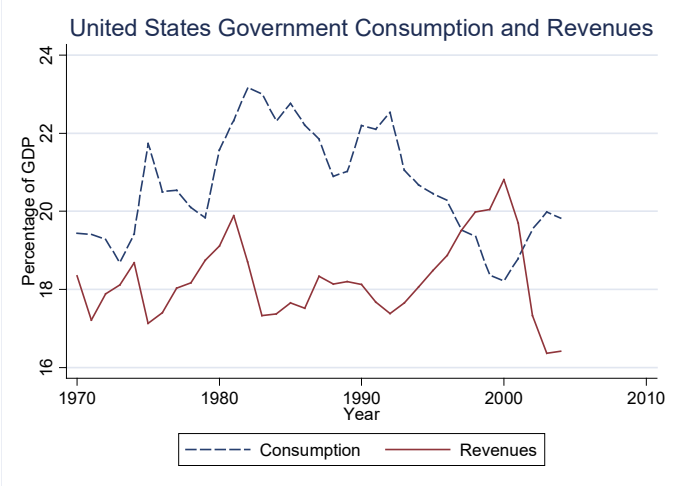
Williamson, Jeffrey (2002). Winners and Losers Over Two Centuries of Globalization. *National Bureau of Economic Research*. Paper delivered as the 2002 *WIDER* annual lecture, Copenhagen (September 5, 2005).

