ASEAN+3 Monetary and Financial Integration: What we need for a new framework?

Reza Moosavi Mohseni
“ASEAN+3” Monetary and Financial Integration: What we need for a new Framework?

A Post-Doctoral Research Project

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Introduction:

Before 1997, few people would have seriously advocated monetary cooperation in East Asia especially the “ASEAN”1 Countries. But the financial crisis 1997-1998 in East Asia provided costly lessons for the East Asian Countries in the importance of regional cooperation (Huang and Guo; 2006). The crisis fundamentally changed East Asia’s perspective on economic integration and be the cause of a great political interest in monetary and financial cooperation in the region. The crisis revealed the financial fragility of the region and highlighted the need for a regional financial architecture. Since the crisis, there has been a proliferation of proposal for fostering ASEAN monetary and financial integration.

In November 1999, leaders of the ASEAN+32 agree to create the establishment of currency swaps and repurchase agreements as a credit line against future financial shocks. In May 2000, the finance minister of the ASEAN+3 agreed through the “Chiang Mai Initiative” to plan for closer monetary and financial cooperation (Kwack; 2005). In November 2002, it was proposed at the ASEAN Heads of Government meeting in Phnom Penh that the region should consider the possibility of creating an “ASEAN Economy Community” (AEC) by 2020, a timeframe that was later shorter to 2015. In May 2005, ASEAN+3 Members have agreed to expand their network of bilateral currency swaps into “multilateralization”, which could eventually create a “de facto Asian Monetary Fund”. Another key issue has been taken up is forging the Asian Bond Market Initiative (ABMI) by ensuring that Asia collects more of its own saving for channeling into local investment instead of relying on borrowing from outside the region (Huang and Guo; 2006). Therefore, these steps are now widely envisioned to provide a significant basis for regional monetary integration with the possible formation of a single common currency.

Economic analysts argued that the ASEAN+3 countries can be the reasonable candidates for an optimum currency area. It seems if these countries follow the specific agenda they can satisfy major conditions and criteria for forming a single currency bloc.

The objectives of this project are in the following aspects. First we formulate a vector autoregressive (VAR) model to evaluate the underlying shocks (domestic, regional and global) for ASEAN+3 countries to make an assessment for the feasibility of creating an optimum currency area. According to Mundell (1961) and McKinnon (1963) -that are two seminal works on optimum currency area- the intensive for two economies to peg their

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1. Association of South East Asian Nations. It contains: Indonesia, Malaysia, Singapore, Thailand, the Philippine, Brunei, Vietnam, Laos, Cambodia, and Myanmar.
2. Contain ASEAN countries + China, Japan, and South Korea.
bilateral exchange rate rise with the bilateral intensity of trade, flexibility of factor markets and symmetry of underlying shocks. However, it is generally accepted that the correlation of shocks is the criterion in a country’s decision to join a currency union (Huang and Guo, 2006). Mundell (1961) argued that countries facing positively correlated economic shocks (symmetric) will be better for making a currency union, because they would allow the use of the same policies to adjust any imbalances. Second we want to find the currency bloc which is more suitable for ASEAN+3 countries. Finally this project will suggest a framework that the ASEAN+3 countries need to follow to extend the economic integration among them and make a monetary cooperation lead to a single common currency.

The reminder of the project organized as follows. Section 2 describes the background of the subject. Section 3 analyses the econometric method that we want to employ in this project. Next section details the specification of our VAR model. Section 5 shows our empirical findings. And finally, summary and conclusion remarks end this project.
**Academic Background:**

However, John Stuart Mill knew the idea of choosing peculiar currency with all independent countries as a barbarian reflection and said:

“So much of barbarism, however, still remains in the transactions of most civilized nations, that almost all independent countries choose to assert their nationality by having, to their own inconvenience and that of their neighbors, a peculiar currency of their own” (quoted in Mundel, 2005; P.466).

Or, Cesarano (2005) and Dellas and Tavlas (2009) have believed that the Mundell’s theory of optimum currency area is the other trying to advocate the Friedman’s flexible exchange rate by the early 1950s, but as Bayoumi and Echengreen (1997) stated, serious work on this subject started by semantic paper of Mundell (1961) and continued by two brilliant papers by Mckinnon (1963) and Kenen (1969).

Mundell (1961) argued that the optimum currency area (OCA) is a region not the world. He proposed three criteria in his seminal paper for OCA:

1. Factor mobility.
2. Price flexibility.
3. Symmetry of underlying shocks

The elimination of borders among countries would not mean an OCA established. A single currency area needs a single central bank and regional monetary and fiscal policies.

McKinnon (1963) developed the idea of openness of the economy as a new criterion that should be added to the Mundell’s criteria. He argued if a shock changes the relative tradable non-tradable price, the exchange rate will be changed, and then the general price level that includes both tradable and non-tradable prices will be fluctuated more in the relatively open economy, so the openness affecting the economic policies. He believed this idea should be modified the OCA can affect external prices.

Kenen (1969) proposed diversification to the theory of OCA. He argued in the presence of factor mobility among countries, the countries with similar structures of production are more suitable candidate to establish an OCA. It seems in the well-diversified economies, sector-specified shocks affect them symmetrically.

Grubel (1970) described and extended the nature of optimum currency areas. He clarified the institutional change in OCA and analyzed the relationships between welfare and forming an OCA. He argued that these areas need a supra-nation agency to conduct monetary
and fiscal policies for the region. He found that forming an OCA can improve the welfare of the resident within these territories above the level of enjoyment when each of these countries has a separate currency.

After these seminal papers that made a framework for the theory of OCA, the theory changed as a serious and debatable academic subject. In this part we want to describe some of important articles that have been written in this area of study.

Lane (1996) employed a two-country economic union model to analyze the stability of monetary policy in such union. In this model wages are assumed to be determined prior to the realization of demand shocks. Wages are set equal to the expected money supply. He found that in the case of asymmetric shocks the currency union is not desirable, and under McKinnon’s rule the monetary authority does not do anything when the shocks are asymmetric. It means that the monetary authority never use the active policy if they care equally about all the members against the demand shocks.

Bayoumi and Eichengreen (1997) developed a procedure to find the relationship between OCA and the volatility of nominal exchange rate. They argued that nominal interest rate can provide a better and of course easier benchmark for comparison. He found that economic integration make the countries of the region ready to increase their bilateral trade and accept the monetary integration.

Frankel and Rose (1998) employed a cross-country covariance of output to found the impact of integration (reducing the barriers) on business cycles. They argued that because the effect of integration on business cycle is ambiguous, we should resolve it empirically. There finding showed that “countries with closer trade links have tightly correlated business cycle”. On one hand, countries with “symmetric cycle” are more suitable to make an OCA. On the other hand, Countries with “idiosyncratic cycles” give up an important tool for stabilization if they join in an OCA. They argued that however, European data shows that some of these countries can be poor candidate for entry to OCA, but due to highly correlated business cycles shaping OCA in Europe can be acceptable.

Buiter (2000) analyzed if it is better for the UK to be a monetary union or join EMU. Generally he wanted to answer to this question that what determines a nation optimal currency regime. Buiter started with Microeconomic benefit of OCA. He argued that in the micro level at least three technical important arguments should be analyzed when we want to answer to the above question. The first one is the transaction cost, second is the seigniorage, and the last is the financial stability. In the macro level, Buiter argued that the most important role of monetary union is the ability of a nation to conduct its stabilization policy. He found
that the UK is too open and small to be an OCA. For the UK the foreign exchange market is the source of shocks and instability. He concluded that the case of immediate membership of the UK in the EMU is overwhelming.

Bayoumi, Eichengreen and Mauro (2000) analyze the ASEAN+3 countries to form an OCA. They employed the methodology of Bayoumi and Eichengreen (1994) and after analyzing and comparing the ASEAN+3 countries with EMU, they argued that however these countries are less suitable to form an OCA but they are not significantly in worse position than the EU before the Maastricht Treaty. They believed that the most important condition to shape an OCA is political rather than economical, thus commitment of each countries can have the important role for this attempt.

Alesina and Barro (2001) analyzed the benefits and costs of currency board, dollarization and currency union and extended the classic theory of OCA. They argued that the transaction costs and macroeconomic stabilization are two important benefits and loss of seigniorage and the dependent of client’s monetary policy to the anchor’s central bank are two important costs of currency board, dollarization and currency union. They found that between the most important anchors (dollar, euro and yen) yen does not look an acceptable anchor. With the exception of Indonesia all other East Asian Countries, central and South America are in the dollar’s block. On the other hand Africa and Eastern Europe are potential clients of the euro.

Karras and Stokes (2001) employed a time inconsistent model³ to find the benefit of being a member of a monetary union. They tried to answer to this question that what would be the optimal timing for forming such a union and when should another country candidate to join? They found that the first best candidates for EMU are France, Germany, Austria, Belgium and the Netherland. The opposite conclusion can be seen for the UK, Ireland, Sweden and Greece. Finally Karras and Stokes concluded that EU and euro membership instead of being economic decision are political processes.

Frankel and Rose (2002) employed the well known gravity model to find the impacts of common currencies on trade and income. They used the data of over 200 countries and dependencies. Their model is based on Mankew, Romer, and Weil (1992). They found that currency union has a large impact in creating trade. On the other hand, countries belonging to this union are more open than the other countries. This indicates that the currency union should include important trade partners, because the magnitude of this effect is depend on the

³ For more details about time inconsistency models see Moosavi (2010).
countries in the union. They also found that openness has a linear positive and significant effect on income per capita.

Rose and Engle (2002) employed an international trade gravity model to analyze different features of OCA and compare it with countries by sovereign monies. Their model is based on Rose (2000). They found that more trade, the lower volatility of real exchange rate and more synchronized business cycles between members of currency union than countries with sovereign monies are the experience that we can see in this comparison. They also find that even dollarized countries more likely to satisfy the criteria for OCA but currency union much more increases the degree of integration.

Chow and Kim (2003) investigated the feasibility of an OCA in East Asian Countries by employed a three-variable VAR model with global ($\Delta y_t^g$), regional ($\Delta y_t^r$) and local ($\Delta y_t^d$) outputs. They assumed that regional ($\Delta y_t^r$) and local ($\Delta y_t^d$) shocks do not have any long run effects on global output and local shock does not have any affects on regional output. On the other hand, local countries are small in the region and region is small on the global economy.

Chow and Kim model is as follows:

\[
\begin{bmatrix}
\Delta y_t^g \\
\Delta y_t^r \\
\Delta y_t^d
\end{bmatrix} =
\begin{bmatrix}
A_{11}(L) & A_{12}(L) & A_{13}(L) \\
A_{21}(L) & A_{22}(L) & A_{23}(L) \\
A_{31}(L) & A_{32}(L) & A_{33}(L)
\end{bmatrix}
\begin{bmatrix}
u_t^g \\
u_t^r \\
u_t^d
\end{bmatrix}
\]

Where $A_{ij}(L) = a_{ij}^0 + a_{ij}^1L + a_{ij}^2L + ...$

The results showed that based on the OCA indicators, it is costly for East Asian Countries to form a common currency union.