Graphs

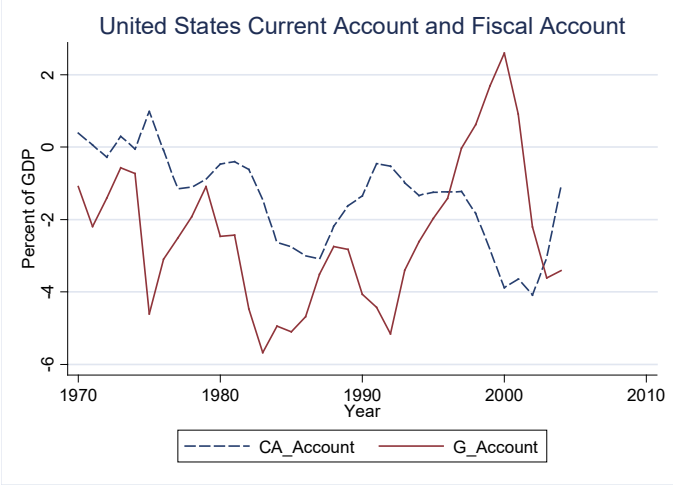
Graph 1A



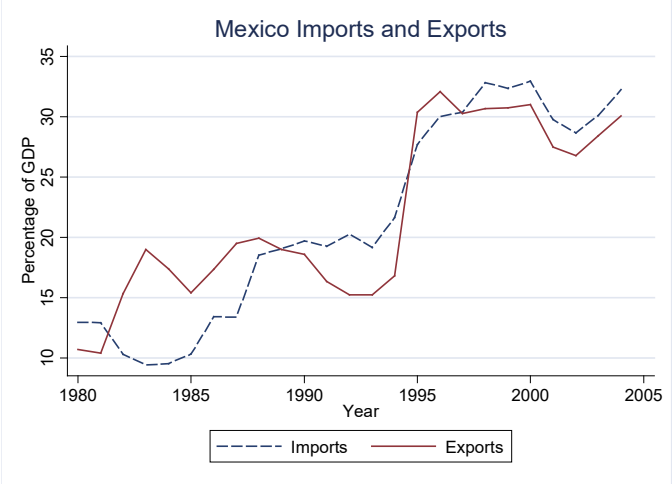
Graph 1B



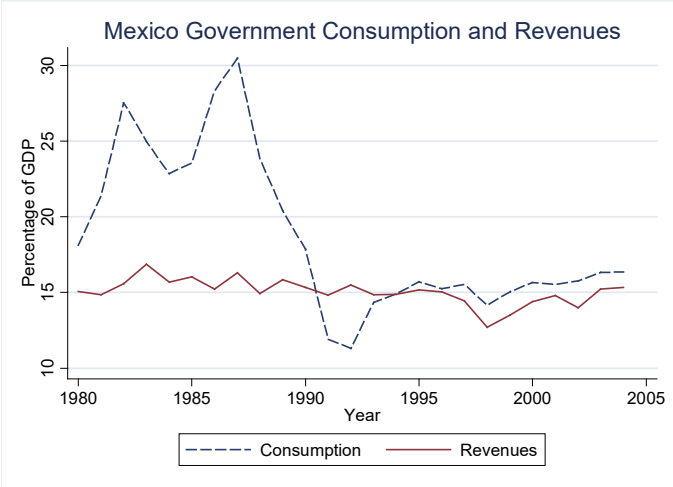
Graph 1C



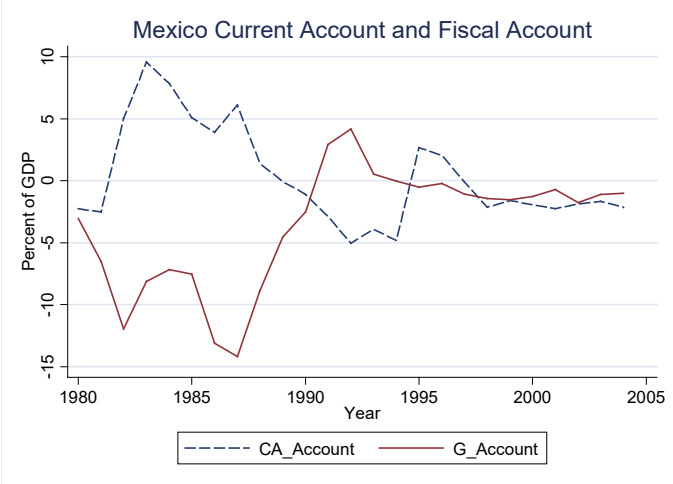
Graph 2A



Graph 2B

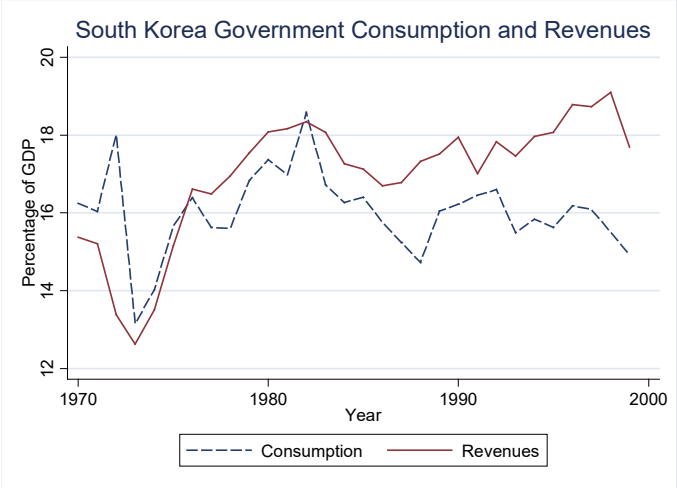


Graph 2C

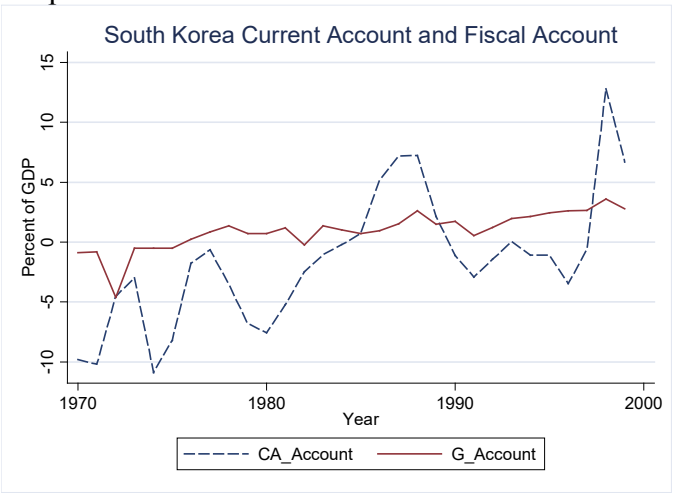


Graph 3A

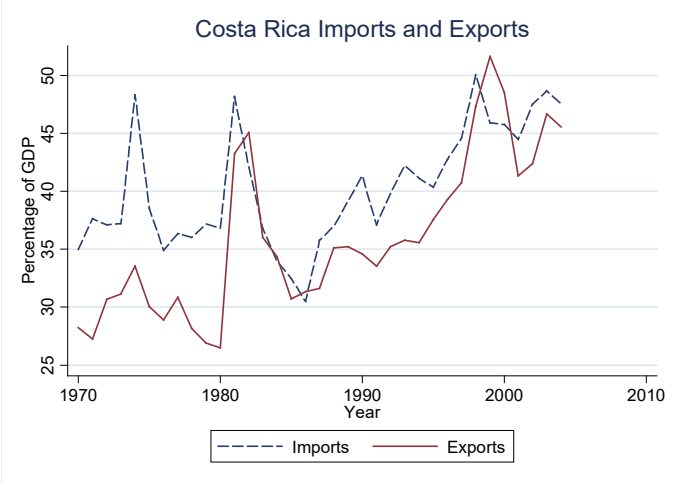
Graph 3B



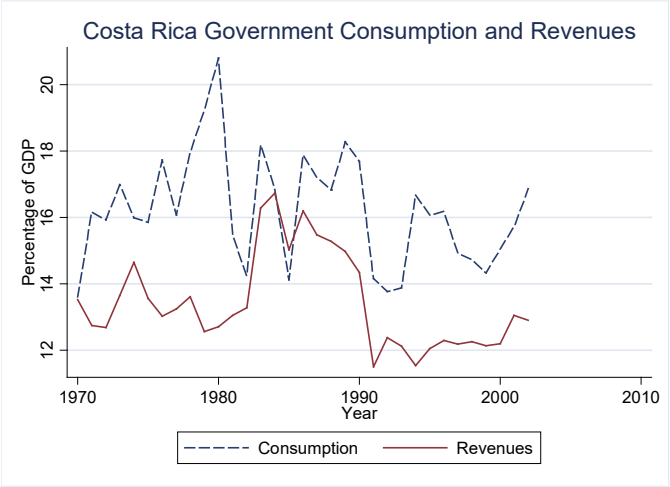
Graph 3C



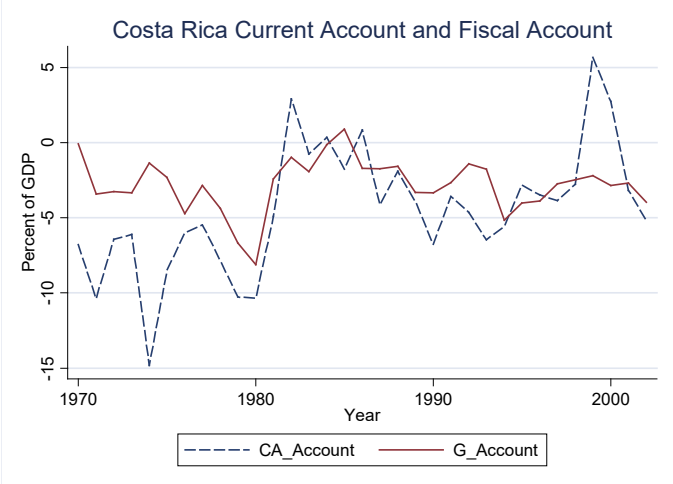
Graph 4A



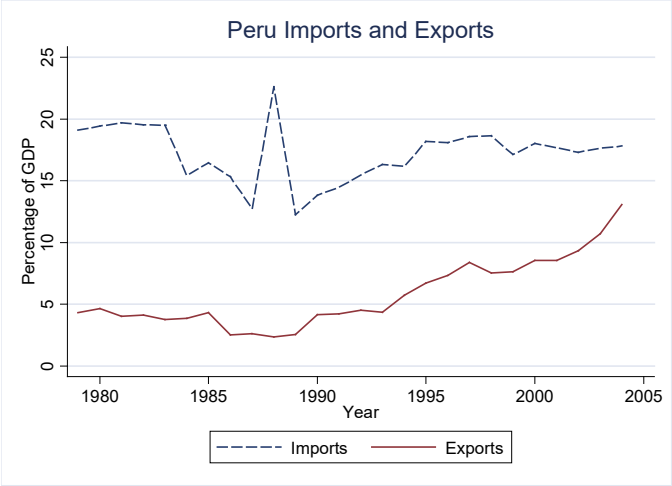
Graph 4B



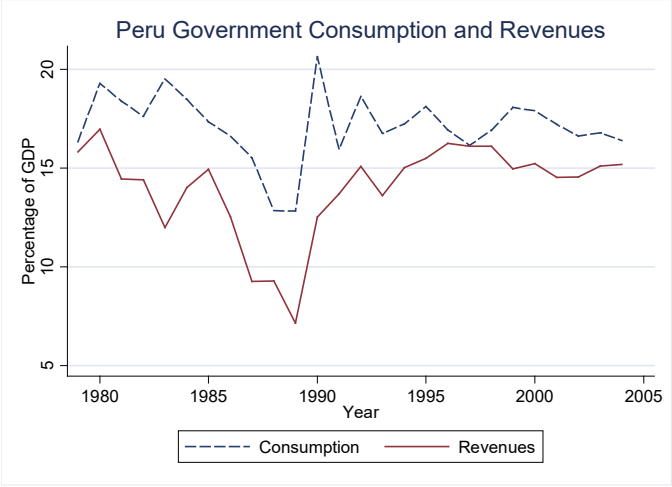
Graph 4C



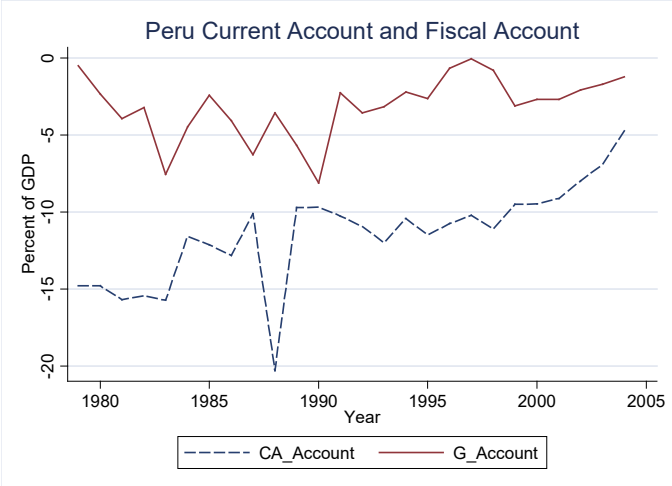
Graph 5A



Graph 5B



Graph 5C



Tables

Table 1: Dickey-Fuller Tests[1]

	Imports	Exports	Government Revenues	Government Consumption	CA Deficit	Fiscal Deficit
United States (n = 35)	-0.509	-0.599	-1.938	-1.728	-2.919	-1.950
Mexico (n = 25)	-0.342	-1.409	-2.636	-1.303	-1.828	-1.377
South Korea (n = 35)	-2.627	-2.689	-0.487	-0.376	-2.560	-2.729
Costa Rica (n = 36)	-2.455	-1.756	-1.993	-4.118	-2.912	-3.441
Peru (n = 26)	-4.399	1.844	-2.033	-4.082	-2.569	-3.153