Zhang, Sato and McAleer (2004) employed a three-variable structural VAR model to test the symmetry of structural shock in East Asian Countries. They focus on this criterion to analyze the feasibility of forming OCA in the above countries. They found that the estimation results do not show that East Asian Region has viability to form an OCA.

Zorzi and De Santis (2004) in a theoretical analysis implemented a version of time-consistency model to find the relationship between transmission mechanism across members of currency unions and the real exchange rate. Their model is based on two equations. The first one is the standard quadratic loss function, and the second equation is the aggregate supply side of the economy. They assumed that the real exchange rate is an exogenous variable. They found that if the transmission mechanism would be different across the members of currency unions, real exchange rate shocks affect the region’s inflation rate, output and welfare, and these impacts have larger cyclical effect on smaller countries.
Khamfula and Huizinga (2004) employed a Generalized Auto-Regressive Conditional Heteroscedasticity (GARCH) Model to investigate whether a monetary union is viable among the Southern African Development Community (SADAC). They found that there is a strong asymmetry of real exchange rate shocks among most of the SADAC countries. On the other hand they found that the volatility of real exchange rate of SADAC members is more in the long run than short run. Thus, they summarized that based on the above criterion the SADAC countries cannot form a monetary union.

Robert Mundell (2005) described the idea of the world currency. He advocated a global currency that he called it INTRO. He proposed a three stage plan as follows:

1. Transition to stable exchange rate.
2. The G-3 monetary union (conducted by European Central Bank, Federal Reserve, and Bank of Japan) based on the DEY (Dollar, Euro, and Yen).
3. Creating of the INTRO.

Mundell finished his speech by Paul Volcker suggestion: “a global economy needs a global currency”.

Lim (2005) used three different methods to test the viability of OCA in East Asian region. Co-movement of prices, test for converging currency trend, and co-integration analysis are these methods. The result of the first method indicated that except Indonesia all other East Asian countries have co-movement with both dollar and yen. In other word, both dollar and yen can be suitable anchor for these countries. He also found from the currency converging test that at least the currency of five countries namely Hong Kong, Indonesia, Malaysia, the Philippine and Thailand move at a constant rate from the yen. Co-integration method showed that apart from Hong Kong none of the East Asian countries had a long run relationship by yen.

Buigut and Valev (2005) employed a simple two-variable VAR model assessed the suitability of the East African Countries (EAC) to forming a monetary union. At first they found that due to high trade link with euro zone, pegging a common EAC currency to the euro can be beneficial. The results of the VAR analysis indicated that the shocks among EAC are asymmetric. This means EAC countries are the poor candidates to forming an OCA.

Karras (2005) examined costs and benefits of membership of Asia-Pacific economies in a yen bloc monetary union. Theoretical framework of his paper is based on Clarida et al. (1993). This framework is a new Keynesian monetary model with a loss function for monetary authority and Expected-Augmented Phillips curve. He found that the cost of membership in yen block can be shown by increasing in the volatility of output. The size of
this cost depends on the correlation between Japan’s cyclical output and cyclical output of the member. The benefit of adapting yen block can be shown by lower and more stable average inflation in the member’s economy. Adapting yen also can eliminate the variability of the exchange rate. He summarized that this criterion (cost-benefit analysis) shows different gain and loss across these countries.

Bystrom, Olofsdotter and Soderstrom (2005) analyzed the feasibility of Chinese different regions to form an optimum currency area. They employed different indices such as economic size, degree of openness, product variation, and regional inflation. They found that based on these indices, it is difficult to have a clear cut conclusion. Some of these indices support the viability of China to form an OCA. When the region includes Hong Kong and Macao then the overall correlation among the region would be weakened and this supported that these two sub-regions are different from the rest of China. Finally they suggested that it is possible to have two different sub-grouping of regions to form an OCA. The first is Hong Kong, Macao, Beijing, and Xiang and second sub-group is all other regions.

Huang and Guo (2006) employed a four-variable structural VAR model to make an assessment of the viability of creating an OCA in East Asia. There results showed that the 1997 financial crisis may help ASEAN countries to improve the correlation of supply shocks in the region. The findings also support that Japan has a leading role in the capital markets in East Asia. There founding confirmed Bayuomi and Eichengreen (1994) that argued whole of this region does not have enough readiness to form an OCA. They proposed that at first Korea, Hong Kong, Indonesia, Malaysia, Singapore and Thailand create a currency union.

Sahin (2006) used a genetic algorithm to determine the possibility and likelihood of creating an optimal currency union for MENA countries. He described that there are two different approaches for analyzing the OCA: the traditional approach that is based on the indices that proposed by Mundell (1961), McKinnon (1963), and Kenen (1969). The second approach is benefit-cost approach. In this approach we should evaluate cost and benefit of joining an OCA. He used the second approach and concluded that the MENA region should consider forming an OCA both to decrease imbalances in macroeconomic and to make a new economic power in the world.

Zhang, Sato and McAleer (2008) focused on the shocking aspect (only internal shocks) of monetary union. They wanted to analyze the feasibility of “Grater China” (Chinese trio: Taiwan, Hong Kong, and Mainland China) to move toward a currency union. They employed a three-variable VAR model including real effective exchange rate (demand shock), money supply (monetary shock), and real output (supply shock). Results showed that
increasing the symmetry of shock among Great China makes it possible that the Chinese trio
to create a currency union.

Zhao and Kim (2009) used a three variable structural VAR to modeling the national
outputs determined by three different shocks to find if CFA franc zone is an OCA. They
employed the model that developed by chow and Kim (2003) in which the domestic output
affected by global, regional and domestic shocks. They use the regional shocks as a
suitability key indicator of a country to join in an OCA. The results showed that among the
members of the CFA franc zone there is a little convergence in the economic structure. It
means that creating an OCA is costly in this zone.

Lee and Azali (2010) employed a system of Generalized Method of Moments (GMM)
approach to test the endogeneity of OCA criteria in East Asia. The results showed that
increased in trade among the region can lead to more synchronized business cycle. They also
found that there is a scope for “ASEAN-5 plus 3” to form a monetary union.
### Selected Studies: Monetary Integration and Optimum Currency Area

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<th>Main Findings</th>
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<tr>
<td>Lee and Azali (2010)</td>
<td>East Asia (ASEAN-5 plus 3) Data: 1970-2006</td>
<td>GMM- Panel Analysis</td>
<td>Bilateral business cycle, bilateral trade intensity, financial integration</td>
<td>The estimate indicate that: Increased trade increases the business cycle synchronization in the region. More similar the countries’ economic structure the more correlated the business cycle. Increase financial integration leads to lower business cycle correlations. There exists scope for East Asia to form a monetary union.</td>
</tr>
<tr>
<td>Zhang, Sato and McAleer (2008)</td>
<td>Greater China (China, Hong Kong and Taiwan) Quarterly Data 1980:4-2004:4</td>
<td>3-variable VAR Impulse response Variance decomposition</td>
<td>Monetary Shock (M2), Supply Shock (Real GDP) and Demand Shock (Real Exchange Rate)</td>
<td>The empirical result suggest that, it is feasible for the Grate China to move toward a currency union.</td>
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<tr>
<td>Huang and Guo (2006)</td>
<td>East Asia (ASEAN-5 plus 3)</td>
<td>4-variable VAR Impulse-response Variance decomposition</td>
<td>World Real GDP, Domestic Real GDP, Real Exchange Rate and Domestic Price Level</td>
<td>The result show that it is not ideal to create a currency union in the whole region presently. Currency union in East Asia can only be Effective if the response functions of the real exchange rate will be similar.</td>
</tr>
<tr>
<td>Hasan Sahin (2006)</td>
<td>MENA Countries Annual Data: 1970-1999</td>
<td>Cost-Benefit Approach and Generic Algorithm</td>
<td>Inflation Rate, Degree of Openness, Real Exchange rate</td>
<td>The paper conclude that countries which are in the MENA region should consider to form a currency union both to decrease any macroeconomic imbalances and to bring their individual power together to be a new economic power.</td>
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<tr>
<td>Bystrom, Olofsdotter and Soderstrom (2005)</td>
<td>China’s Provinces plus Hong Kong and Taiwan 2001</td>
<td>Cross sectional Correlation</td>
<td>Degree of product variation, Economic Size, Degree of openness, Similarity in production and inflation rate, covariance in output growth, external trade, regional budget</td>
<td>The result indicate that the arguments in favor of China constituting an optimum currency area, in 2001, are stronger than those against.</td>
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<td>Sung Y. Kwack (2005)</td>
<td>East Asia Annual Data 1975-2001</td>
<td>Frankel and Wei (1994)</td>
<td>Rate of variation of currency</td>
<td>The lack of political commitment in East Asia constitutes the strongest factor against forming common currency area. At present such an area is a very distant prospect. A quasi-monetary unions beneficial as well as attainable.</td>
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<tr>
<td>Karras (2005)</td>
<td>18 Asian and Pacific Countries Annual Data 1960-2001</td>
<td>Cost-Benefit Analysis, HP Filter and Band-Pass filter</td>
<td>Real GDP and Nominal Exchange Rate</td>
<td>The result show that because of the correlation between cost and benefit of adapting the yen, the net benefit are difficult to compute and compare, so the economic criteria may not be a good predictor of actual participation in a yen-based monetary union.</td>
</tr>
<tr>
<td>Buigut and Valev (2005)</td>
<td>East African Monetary Union Annual Data 1970-2001</td>
<td>2-variable VAR Impulse-response Variance decomposition</td>
<td>Log of real output and price level</td>
<td>The correlation results indicate that contemporaneous shocks among the EA countries are mostly asymmetric, so the currency union at the moment do not support, but the results indicate that more integration may improve the symmetry of shocks.</td>
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<tr>
<td>Zorzi and Santis (2004)</td>
<td>-</td>
<td>Alessina and Barro (2002)</td>
<td>Inflation, Output, Expected inflation</td>
<td>There is an interaction between differences in transmission mechanisms across countries and real exchange rate shocks. When the transmission mechanisms are different, the currency union’s aggregate inflation, output and welfare are affected by sectoral shocks in productivity. In the absence of domestic correlation factors, the impact is larger in smaller countries.</td>
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<tr>
<td>Khamfula and Huizinga (2004)</td>
<td>SADC Annual Data: 1980-1996</td>
<td>GARCH</td>
<td>Real exchange rate, differences in growth rate of M1 between two countries, differences in interest rate between two countries</td>
<td>The result shows that SADC countries as a whole should not start a monetary union, at least not in the near future, since the countries are simply too different to form an optimum currency union.</td>
</tr>
<tr>
<td>Zhang, Sato and McAleer (2004)</td>
<td>East Asia (ASEAN + 3) Quarterly Data 1983:1-2000:3</td>
<td>3-variable VAR Variance Decomposition and Impulse Response</td>
<td>Real GDP, CPI and Real exchange rate</td>
<td>The findings show that the exchange rate of the East Asian Countries are relatively stable. But, the empirical results do not display strong support for forming an optimum currency region. They do imply that some sub-regions are better candidates for currency arrangements.</td>
</tr>
<tr>
<td>Chow and Kim (2003)</td>
<td>East Asia (E9 Countries) Quarterly Data 1971:1-1997:1</td>
<td>3-variable VAR</td>
<td>Global shock (US output), Regional shock (Japan output), Local shock (Local output)</td>
<td>The findings show that a common currency peg would be more costly in E9 countries than in the EMU countries.</td>
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### Selected Studies:

**Monetary Integration and Optimum Currency Area**

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- The currency union boosts a country’s total trade.  
- The currency union has a positive effect on income  
- The currency union has a positive significant effect on output. |
| Alesina and Barro (2002) | Theoretical Work | A Model of Currency Union | Output, Labor, Intermediate input, Price of final and intermediate goods, consumption | Common currencies affect trading costs, and the amount of trade, output and consumption. The adoption of another country’s currency, trades-off the benefits of commitment to price stability against the loss of an independent monetary policy. |
| Alesina and Barro (2001) | All World Countries (Dollar area, Euro Area and Yen Area) | | Alesina and Barro (2000) and Alesina et. al. (2000) | They found that:  
- There seems Canada, most of Central and South America and East Asia belong to the dollar area.  
- Western Europe and most of Africa also belong to the Euro area.  
- They did not find any Yen area belong Japan and maybe Indonesia. |
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<td>Karras and Stokes (2001)</td>
<td>EMU Countries Annual Data 1961-1997</td>
<td>Barro and Gordon (1983) and HP Filter</td>
<td>Criteria: the relative magnitude of Cyclical Output Shocks and degree of Synchronization</td>
<td>The findings show that the estimated parameters (criteria) are not constant over time. It has to be acknowledge that EU and euro membership are political processes, involving more than strictly economic decision.</td>
</tr>
<tr>
<td>Bayoumi, Eichengreen and Mauro (2000)</td>
<td>ASEAN + 3 Annual Data 1968-1998</td>
<td>Bayoumi and Eichengreen (1994)</td>
<td>The results show that ASEAN+3 countries today are less suitable for a regional monetary arrangement than the Euro area was before the Maastricht Treaty, but the differences are not large.</td>
<td></td>
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<tr>
<td>Bui (2000)</td>
<td>The UK</td>
<td>-</td>
<td>Criteria: Seigniorage, Financial Stability (The Lender of Last Resort), Macroeconomic Stabilization (Inflation and Exchange rate), Openness and Factor Mobility, Monetary Policy Transmission</td>
<td>The UK is too small and too open to be an optimal currency area. For a case like this, the foreign exchange market is mainly a source of noise, shocks and instability. The results suggest that, the economic case for immediate the UK membership in EMU is overwhelming. It is of course important that an entry rate be close to the UK’s Fundamental Exchange Rate.</td>
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<tr>
<td>Frankel and Rose (1998)</td>
<td>EMU Countries Panel Data 1967-1985:2 and 21 countries</td>
<td>OLS and HP Filter</td>
<td>Cross-country covariance of output, Business cycle correlation, Bilateral trade intensity</td>
<td>They found a strong positive relationship between the degree of bilateral trade intensity and the cross country bilateral correlation of business cycle activity. The countries with closer trade links tend to have more tightly correlated business cycles.</td>
</tr>
<tr>
<td>Bayoumi, Eichengreen (1997)</td>
<td>15 European Countries Annual Data 1973-1992</td>
<td>OLS</td>
<td>The standard deviation of the bilateral exchange rate, the sum of the absolute difference share of agricultural and manufacturing trade in total merchandise trade, the ratio of exports to domestic GDP, the mean of the two GDP’s measure in US $.</td>
<td>The results dividing the European Countries into those exhibiting a high level of readiness, those with a tendency to converge and those in which little or no convergence is evident. Further finding shows a relationship between economic integration and monetary integration. Economic integration has increased Countries’ readiness for monetary integration.</td>
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<th>Main Findings</th>
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<tr>
<td>Karras and Stokes (2001)</td>
<td>EMU Countries Annual Data 1961-1997</td>
<td>Barro and Gordon (1983) and HP Filter</td>
<td>Criteria: the relative magnitude of Cyclical Output Shocks and degree of Synchronization</td>
<td>The findings show that the estimated parameters (criteria) are not constant over time. It has to be acknowledge that EU and euro membership are political processes, involving more than strictly economic decision.</td>
</tr>
<tr>
<td>Bayoumi, Eichengreen and Mauro (2000)</td>
<td>ASEAN + 3 Annual Data 1968-1998</td>
<td>Bayoumi and Eichengreen (1994)</td>
<td>The results show that ASEAN+3 countries today are less suitable for a regional monetary arrangement than the Euro area was before the Maastricht Treaty, but the differences are not large.</td>
<td></td>
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<tr>
<td>Bui (2000)</td>
<td>The UK</td>
<td>-</td>
<td>Criteria: Seigniorage, Financial Stability (The Lender of Last Resort), Macroeconomic Stabilization (Inflation and Exchange rate), Openness and Factor Mobility, Monetary Policy Transmission</td>
<td>The UK is too small and too open to be an optimal currency area. For a case like this, the foreign exchange market is mainly a source of noise, shocks and instability. The results suggest that, the economic case for immediate the UK membership in EMU is overwhelming. It is of course important that an entry rate be close to the UK’s Fundamental Exchange Rate.</td>
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## Selected Studies: Monetary Integration and Optimum Currency Area

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<tr>
<td>Frankel and Rose (1998)</td>
<td>EMU Countries Panel Data 1967-1985:2 and 21 countries</td>
<td>OLS and HP Filter</td>
<td>Cross-country covariance of output, Business cycle correlation, Bilateral trade intensity</td>
<td>They found a strong positive relationship between the degree of bilateral trade intensity and the cross country bilateral correlation of business cycle activity. The countries with closer trade links tend to have more tightly correlated business cycles.</td>
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<tr>
<td>Bayoumi, Eichengreen (1997)</td>
<td>15 European Countries Annual Data 1973-1992</td>
<td>OLS</td>
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## Selected Studies:
Monetary Integration and Optimum Currency Area

<table>
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<tbody>
<tr>
<td>P. Kenen (1969)</td>
<td>-</td>
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<td>Suggested criteria are:</td>
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<td>The degree of product diversification</td>
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<td>The level of fiscal integration</td>
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<td>R. I. McKinnon (1963)</td>
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<td>Suggested criteria are:</td>
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<td>The degree of openness</td>
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<td>The size of an economy</td>
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<td>R. A. Mundell (1961)</td>
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<td>-</td>
<td>-</td>
<td>Suggested criteria are:</td>
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<td>The structure of trade</td>
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<td>The similarity of shocks</td>
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<tr>
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<td>The degree of labor mobility</td>
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Econometric Method:

In this part we want to present one of the most important statistical approaches to analysis the relationship among time series. After brilliant work of Sims (1980), vector autoregressions (VARs) have become the most important toolkit to analyze the multivariate time series. He developed VAR as an alternative to the traditional simultaneous equation systems. As Sims (1980), Mills (1998), Stock and Watson (2001), and others described VARs providing a reasonable approach to summarize data, data description, forecasting and policy analysis. It means that VARs can cover all the things that we need to do in macroeconomics. VAR can help us to estimate the effect of unpredictable disturbances in the economy, too.

As Stock and Watson (2001) described we can categorized VARs in three varieties:

1. Reduced VAR: reduced VAR expresses each variable as the past value of this variable and all other variables. The relationship between these variables is linear and the error term should be serially uncorrelated.

2. Recursive VAR: in this type of VAR the error terms in each equation to be uncorrelated with the errors in the previous regression equations. In the recursive VAR, order of the variables is very important and changing the order will change the VAR equations.

3. Structural VAR: in this type of VAR economist use the economic theory to find the links between the variables. Sims (1986) and Bernanke (1986) propose modeling that the innovations using economic analysis.

Nevertheless, VAR systems with the impulse response function and the variance decomposition have an important role on the modern time series analysis.

In the following, we present the VAR system then we describe the impulse response function and the variance decomposition. Last part of this section presents the VAR system that we employed in this study.

Representation of the VAR System:

Suppose a k-dimensional stochastic process \( \{y_t\} \). The reduced form of vector autoregressive of order \( p \) of this process i.e. VAR(\( p \)) can be described as follows:

\[
y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + A_3 y_{t-3} + ... + A_p y_{t-p} + \xi_t
\]

This is the linear dynamic model of the above stochastic process. \( A_0 \) denotes the vector of constant terms and \( A_i \forall i = 1,...p \) are \( k \times k \) coefficient matrices. \( \xi_t \) is a
k-dimensional white noise process with time invariant positive definite covariance matrix i.e. 
\[ \Sigma_i = E(\xi_i \xi_i^\prime) \]

For summarizing the above equation, lag operator is very useful. This operator is represented by symbol \(L\):
\[ y_{t-1} = Ly_t \]

Now consider we want to apply this operator twice for a series:
\[ y_{t-2} = L(y_{t-1}) = L(Ly_t) \]

This double application of the lag operator can be shown by \(L^2\) i.e. \(L^2y_t = y_{t-2}\). In general for any integer \(p\):
\[ L^p y_t = y_{t-p} \quad (3) \]

With respect to the above operation equation (2) can be written:
\[ y_t = \sum_{j=0}^{p} A_j Ly_t + A_{j+1} L^2 y_t + \cdots + A_p L^p y_t + \xi_t \quad (4) \]

Or:
\[ y_t - \left( \sum_{j=0}^{p} A_j Ly_t + A_{j+1} L^2 y_t + \cdots + A_p L^p y_t \right) = A_0 + \xi_t \quad (5) \]

The above equation can be written equivalently:
\[ y_t \left[ I_k - \left( A_1 L + A_2 L^2 + A_3 L^3 + \cdots + A_p L^p \right) \right] = A_0 + \xi_t \quad (6) \]

If we show \(A(L) = I_k - \left( A_1 L + A_2 L^2 + A_3 L^3 + \cdots + A_p L^p \right)\) then equation (6) can be written compactly as:
\[ A(L)y_t = A_0 + \xi_t \quad (7) \]

One of the most important features of the above equation is its stability\(^5\). Equation (7) is stable if and only if:

---

4. \(E(\xi_t \xi_s^\prime) = 0; \ \forall t \neq s\) and \(E(\xi_t) = 0\)

5. Stability means equation (7) generate stationary time series. The definitions of stationary are as follows:

i) Covariance (Weak) Stationary: the sequence of a random variables \(\{y_t\}_{t=1}^{\infty}\) is said to be weak stationary if \(\forall t:\)
   a) \(E(y_t) = \mu; \ \ p \mu < \infty\)
   b) \(\gamma(0) = E(y_t - E(y_t)) = \text{Var}(y_t) = \sigma^2; \ \ p \sigma^2 < \infty\)
   c) \(\gamma(j) = E[(y_t - E(y_t))(y_{t+j} - E(y_{t+j}))] = \gamma; \ \ p \gamma < \infty\)
\[ \det\left(I_k - A_1 z - A_2 z^2 - A_3 z^3 - \ldots - A_p z^p\right) \neq 0; \quad |z| \leq 1 \]  

Lütkepohl (2006) argued that we can calculate the eigenvalues of the coefficient matrix to find if the VAR(p) is stable or not. VAR(p) can be written as a VAR(1) process:

\[ \zeta_t = A\zeta_{t-1} + \vartheta_t \]  

where \( \zeta_t \) and \( \vartheta_t \) are \((kp \times 1)\) and \( A \) is \((kp \times kp)\) and we can show them as follows:

\[
\begin{bmatrix}
  y_t \\
  \vdots \\
  y_{t-p+1}
\end{bmatrix} = 
\begin{bmatrix}
  A_1 & A_2 & \ldots & A_{p-1} & A_p \\
  I & 0 & \ldots & 0 & 0 \\
  0 & I & \ldots & 0 & 0 \\
  \vdots & \vdots & \ddots & \vdots & \vdots \\
  0 & 0 & \ldots & I & 0
\end{bmatrix}
\begin{bmatrix}
  \zeta_t \\
  0 \\
  \vdots \\
  0
\end{bmatrix}
\]

In practice we can say that our VAR(p) is stable if and only if the Module of the eigenvalues of \( A \) are less than one.