Notes:
1. Mackinnon critical values α = .05, -2.974 n = 35
-2.978 n = 30
-3.000 n = 25

Table 2A: Multicointegration Tests of the Current Account

	Sum of Exports	Exports	Trend	Constant	Dickey-Fuller of Residuals[1]
United States	1.340	-1.107	-1.526	2.768	-1.895
Mexico	1.337	-0.235	-7.347	1.561	-1.365
South Korea	0.137	0.699	27.187	-19.896	-1.458
Costa Rica	0.528	0.695	20.234	-9.512	-1.673
Peru[2]	---	---	---	---	---

Notes:
1. DF critical values α = 0.05 and α = 0.10 are -4.42 and -4.08 from Engsted et al. (1997)
2. Since Peru's import series was shown to be stationary in the first set of DF tests, we do not test for multicointegration.

Table 2B: Cointegration Tests of the Current Account

	Exports	Constant	Dickey-Fuller of Residuals[1]
United States	0.841	2.663	-2.801
Mexico	1.052	-1.425	-1.989
South Korea	.368	20.388	-2.602
Costa Rica	0.577	19.41	-3.501
Peru	---	---	---

Notes:
1. DF critical values α = 0.05 and α = 0.10 are -3.29 and -2.90 from Engle and Yoo (1991).

Table 3A: Multicointegration Tests of the Fiscal Account

	Sum of Revenues	Revenues	Trend	Constant	Dickey-Fuller of Residuals[1]
United States	-1.527	0.712	49.021	-22.583	-1.578
Mexico	5.907	1.411	-70.528	-12.514	-1.824
South Korea	0.716	0.841	3.674	-3.256	-3.215
Costa Rica[2]	---	---	---	---	---
Peru[3]	---	---	---	---	---

Notes:
1. DF critical values $\alpha = 0.05$ and $\alpha = 0.10$ are -4.42 and -4.08 from Engsted *et al.* (1997).
2. Since Costa Rica's government consumption series was shown to be stationary in the first set of DF tests, we do not test for (multi)cointegration of the fiscal account.
3. Since Peru's government consumption series was shown to be stationary in the first set of DF tests, we do not test for (multi)cointegration of the fiscal account.

Table 3B: Cointegration Tests of the Fiscal Account

	Revenues	Constant	Dickey-Fuller Of Residuals
United States	-0.482	29.452	-1.523
Mexico	3.551	-34.777	-2.103
South Korea	0.895	0.747	-2.774
Costa Rica	---	---	---
Peru	---	---	---

Notes:
1. DF critical values $\alpha = 0.05$ and $\alpha = 0.10$ are -3.29 and -2.90 from Engle and Yoo (1991).

Twin Deficit Statistics

Table 4A: Cointegration Test of Deficit Accounts

	Fiscal Deficit	Constant	Dickey-Fuller of Residuals[1]
United States	-0.178	-1.590	-2.962
Mexico	-0.619	1.961	-2.977
South Korea	1.853	2.600	-3.016

Notes:
1. DF critical values $\alpha = 0.05$ and $\alpha = 0.10$ are -3.29 and -2.90 from Engle and Yoo (1991).

Table 4B: Simple Regression Test of Deficit Account

	Fiscal Deficit	**Constant**	$\bar{R}^2$
Costa Rica[1]	0.955	5.013	0.160
Peru[1]	0.686	8.739	0.094

Notes:

1. This was a regression performed on the change in the current account deficit from one period to the next on the fiscal account. Since the current account was an I(1) series (see table 1), using the change variable creates an I(0) series which allows for simple regression.