We can estimate the coefficient of a VAR(p) process by OLS applied separately to each of the equations. If \( \zeta_t \sim \mathcal{N} \), then this estimator is equal to MLE conditional to initial value\(^6\).

**Impulse Response Function:**

The impulse response function measure the impact of a shock equal to one standard deviation of the error term of one endogenous variable on the other endogenous variable and is based on the MA representation of a VAR(p) process. A stable VAR(p) can be represented as an infinite moving average i.e. MA(\( \infty \)):

\[ y_t = A^{-1}(L)A_0 + A^{-1}(L)\zeta_t \]  

If we represent \( \zeta = A^{-1}(L)A_0 \) and \( B(L) = A^{-1}(L) \), then we can show the Wold moving average representation of a stable VAR(p) process as follows:

\[ y_t = \zeta + B(L)\zeta_t \]

\(^6\). For more details see; Hamilton (1994), Chapters 10 & 11.
By using the lag operator:

\[ y_t = \zeta + B_0 \xi_t + B_1 \xi_{t-1} + B_2 \xi_{t-2} + B_3 \xi_{t-3} + \ldots \]  \hspace{1cm} (12)

where \( B_0 = I_k \) and \( B_j; \ \forall j = 1, \ldots, \infty \) can be calculated recursively as follows:

\[ B_j = \sum_{i=1}^{j} B_{i-j} A_j; \quad \forall j = 1, \ldots, \infty \] and for \( j > p; \ A_j = 0 \)

As we know \( \xi_t \) is the residual of the reduced form of VAR(p), so it is easy to understand that they should be correlated and there is no direct economical and statistical interpretation. However, the econometricians propose that it is better that we derived the orthogonal impulse response function from Choleski decomposition of the error variance-covariance matrix i.e. \( \Sigma_\xi = E(\xi_t \xi_t') = PP'; \) where \( P \) is a lower triangular matrix. Now the moving average representation of VAR(p) can be shown as:

\[ y_t = \zeta + \psi_0 \varepsilon_t + \psi_1 \varepsilon_{t-1} + \psi_2 \varepsilon_{t-2} + \psi_3 \varepsilon_{t-3} + \ldots \] \hspace{1cm} (13)

where \( \varepsilon_t = P^{-1} \xi_t \) and \( \psi_j = B_j; \ \forall i = 0, 1, \ldots \). We called \( \varepsilon_t \) as an innovation. Here, \( \psi_j^0 = \frac{\partial y_{t-\tau}}{\partial \varepsilon_{j,\tau}} \);

\( \forall i, j = 1, 2, \ldots, k; \tau = 1, 2, \ldots \) show the lagged effect of the impulse response sequences of a unit shock of variable \( j \) on variable \( i \). Due to \( B_0 = I_k \) then \( \psi_0 = P \), thus \( \psi_0^0 = \frac{\partial y_{t-\tau}}{\partial \varepsilon_{j,\tau}} \);

\( \forall i, j = 1, 2, \ldots, k \) are the impact multipliers that measure the immediate impact of a unit shock in variable \( j \) on variable \( i \) (Kirchgässner and Wolters; 2007).

As we know \( P \) is a lower triangular matrix, thus a shock in the first variable of a VAR(p) can influence on all the remaining variables, and the second and the other variables cannot have any direct impact on \( y_1 \).

If our VAR(p) process is stationary, then the time path of the value of the impulse response function (at least asymptotically) approach to zero i.e. the effect of innovation on one variable expire over the time.

**Forecast Error Variance Decomposition:**

The forecast error\(^7\) variance decomposition (hereafter variance decomposition) is based on the orthogonal impulse response function. Variance decomposition analyzes the

\[^7\] For a given VAR(p) forecast can be calculated recursively as follows:

\[ y_{T+h|T} = A_0 y_{T+h-n|T} + A_1 y_{T+h-2|T} + A_2 y_{T+h-n-2|T} + \ldots + A_p y_{T+h-n-p|T}; \quad \forall h = 1, 2, \ldots, n \]

The forecast error covariance matrix is as follows:
contribution of \( y_{j,T+h} \) to the \( h \) step forecast of another variable i.e. \( y_{i,T+h+1} \). It can be defined as the proportion of movement in a sequence due to its own shocks versus to the other variables (Enders; 2000). Based on this definition we can compute variance decomposition for \( y_{j,T+h} - y_{j,T+h+1} \) in percentage term as follows:

\[
VD_j(h) = \left( \psi_{j,j,0}^2 + \psi_{j,j,1}^2 + \ldots + \psi_{j,j,h-1}^2 \right) \frac{\sigma_j^2(h)}{\sigma_j^2(h)}
\]

(14)

where \( \sigma_j^2(h) = \sum_{j=1}^k \left( \psi_{j,j,0}^2 + \psi_{j,j,1}^2 + \ldots + \psi_{j,j,h-1}^2 \right) \) is the variance of the forecast error variance. Due to \( \psi_{j,j}^2(h) \geq 0 \), when then forecast horizon \( h \) increases i.e. \( h \to \infty \) the variance of the forecast error increases too.

\[
\text{cov}\left( y_{T+1} - y_{T+1} \right) = \begin{bmatrix} \psi_t & 0 & \ldots & 0 \\ \vdots & \ddots & \ddots & \vdots \\ \psi_{t-1} & \psi_{t-2} & \ldots & 0 \\ \psi_{t+1} & \psi_{t+2} & \ldots & 0 \end{bmatrix} \left( \sum_{k=0}^p \psi_k \right).
\]

where \( \psi \) are the coefficient matrices of the Wold moving average representative of a stable VAR(p) process (Pfaff; 2008).
Structure of the Model:

Sims (1986) and Bernanke (1986), Blanchard and Quah (1989)’s structural vector autoregressive (SVAR) are among the first models that underlying the structural shocks. After these seminal papers Bayoumi and Echingreen (1993) employed a variant of this model to deal with the issue of macro disturbances through the econometric estimations.

As we described in the academic background, the empirical literatures on the OCA mostly are based on the small VARs. Stock and Watson (1996) argued small-scale VARs are often unstable and poor predictors of the future. In this paper we employ a ten-variable VAR model to examine the correlation and the size of the disturbances. As we know countries by small size and more correlated of disturbances are better candidates for OCA. We developed Chow and Kim (2003)’s model. In our study we consider three types of shocks: internal, regional and global. The regional shocks affect the area countries from the inside of that area but the global shocks affect the countries from outside of the area. On the other hand, we consider three external regional and three external global shocks that affect the economy - supply shocks, demand shocks and monetary shocks. Internal shocks can be divided into supply shocks, demand shocks, monetary shocks and financial shocks. So our model can be written as:

\[ x_t = \begin{pmatrix} y_t^g, p_t^g, i_t^g, y_t^r, p_t^r, i_t^r, y_t^d, p_t^d, i_t^d, e_t^d \end{pmatrix} \]  \quad (15)  

where \( y \) is the output, \( p \) shows the price level, \( i \) is the interest rate, and \( e \) is the real exchange rate. The superscripts \( g, r, d \) refer to global, regional and domestic, respectively.

Our structural model can be written as:

\[ x_t = A(L)e_{\mu}^k \quad k = g, r, d ; \quad j = S, D, M, F \]  \quad (16)  

where \( e \) shows different types of serially uncorrelated and orthonormal shocks and the subscript \( j = S, D, M, F \) shows supply, demand, monetary and financial shocks, respectively. 

\( A \) is a \( 10 \times 10 \) matrix that defines the impulse response of the endogenous variables to the structural shocks. Thus:

\[
A(L) = \begin{bmatrix}
A_{11}(L) & A_{12}(L) & \cdots & A_{1,10}(L) \\
A_{21}(L) & A_{22}(L) & \cdots & A_{2,10}(L) \\
& \ddots & \ddots & \ddots \\
& & \ddots & \ddots \\
A_{10,1}(L) & A_{10,2}(L) & \cdots & A_{10,10}(L)
\end{bmatrix}
\]
As we know to identify this model, it is necessary to impose 45 restrictions on the structural model. The long run restrictions of the above model are as follow:

\begin{align*}
A_{12}(L) &= A_{13}(L) = A_{14}(L) = A_{15}(L) = A_{16}(L) = A_{17}(L) = A_{18}(L) = A_{19}(L) = A_{1,10}(L) = 0 \\
A_{23}(L) &= A_{24}(L) = A_{25}(L) = A_{26}(L) = A_{27}(L) = A_{28}(L) = A_{29}(L) = A_{2,10}(L) = 0 \\
A_{34}(L) &= A_{35}(L) = A_{36}(L) = A_{37}(L) = A_{38}(L) = A_{39}(L) = A_{3,10}(L) = 0 \\
A_{45}(L) &= A_{46}(L) = A_{47}(L) = A_{48}(L) = A_{49}(L) = A_{4,10}(L) = 0 \\
A_{56}(L) &= A_{57}(L) = A_{58}(L) = A_{59}(L) = A_{5,10}(L) = 0 \\
A_{67}(L) &= A_{68}(L) = A_{69}(L) = A_{6,10}(L) = 0 \\
A_{78}(L) &= A_{79}(L) = A_{7,10}(L) = 0 \\
A_{89}(L) &= A_{8,10}(L) = 0 \\
A_{9,10}(L) &= 0
\end{align*}

Therefore, we can rewrite the recursive system as:

\[
\begin{bmatrix}
x_1^e \\
p_1^e \\
i_1^e \\
y_1^e \\
p_1^d \\
i_1^d \end{bmatrix} = 
\begin{bmatrix}
A_{11}(L) & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
A_{21}(L) & A_{22}(L) & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
A_{31}(L) & A_{32}(L) & A_{33}(L) & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) & 0 & 0 & 0 & 0 & 0 & 0 \\
A_{51}(L) & A_{52}(L) & A_{53}(L) & A_{54}(L) & A_{55}(L) & 0 & 0 & 0 & 0 & 0 \\
A_{61}(L) & A_{62}(L) & A_{63}(L) & A_{64}(L) & A_{65}(L) & A_{66}(L) & 0 & 0 & 0 & 0 \\
A_{71}(L) & A_{72}(L) & A_{73}(L) & A_{74}(L) & A_{75}(L) & A_{76}(L) & A_{77}(L) & 0 & 0 & 0 \\
A_{81}(L) & A_{82}(L) & A_{83}(L) & A_{84}(L) & A_{85}(L) & A_{86}(L) & A_{87}(L) & A_{88}(L) & A_{89}(L) & 0 \\
A_{91}(L) & A_{92}(L) & A_{93}(L) & A_{94}(L) & A_{95}(L) & A_{96}(L) & A_{97}(L) & A_{98}(L) & A_{99}(L) & 0 \\
A_{10,1}(L) & A_{10,2}(L) & A_{10,3}(L) & A_{10,4}(L) & A_{10,5}(L) & A_{10,6}(L) & A_{10,7}(L) & A_{10,8}(L) & A_{10,9}(L) & A_{10,10}(L)
\end{bmatrix} \begin{bmatrix}
\varepsilon_1^e \\
\varepsilon_1^d \\
\varepsilon_2^e \\
\varepsilon_3^e \\
\varepsilon_4^e \\
\varepsilon_5^e \\
\varepsilon_6^e \\
\varepsilon_7^e \\
\varepsilon_8^e \\
\varepsilon_9^e \\
\varepsilon_{10}^e \\
\varepsilon_{11}^d
\end{bmatrix}
\]

The reduced form of VAR model for estimation is as follow:

\[x_t = B(L)x_{t-1} + \xi_t\]  \hspace{1cm} (17)

where in the above equation \(\xi_t\) is the vector of reduced form error term.

---

8. If \(n\) shows the number of variables in the VAR model then for identifying the structural model from the estimated model, we need to impose \(\frac{n^2 - n}{2}\) restrictions on the structural VAR.
Empirical Results:

In this part we want to estimate and report our results. This chapter accomplishes two main objectives. First, with respect to correlation of supply shocks—which is obtained from estimating our VAR model among ASEAN+3 countries, we examined whether creating an OCA is viable to sustain or not. As we know if the supply shocks are highly correlated or symmetric (positive impact) within the region i.e. $\text{corr}(\xi^y_i, \xi^y_j) > 0; \forall i, j$, then this region can be a proper candidate for a currency union. Second, by using the correlation between regional and global supply shocks among countries we want to find that which currency bloc (yen or dollar) is more suitable for this area? If the global supply shocks are relatively more important than regional ones then forming a $-$bloc may be a better policy choice than yen-bloc. On the other hand, a high (low) correlation of supply shocks between the home and the anchor country suggests that the economies are subject to symmetric (asymmetric) shocks are good (poor) candidate for a currency union (Chow and Kim; 2003).

Data Description

We use quarterly data from the first quarter of 1993 until fourth quarter of 2010. The availability of data in our scope countries—especially china—influences our choice of sample period. We collected our data from data stream. As we already mentioned the scope countries are ASEAN-5+3 (hereafter AMFPT) which contain Indonesia, Malaysia, Singapore, Thailand, the Philippine, Japan, Korea, and China (main land). We begin our analysis by examining the integration of our data.

The Unit Root Test:

Table 1, shows this test statistics. We used the Phillips-Peron test. The critical value at 5% significant level is -2.902953. As we can see except interest rate in Japan and GDP in Indonesia i.e. $\sim I(0)$, it is impossible to reject the null hypothesis of one unit root for each of our series $\sim I(1)$. Details of our findings are presented in appendix 1.

---

9. Statistically if $\text{corr}(\xi^y_i, \xi^d_i) > \text{corr}(\xi^r_i, \xi^d_i); \forall i \Rightarrow$ $-$bloc is more suitable.
VAR Estimation:

We estimate separate VAR model—as we described it in the previous chapter—to find the correlation of the underlying supply shocks. The number of lags in the model is equal to one and based on the Shwartz-Baysian Information Criterion. Appendix 2 reports the estimation of our VAR model.

As we have already described stability is one of the most important properties of the VAR model. This means that at least our model generates stationary time series with time invariant means, variances and covariance. Appendix 3 represent that all of our VAR estimation for each countries have fulfilled this properties.

Appendix 4 and 5 shows the impulse response and the variance decomposition of our VAR model for each country, respectively.

Main findings:

From this point on, we want to estimate and analyzing the underlying of the supply shocks and the correlation between these shocks within a VAR model. As we have already described if the correlation is positive then we have symmetric shocks, on the other hand, if the correlation is negative or zero then the shocks are categorized as asymmetric.

We start with domestic supply shocks among countries. Table 2 displays the cross-correlation of the supply shocks for AMFPT.

<table>
<thead>
<tr>
<th>Countries</th>
<th>China</th>
<th>Indonesia</th>
<th>Korea</th>
<th>Malaysia</th>
<th>Philippine</th>
<th>Singapore</th>
<th>Thailand</th>
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<tbody>
<tr>
<td>China</td>
<td>1.00000</td>
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</tr>
<tr>
<td>Indonesia</td>
<td>0.21580</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>0.28519</td>
<td>0.07306</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.48535</td>
<td>0.29837</td>
<td>0.37378</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Philippine</td>
<td>0.73302</td>
<td>-0.00826</td>
<td>0.50021</td>
<td>0.21605</td>
<td>1.00000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>-0.17477</td>
<td>0.24472</td>
<td>-0.06996</td>
<td>0.18744</td>
<td>-0.20551</td>
<td>1.00000</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>0.49101</td>
<td>-0.34214</td>
<td>0.36193</td>
<td>-0.04042</td>
<td>0.70772</td>
<td>-0.18525</td>
<td>1.00000</td>
</tr>
</tbody>
</table>

The results show that the correlation among Japan, China, Korea, Malaysia, and the Philippine are symmetric. The first is that all the countries in this region cannot shape an OCA. Singapore and Thailand have different types of monetary policy. The Monetary Authority of Singapore (MAS) is the central bank of Singapore and carried out a full range of central banking functions. MAS uses the intervention operation in the foreign exchange
markets as its instruments to achieve the final goal of central bank that is price stability (Moosavi; 2010). Bank of Thailand (BOT) accepted the IMF program in May 2000. The main property of this program is inflation targeting. It seems this program have changed the monetary transmission mechanism. However, the inflation targeting allows the monetary policy to manage the impact of internal and external shocks on the Thai economy (Moosavi; 2010). Indonesia has growth experiences that are sufficiently different from the other countries. High level of inflation is another property of this country.

The above analysis and based on OCA theories, creating a common currency area among all of AMFPT countries is costly and difficult to sustain. This finding supports Chow and Kim (2003). But as it seems East Asian Countries are the most suitable to create the second serious OCA. We propose that the five countries called Japan, China, Korea, Malaysia, and the Philippine with symmetric supply shocks make a sub-area that accepts to create a single currency area. At first they should peg their exchange rate in the OCA and float with the rest of the world. The other countries in the area should form a currency union (or currency board) -like CFA franc zone- but in the zone of the first sub-area. These countries should recover their economy and wait until to be a good candidate to join the OCA.

Now we want to find the best bloc for this area. Table 3 and gharph1 show the regional and global correlation in the region.

### Table 3: Global and Regional Correlation of Supply Shocks:

<table>
<thead>
<tr>
<th>Countries</th>
<th>China</th>
<th>Indonesia</th>
<th>Korea</th>
<th>Malaysia</th>
<th>Philippine</th>
<th>Singapore</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan (Regional)</td>
<td>0.28309</td>
<td>0.08455</td>
<td>0.15503</td>
<td>0.36421</td>
<td>0.29219</td>
<td>0.30294</td>
<td>0.20568</td>
</tr>
<tr>
<td>USA (Global)</td>
<td>0.42661</td>
<td>-0.01323</td>
<td>0.26800</td>
<td>0.51972</td>
<td>0.34584</td>
<td>0.25683</td>
<td>0.29064</td>
</tr>
</tbody>
</table>

Perhaps the most striking result of table 3 is the negative Indonesia-USA correlation. As we can see both dollar and yen can be suitable anchor for these countries, but with the exception of Indonesia all other AMFPT countries are better potential clients of dollar. This finding supports Alesina and Barro (2001) and Lim (2005). On the other word, the higher correlation between the USA and the AMFPT countries show that the US dollar can be a better anchor for an optimum currency union. However, the Regional correlation of supply shocks is positive, too. It means yen can be the second best potential client.

But as we know the fluctuations in the yen-dollar exchange rate is the most important source of disturbances in this area (Kwan; 1994). On the other hand, most of the AMFPT
countries have small and open economy and foreign exchange market can be the most important source of shocks. Due to this problem we strongly recommended that the region should peg their common currency to the basket of the most important potential anchor: dollar, yen, and euro. It can help to reduce the impact of probable international shocks in this OCA.

What AMSPT needs to do?

In this part we want to describe a framework that can be used by AMFPT to organize this transition. The structure of this framework is based on three objectives.

1. The Regional Exchange Rate Mechanism:

   As we have already described all countries in this region cannot shape an OCA. The most suitable sub-region contains: Japan, China\textsuperscript{10}, Korea, Malaysia, and the Philippine. These countries should create the OCA with a single currency and peg their exchange rate in the sub-area to the basket of the most important currencies (dollar, euro, and yen) and float their common currency to the rest of the world. The second sub-region can be the trio of Singapore, Thailand, and Indonesia. The economic level of these three countries is nearer to the first sub-region. It seems that they can join to the OCA sooner than the other countries. This trio should form a currency boards (lock local currencies to the common currency of the first group) in the zone of first sub-region. The third sub-region contains: Brunei, Vietnam, Laos, Cambodia, and Myanmar. These countries have growth and development that are

---

\textsuperscript{10} Studies show that Chinese trio (mainland, Taiwan, and Hong Kong) can make a currency union (Zhang, Sato and McAleer; 2008). Thus it would be possible to expand the first sub-region to Grate China.
sufficiently different from the above duet sub-regions. These countries again can form a currency boards or dollarized\textsuperscript{11} their currencies and used the common currency of the first sub-region.

2. The Regional Institutional Arrangements:

The accurate and strong regional institutional arrangements for managing and organizing this important transition are the other important things that this area needs. As we know countries with different level of growth and development -like ASEAN+3- need a high capability with designing a very efficient management to conduct fiscal and monetary policy of the region. Seigniorage\textsuperscript{12} (government revenues from money issuance), commitment to accept the single currency, commitment to stay in the region, commitment to removing their barriers (factors and goods mobility in the region), regional fiscal and monetary policies cooperation, all in all are the things that need the supra-national organizations. As we have already mentioned AMFPT countries have different level of growth and development and integration of such countries need to design a very strong and efficient conductor.

3. The Regional Legislation Arrangement:

Like a country the currency area needs rules, laws and different types of act. A legislation parliament can be the only legal place to create these rules and laws.

\textsuperscript{11} As we know dollarization means use of another countries currency that may not be the US dollar.

\textsuperscript{12} Buiter (2000) argued when a country accept to be a member of an OCA, it loses the national segniorage. Thus, this country should gain a proper share of the regional seniorage.
Summary and Conclusion Remark:

After the crisis 1997-1998 and the financial fragility of this region, the perspective of the East Asian countries about economic integration completely changed. They accepted that this region needs to develop and foster the idea of monetary integration among these countries. There is a conflict between economists about the viability of ASEAN+3 to make the second OCA. Some of the scholars in this field of study argued that the ASEAN+3 countries shape the most suitable region to create the second OCA in the world (Bayoumi, Eichengreen, and Mauro 2000), Lim; 2005, Huang and Guo (2006), Lee and Azali; 2010). On the other hand, we can find some studies that there results show these area does not have enough viability to form a single currency union. (Chow and Kim; 2003, Zhang, Sato, and McAleer; 2004).

In this study we developed the Chow and Kim (2003)’s model. In this study we employed a ten-variable VAR model and based on it we consider three groups of shocks: three external global shocks, three external regional shocks and four internal (domestic) shocks. We employed the above VAR model to focus on two important objectives. At first we want to evaluate the underlying shocks to find the feasibility of forming an OCA in AMFPT region. Then we want to find the most suitable currency bloc for this region.

The results from the correlation of supply shocks show that forming an OCA for all of the countries in the region is costly and difficult to sustain. We categorized this region into three sub-regions. At first, five countries called Japan, China, Korea, Malaysia, and the Philippine with symmetric supply shocks should create the single currency area. The rest of the countries in the region should accept to form a currency boards in the zone of the above single currency. It seems the remaining countries also should be categorized into a duet sub-region. Thus the second sub-region contains Singapore, Thailand and Indonesia that show more harmony with the first five countries. The third sub-region that has growth and development that is different from the former sub-regions contains: Brunei, Vietnam, Laos, Cambodia, and Myanmar.

The findings also showed that both dollar and yen can be suitable anchor for the region. But due to higher cross-correlation between global and domestic shocks we proposed that dollar must be the first best choice. But again and because the foreign exchange market can be the most important source of international volatility, we strongly recommend that these countries use a basket of dollar, yen and euro as there anchor.

The final point of this study described the proper arrangements that the AMFPT countries should set up to be successful in this transition. Proper regional exchange rate
mechanism and establish supra-national organization for conducting policies and the regional legislation framework seems to be the most important things that this region should focus on them.

Obviously, as most of the scholars in this field study argued the most important reason for a monetary union to accept an OCA is a political rather than economical process (Bayoumi, Eichengreen, and Maruo; 2000, and Frankel and Rose; 2002). Thus, it seems the time to be to build the second OCA in the world is reached. And as we have already mentioned the ASEAN+3 countries can be the most suitable region for it.
References:


Zhao, Xiaodan and Yoonbai Kim (2009), Is the CFA Franc Zone an Optimum Currency Area?, *World Development*, 37(12): 1877-1886.
Appendices:

Appendix 1: Unit Root Test (Phillips-Perron):

Null Hypothesis: D(CPIC) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-4.679906</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction) 1.941858
HAC corrected variance (Bartlett kernel) 1.940672

Phillips-Perron Test Equation
Dependent Variable: D(CPIC,2)
Method: Least Squares
Date: 06/05/11   Time: 12:04
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(CPIC(-1))</td>
<td>-0.469615</td>
<td>0.100332</td>
<td>-4.680591</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.073844</td>
<td>0.169338</td>
<td>-0.406074</td>
<td>0.6642</td>
</tr>
</tbody>
</table>

R-squared 0.243671
Adjusted R-squared 0.232548
S.E. of regression 1.413850
Sum squared resid 135.9301
Log likelihood -122.5533
F-statistic 21.90793
Prob(F-statistic) 0.000014
Null Hypothesis: D(CPII) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-5.096238</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.527045</td>
</tr>
<tr>
<td>5% level</td>
<td>-2.903566</td>
</tr>
<tr>
<td>10% level</td>
<td>-2.589227</td>
</tr>
</tbody>
</table>


Residual variance (no correction) 3.268789
HAC corrected variance (Bartlett kernel) 3.399597

Phillips-Perron Test Equation
Dependent Variable: D(CPII,2)
Method: Least Squares
Date: 06/05/11 Time: 12:04
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(CPII(-1))</td>
<td>-0.542747</td>
<td>0.107500</td>
<td>-5.048808</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.996953</td>
<td>0.291492</td>
<td>3.420169</td>
<td>0.0011</td>
</tr>
</tbody>
</table>

R-squared 0.272653 Mean dependent var 0.027143
Adjusted R-squared 0.261957 S.D. dependent var 2.135242
S.E. of regression 1.834374 Akaike info criterion 4.079439
Sum squared resid 228.8152 Schwarz criterion 4.143682
Log likelihood -140.7804 Hannan-Quinn criter. 4.104957
F-statistic 25.49046 Durbin-Watson stat 2.007075
Prob(F-statistic) 0.000004

Null Hypothesis: D(CPII) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-10.19090</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.527045</td>
</tr>
<tr>
<td>5% level</td>
<td>-2.903566</td>
</tr>
<tr>
<td>10% level</td>
<td>-2.589227</td>
</tr>
</tbody>
</table>


Residual variance (no correction) 0.257649
HAC corrected variance (Bartlett kernel) 0.279614
Phillips-Perron Test Equation
Dependent Variable: D(CPIJ,2)
Method: Least Squares
Date: 06/05/11   Time: 12:05
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(CPIJ(-1))</td>
<td>-1.199345</td>
<td>0.116746</td>
<td>-10.27308</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.003716</td>
<td>0.061555</td>
<td>-0.060371</td>
<td>0.9520</td>
</tr>
</tbody>
</table>

R-squared       0.608151  Mean dependent var -0.007143
Adjusted R-squared  0.602388  S.D. dependent var 0.816731
S.E. of regression    0.515002  Akaike info criterion 1.538863
Sum squared resid     18.03543  Schwarz criterion 1.603105
Log likelihood       -51.86019  Hannan-Quinn criter. 1.564381
F-statistic          105.5361   Durbin-Watson stat 1.968270
Prob(F-statistic)    0.000000

Null Hypothesis: D(CPIK) has a unit root
Exogenous: Constant
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-8.458494</td>
</tr>
</tbody>
</table>

Test critical values:
1% level  -3.527045
5% level  -2.903566
10% level -2.589227


Residual variance (no correction) 0.423095
HAC corrected variance (Bartlett kernel) 0.262658

Phillips-Perron Test Equation
Dependent Variable: D(CPIK,2)
Method: Least Squares
Date: 06/05/11   Time: 12:05
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(CPIK(-1))</td>
<td>-0.997136</td>
<td>0.120920</td>
<td>-8.246275</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.779750</td>
<td>0.123472</td>
<td>6.315210</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared       0.500004  Mean dependent var -0.003571
Adjusted R-squared  0.492651  S.D. dependent var 0.926532
S.E. of regression    0.659954  Akaike info criterion 2.034862
Sum squared resid     29.61668  Schwarz criterion 2.099105
Log likelihood       -69.22018  Hannan-Quinn criter. 2.060380
F-statistic          68.00105   Durbin-Watson stat 1.984222
Prob(F-statistic)    0.000000
Null Hypothesis: $\Delta (CPIM)$ has a unit root
Exogenous: Constant
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-6.829394</td>
</tr>
</tbody>
</table>

Test critical values:

- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction): 0.544323
HAC corrected variance (Bartlett kernel): 0.298750

Phillips-Perron Test Equation
Dependent Variable: $\Delta (CPIM,2)$
Method: Least Squares
Date: 06/05/11   Time: 12:05
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta (CPIM(-1))$</td>
<td>-0.826167</td>
<td>0.119422</td>
<td>-6.918077</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.494520</td>
<td>0.114518</td>
<td>4.318259</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

R-squared: 0.413084
Mean dependent var: 1.91E-16
Adjusted R-squared: 0.404453
S.D. dependent var: 0.969984
S.E. of regression: 0.748554
Akaike info criterion: 2.286807
Sum squared resid: 38.10261
Schwarz criterion: 2.351050
Log likelihood: -78.03826
Hannan-Quinn crit.: 2.312325
F-statistic: 47.85979
Durbin-Watson stat: 1.912705
Prob(F-statistic): 0.000000

Null Hypothesis: $\Delta (CPIM)$ has a unit root
Exogenous: Constant
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-5.703082</td>
</tr>
</tbody>
</table>

Test critical values:

- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction): 0.962686
HAC corrected variance (Bartlett kernel): 0.655615
Phillips-Perron Test Equation
Dependent Variable: D(CPIS, 2)
Method: Least Squares
Date: 06/05/11   Time: 12:06
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(CPIS(-1))</td>
<td>-0.688438</td>
<td>0.115232</td>
<td>-5.974375</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.795638</td>
<td>0.178585</td>
<td>4.455222</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared                        | 0.344219    | Mean dependent var | -1.30E-16  |
Adjusted R-squared               | 0.334575    | S.D. dependent var | 1.220359   |
S.E. of regression               | 0.995490    | Akaike info criterion | 2.856992  |
Sum squared resid                | 67.38805    | Schwarz criterion | 2.921235   |
Log likelihood                   | -97.99474   | Hannan-Quinn criter. | 2.882510  |
F-statistic                      | 35.69316    | Durbin-Watson stat | 1.912619   |
Prob(F-statistic)                | 0.000000    |               |             |

Null Hypothesis: D(CPIS) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-4.257339</td>
</tr>
</tbody>
</table>

Test critical values:
1% level     -3.527045
5% level     -2.903566
10% level    -2.589227


Residual variance (no correction)               | 0.247331|
HAC corrected variance (Bartlett kernel)       | 0.251794|

Phillips-Perron Test Equation
Dependent Variable: D(CPIS, 2)
Method: Least Squares
Date: 06/05/11   Time: 12:06
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(CPIS(-1))</td>
<td>-0.426771</td>
<td>0.100824</td>
<td>-4.232818</td>
<td>0.0001</td>
</tr>
<tr>
<td>C</td>
<td>0.171354</td>
<td>0.071527</td>
<td>2.395642</td>
<td>0.0193</td>
</tr>
</tbody>
</table>

R-squared                        | 0.208536    | Mean dependent var | 0.008571  |
Adjusted R-squared               | 0.196897    | S.D. dependent var | 0.563051  |
S.E. of regression               | 0.504584    | Akaike info criterion | 1.497991  |
Sum squared resid                | 17.31316    | Schwarz criterion | 1.562234  |
Log likelihood                   | -50.42970   | Hannan-Quinn criter. | 1.523509  |
F-statistic                      | 17.91675    | Durbin-Watson stat | 1.960370  |
Prob(F-statistic)                | 0.000071    |               |             |
Null Hypothesis: $D(CPIT)$ has a unit root
Exogenous: Constant
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5.790973</td>
<td>0.0000</td>
<td></td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction) 0.963311
HAC corrected variance (Bartlett kernel) 0.598457

Phillips-Perron Test Equation
Dependent Variable: $D(CPIT,2)$
Method: Least Squares
Date: 06/05/11   Time: 12:06
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D(CPIT(-1))$</td>
<td>-0.705543</td>
<td>0.116035</td>
<td>-6.080461</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.515547</td>
<td>0.146957</td>
<td>3.508152</td>
<td>0.0008</td>
</tr>
</tbody>
</table>

R-squared 0.352208
Adjusted R-squared 0.342682
S.E. of regression 0.995813
Sum squared resid 67.43179
Log likelihood -98.01745
F-statistic 36.97200
Prob(F-statistic) 0.00000

Null Hypothesis: $D(CPIU)$ has a unit root
Exogenous: Constant
Bandwidth: 31 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-7.998105</td>
<td>0.0000</td>
<td></td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction) 0.432417
HAC corrected variance (Bartlett kernel) 0.119200
Phillips-Perron Test Equation
Dependent Variable: D(CPIU,2)
Method: Least Squares
Date: 06/05/11  Time: 12:06
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(CPIU(-1))</td>
<td>-0.866851</td>
<td>0.120306</td>
<td>-7.205372</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.473911</td>
<td>0.103621</td>
<td>4.573498</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared 0.432943  Mean dependent var -0.002857
Adjusted R-squared 0.424604  S.D. dependent var 0.879554
S.E. of regression 0.667184  Akaike info criterion 2.056655
Sum squared resid 30.26918  Schwarz criterion 2.120898
Log likelihood -69.98292  Hannan-Quinn criter. 2.082173
F-statistic 51.91738  Durbin-Watson stat 1.872081
Prob(F-statistic) 0.000000

Null Hypothesis: D(ERC) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-8.081805</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Test critical values:
1% level -3.527045
5% level -2.903566
10% level -2.589227


Residual variance (no correction) 0.124108
HAC corrected variance (Bartlett kernel) 0.124108
Phillips-Perron Test Equation
Dependent Variable: D(ERC,2)
Method: Least Squares
Date: 06/05/11   Time: 12:07
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(ERC(-1))</td>
<td>-0.980608</td>
<td>0.121335</td>
<td>-8.081805</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.013134</td>
<td>0.042758</td>
<td>0.307182</td>
<td>0.7596</td>
</tr>
</tbody>
</table>

R-squared                      0.489932
Adjusted R-squared            0.482431
S.E. of regression           0.357433
Sum squared resid            8.687577
Log likelihood               -26.29466
F-statistic                  65.31557
Prob(F-statistic)            0.000000

Null Hypothesis: D(ERI) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-8.546833</td>
</tr>
</tbody>
</table>

Test critical values:
1% level     -3.527045
5% level     -2.903566
10% level    -2.589227


Residual variance (no correction) 1007938.
HAC corrected variance (Bartlett kernel) 1030987.

Phillips-Perron Test Equation
Dependent Variable: D(ERI,2)
Method: Least Squares
Date: 06/05/11   Time: 12:24
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(ERI(-1))</td>
<td>-1.036148</td>
<td>0.121210</td>
<td>-8.548387</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>101.4363</td>
<td>122.3403</td>
<td>0.829132</td>
<td>0.4099</td>
</tr>
</tbody>
</table>

R-squared                      0.517987
Adjusted R-squared            0.510898
S.E. of regression           1018.618
Sum squared resid            7018.618
Log likelihood               -983.1453
F-statistic                  73.07492
Prob(F-statistic)            0.000000
Null Hypothesis: D(ERK) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10.52541</td>
<td>0.0001</td>
<td></td>
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</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction) 12443.82
HAC corrected variance (Bartlett kernel) 12312.36

Phillips-Perron Test Equation
Dependent Variable: D(ERK,2)
Method: Least Squares
Date: 06/05/11   Time: 13:30
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(ERK(-1))</td>
<td>-1.238165</td>
<td>0.117779</td>
<td>-10.51259</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>5.964167</td>
<td>13.54017</td>
<td>0.440480</td>
<td>0.6610</td>
</tr>
</tbody>
</table>

R-squared 0.619078
Adjusted R-squared 0.613477
S.E. of regression 113.1804
Sum squared resid 871067.1
Log likelihood -429.3400
F-statistic 110.5145
Prob(F-statistic) 0.0000000

Null Hypothesis: D(ERM) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5.422724</td>
<td>0.0000</td>
<td></td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction) 0.014202
HAC corrected variance (Bartlett kernel) 0.014334
Phillips-Perron Test Equation
Dependent Variable: D(ERM,2)
Method: Least Squares
Date: 06/05/11 Time: 13:30
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(ERM(-1))</td>
<td>-0.602122</td>
<td>0.111252</td>
<td>-5.412219</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.004682</td>
<td>0.014478</td>
<td>0.323394</td>
<td>0.7474</td>
</tr>
</tbody>
</table>

R-squared: 0.301074  Mean dependent var: 8.89E-06
Adjusted R-squared: 0.290796  S.D. dependent var: 0.143578
S.E. of regression: 0.120913  Akaike info criterion: -1.359339
Sum squared resid: 0.994153  Schwarz criterion: -1.295097
Log likelihood: 49.57688  Hannan-Quinn criter.: -1.333821
F-statistic: 29.29211  Durbin-Watson stat: 1.981310
Prob(F-statistic): 0.000001

Null Hypothesis: D(ERP) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-5.452717</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction): 2.504202
HAC corrected variance (Bartlett kernel): 2.459598
Phillips-Perron Test Equation
Dependent Variable: D(ERP,2)
Method: Least Squares
Date: 06/05/11   Time: 13:30
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(ERP(-1))</td>
<td>-0.616990</td>
<td>0.112729</td>
<td>-5.473203</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.131988</td>
<td>0.194570</td>
<td>0.678355</td>
<td>0.4998</td>
</tr>
</tbody>
</table>

R-squared         0.305810
Adjusted R-squared 0.295602
S.E. of regression 1.605570
Sum squared resid   175.2941
Log likelihood    -131.4547
F-statistic        29.95595
Prob(F-statistic)  0.000001

Null Hypothesis: D(ERS) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-6.842612</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.527045</td>
</tr>
<tr>
<td>5% level</td>
<td>-2.903566</td>
</tr>
<tr>
<td>10% level</td>
<td>-2.589227</td>
</tr>
</tbody>
</table>


Residual variance (no correction) 0.001379
HAC corrected variance (Bartlett kernel) 0.001346

Phillips-Perron Test Equation
Dependent Variable: D(ERS,2)
Method: Least Squares
Date: 06/05/11   Time: 13:31
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(ERS(-1))</td>
<td>-0.826517</td>
<td>0.120489</td>
<td>-6.859714</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.003766</td>
<td>0.004531</td>
<td>-0.831181</td>
<td>0.4088</td>
</tr>
</tbody>
</table>

R-squared         0.408982
Adjusted R-squared 0.400290
S.E. of regression 0.037678
Sum squared resid   0.096537
Log likelihood    131.1958
F-statistic        47.05568
Prob(F-statistic)  0.000000
Null Hypothesis: \( D(ERT) \) has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-5.922626</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction) | 3.387149
HAC corrected variance (Bartlett kernel) | 2.492873

Phillips-Perron Test Equation
Dependent Variable: \( D(ERT,2) \)
Method: Least Squares
Date: 06/05/11   Time: 13:31
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( D(ERT(-1)) )</td>
<td>-0.719693</td>
<td>0.117075</td>
<td>-6.147269</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.043539</td>
<td>0.223417</td>
<td>0.194876</td>
<td>0.8461</td>
</tr>
</tbody>
</table>

R-squared | 0.357211 | Mean dependent var | -0.019156 |
Adjusted R-squared | 0.347758 | S.D. dependent var | 2.312104 |
S.E. of regression | 1.867290 | Akaike info criterion | 4.115009 |
Sum squared resid | 237.1005 | Schwarz criterion | 4.179251 |
Log likelihood | -142.0253 | Hannan-Quinn criter. | 4.140527 |
F-statistic | 37.78891 | Durbin-Watson stat | 2.006940 |
Prob(F-statistic) | 0.000000 | |

Null Hypothesis: \( D(DRC) \) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-7.083243</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction) | 0.222120
HAC corrected variance (Bartlett kernel) | 0.213873
Phillips-Perron Test Equation
Dependent Variable: D(DRC,2)
Method: Least Squares
Date: 06/05/11   Time: 13:32
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(DRC(-1))</td>
<td>-0.806620</td>
<td>0.113671</td>
<td>-7.096094</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.062246</td>
<td>0.057600</td>
<td>-1.080655</td>
<td>0.2837</td>
</tr>
</tbody>
</table>

R-squared: 0.425455
Adjusted R-squared: 0.417006
S.E. of regression: 15.54837
S.D. dependent var: 0.626262
S.E. of regression: 15.54837
S.D. dependent var: 0.626262

Null Hypothesis: D(FFRI) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6.815939</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Test critical values:
1% level: -3.527045
5% level: -2.903566
10% level: -2.589227


Residual variance (no correction): 34.61378
HAC corrected variance (Bartlett kernel): 40.80216

Phillips-Perron Test Equation
Dependent Variable: D(FFRI,2)
Method: Least Squares
Date: 06/05/11   Time: 13:32
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(FFRI(-1))</td>
<td>-0.790627</td>
<td>0.118552</td>
<td>-6.669032</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.046443</td>
<td>0.713511</td>
<td>-0.065091</td>
<td>0.9483</td>
</tr>
</tbody>
</table>

R-squared: 0.395426
Adjusted R-squared: 0.386536
S.E. of regression: 5.969241
S.D. dependent var: 7.621219
S.E. of regression: 5.969241
S.D. dependent var: 7.621219

Residual variance (no correction): 34.61378
HAC corrected variance (Bartlett kernel): 40.80216

Null Hypothesis: D(FFRI) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6.815939</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Test critical values:
1% level: -3.527045
5% level: -2.903566
10% level: -2.589227

Null Hypothesis: FFRJ has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-5.387955</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.525618
- 5% level: -2.902953
- 10% level: -2.588902


Residual variance (no correction): 0.017669
HAC corrected variance (Bartlett kernel): 0.018605

Phillips-Perron Test Equation
Dependent Variable: D(FFRJ)
Method: Least Squares
Date: 06/05/11 Time: 13:32
Sample (adjusted): 2 72
Included observations: 71 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFRJ(-1)</td>
<td>-0.104655</td>
<td>0.019051</td>
<td>-5.493422</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.006992</td>
<td>0.018842</td>
<td>0.371103</td>
<td>0.7117</td>
</tr>
</tbody>
</table>

R-squared: 0.304279
Adjusted R-squared: 0.294196
S.E. of regression: 0.134839
Sum squared resid: 1.254533
Log likelihood: 42.53041
Prob(F-statistic): 0.000001

Null Hypothesis: D(FFRK) has a unit root
Exogenous: Constant
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-6.155937</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction): 2.860171
HAC corrected variance (Bartlett kernel): 0.651122
Phillips-Perron Test Equation
Dependent Variable: D(FFRK,2)
Method: Least Squares
Date: 06/05/11   Time: 13:33
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(FFRK(-1))</td>
<td>-0.693939</td>
<td>0.115420</td>
<td>-6.012321</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.094600</td>
<td>0.205654</td>
<td>-0.459997</td>
<td>0.6470</td>
</tr>
</tbody>
</table>

R-squared 0.347083
Adjusted R-squared 0.337481
S.E. of regression 1.715894
Sum squared resid 200.2120
Log likelihood -136.1065

Null Hypothesis: D(FFRM) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-5.836571</td>
</tr>
</tbody>
</table>

Test critical values:
1% level -3.527045
5% level -2.903566
10% level -2.589227


Residual variance (no correction) 0.375434
HAC corrected variance (Bartlett kernel) 0.375434

Phillips-Perron Test Equation
Dependent Variable: D(FFRM,2)
Method: Least Squares
Date: 06/05/11   Time: 13:33
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(FFRM(-1))</td>
<td>-0.666378</td>
<td>0.114173</td>
<td>-5.836571</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.041646</td>
<td>0.074743</td>
<td>-0.557191</td>
<td>0.5792</td>
</tr>
</tbody>
</table>

R-squared 0.333762
Adjusted R-squared 0.323964
S.E. of regression 0.621672
Sum squared resid 26.28039
Log likelihood -65.03717
F-statistic 34.06556
Prob(F-statistic) 0.000000
Null Hypothesis: D(FFRP) has a unit root
Exogenous: Constant
Bandwidth: 34 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th></th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-14.72195</td>
<td>0.0001</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.527045</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.903566</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.589227</td>
<td></td>
</tr>
</tbody>
</table>


Residual variance (no correction) | 4.829009
HAC corrected variance (Bartlett kernel) | 0.615842

Phillips-Perron Test Equation
Dependent Variable: D(FFRP,2)
Method: Least Squares
Date: 06/05/11   Time: 13:45
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(FFRP(-1))</td>
<td>-1.069565</td>
<td>0.12042</td>
<td>-8.881767</td>
<td>0.0000</td>
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<tr>
<td>C</td>
<td>-0.100729</td>
<td>0.266856</td>
<td>-0.377464</td>
<td>0.7070</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.537055</td>
<td>Mean dependent var</td>
<td>0.024029</td>
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<tr>
<td>Adjusted R-squared</td>
<td>0.530247</td>
<td>S.D. dependent var</td>
<td>3.253036</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>2.229583</td>
<td>Akaike info criterion</td>
<td>4.469661</td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>338.0306</td>
<td>Schwarz criterion</td>
<td>4.533904</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-154.4381</td>
<td>Hannan-Quinn criter.</td>
<td>4.495179</td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>78.88579</td>
<td>Durbin-Watson stat</td>
<td>1.973731</td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
<td>0.000000</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Null Hypothesis: D(FFRS) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th></th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-6.625105</td>
<td>0.0000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.527045</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.903566</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.589227</td>
<td></td>
</tr>
</tbody>
</table>


Residual variance (no correction) | 0.316771
HAC corrected variance (Bartlett kernel) | 0.316771
Phillips-Perron Test Equation
Dependent Variable: D(FFRS,2)
Method: Least Squares
Date: 06/05/11   Time: 13:46
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(FFRS(-1))</td>
<td>-0.768064</td>
<td>0.115932</td>
<td>-6.625105</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.029734</td>
<td>0.068295</td>
<td>-0.435373</td>
<td>0.6647</td>
</tr>
</tbody>
</table>

R-squared: 0.392271
Mean dependent var: 0.013714
Adjusted R-squared: 0.383334
S.D. dependent var: 0.727181
Sum squared resid: 22.17398

Null Hypothesis: D(FFRT) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6.600582</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction): 3.988244
HAC corrected variance (Bartlett kernel): 3.988244

Phillips-Perron Test Equation
Dependent Variable: D(FFRT,2)
Method: Least Squares
Date: 06/05/11   Time: 13:46
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(FFRT(-1))</td>
<td>-0.780634</td>
<td>0.115828</td>
<td>-6.600582</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-0.078481</td>
<td>0.242446</td>
<td>-0.323705</td>
<td>0.7472</td>
</tr>
</tbody>
</table>

R-squared: 0.390505
Mean dependent var: 0.003429
Adjusted R-squared: 0.381541
S.D. dependent var: 2.576500
Sum squared resid: 279.1771

Residual variance (no correction): 3.988244
HAC corrected variance (Bartlett kernel): 3.988244
Null Hypothesis: D(FFRU) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-3.694385</td>
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Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction): 0.119754
HAC corrected variance (Bartlett kernel): 0.133936

Phillis-Perron Test Equation
Dependent Variable: D(FFRU,2)
Method: Least Squares
Date: 06/05/11  Time: 13:46
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(FFRU(-1))</td>
<td>-0.312356</td>
<td>0.088055</td>
<td>-3.547291</td>
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<tr>
<td>C</td>
<td>-0.012146</td>
<td>0.042118</td>
<td>-0.288378</td>
<td>0.7739</td>
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</table>

R-squared: 0.156152
Mean dependent var: 0.000571

Adjusted R-squared: 0.143743
S.D. dependent var: 0.379435

S.E. of regression: 0.351107
Akaike info criterion: 0.772702

Sum squared resid: 8.382763
Schwarz criterion: 0.836945

Log likelihood: -25.04458
Hannan-Quinn criter.: 0.798220

F-statistic: 12.58327
Durbin-Watson stat: 2.092057

Prob(F-statistic): 0.000710

Null Hypothesis: D(GDPFC) has a unit root
Exogenous: Constant
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-14.67321</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


Residual variance (no correction): 74114823
HAC corrected variance (Bartlett kernel): 53081339
Phillips-Perron Test Equation
Dependent Variable: D(GDPFC,2)
Method: Least Squares
Date: 06/05/11   Time: 13:47
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(GDPFC(-1))</td>
<td>-1.540780</td>
<td>0.113858</td>
<td>-13.53244</td>
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<tr>
<td>C</td>
<td>2422.602</td>
<td>1054.055</td>
<td>2.298365</td>
<td>0.0246</td>
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</table>

R-squared 0.729220
Adjusted R-squared 0.725238
S.E. of regression 8734.682
Sum squared resid 5.19E+09
Log likelihood -733.5651
F-statistic 183.1268

Null Hypothesis: GDPFI has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5.218303</td>
<td>0.0000</td>
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</table>

Test critical values:
1% level -3.525618
5% level -2.902953
10% level -2.588902


Residual variance (no correction) 37432.98
HAC corrected variance (Bartlett kernel) 37432.98

Phillips-Perron Test Equation
Dependent Variable: D(GDPFI)
Method: Least Squares
Date: 06/05/11   Time: 13:47
Sample (adjusted): 2 72
Included observations: 71 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDPFI(-1)</td>
<td>-0.552419</td>
<td>0.105862</td>
<td>-5.218303</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>732.4273</td>
<td>141.8330</td>
<td>5.164012</td>
<td>0.0000</td>
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</table>

R-squared 0.282973
Adjusted R-squared 0.272581
S.E. of regression 196.2600
Sum squared resid 2657741.
Log likelihood -474.5705
F-statistic 27.23069

Prob(F-statistic) 0.000002
Null Hypothesis: $D(GDPFJ)$ has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test critical values:</td>
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<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.527045</td>
<td>0.0000</td>
</tr>
<tr>
<td>5% level</td>
<td>-2.903566</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.589227</td>
<td></td>
</tr>
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</table>


Residual variance (no correction) 27963357
HAC corrected variance (Bartlett kernel) 29156607

Phillips-Perron Test Equation
Dependent Variable: $D(GDPFJ,2)$
Method: Least Squares
Date: 06/05/11   Time: 13:47
Sample (adjusted): 372
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D(GDPFJ(-1))$</td>
<td>-0.803707</td>
<td>0.118621</td>
<td>-6.775412</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>804.8523</td>
<td>651.5531</td>
<td>1.235283</td>
<td>0.2210</td>
</tr>
</tbody>
</table>

R-squared 0.403018  Mean dependent var 23.60173
Adjusted R-squared 0.394238  S.D. dependent var 6893.478
S.E. of regression 5365.241  Akaike info criterion 20.04143
Sum squared resid 1.96E+09  Schwarz criterion 20.10567
Log likelihood -699.4499  Hannan-Quinn criter. 20.06694
F-statistic 45.90621  Durbin-Watson stat 2.046752
Prob(F-statistic) 0.000000

Null Hypothesis: $D(GDPFK)$ has a unit root
Exogenous: Constant
Bandwidth: 18 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test critical values:</td>
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</tr>
<tr>
<td>1% level</td>
<td>-3.527045</td>
<td>0.0001</td>
</tr>
<tr>
<td>5% level</td>
<td>-2.903566</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.589227</td>
<td></td>
</tr>
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</table>


Residual variance (no correction) 1.33E+08
HAC corrected variance (Bartlett kernel) 46682867

Phillips-Perron Test Equation
Dependent Variable: D(GDPFK,2)
Method: Least Squares
Date: 06/05/11 Time: 13:48
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(GDPFK(-1))</td>
<td>-1.632495</td>
<td>0.093501</td>
<td>-17.45968</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>2809.583</td>
<td>1407.884</td>
<td>1.995606</td>
<td>0.0500</td>
</tr>
</tbody>
</table>

R-squared 0.817616  Mean dependent var -140.6300
Adjusted R-squared 0.814934  S.D. dependent var 27183.31
S.E. of regression 9.30E+09  Schwarz criterion 21.66395
Log likelihood -753.9897  Hannan-Quinn criter. 21.62522
F-statistic 304.8403  Durbin-Watson stat 2.049688
Prob(F-statistic) 0.000000

Null Hypothesis: D(GDPFM) has a unit root
Exogenous: Constant
Bandwidth: 19 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th></th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-10.77280</td>
<td>0.0001</td>
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</tbody>
</table>

Test critical values:
- 1% level -3.527045
- 5% level -2.903566
- 10% level -2.589227


Residual variance (no correction) 16465931
HAC corrected variance (Bartlett kernel) 3260607.

Phillips-Perron Test Equation
Dependent Variable: D(GDPFM,2)
Method: Least Squares
Date: 06/05/11 Time: 13:48
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(GDPFM(-1))</td>
<td>-0.982952</td>
<td>0.120813</td>
<td>-8.136174</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>1404.816</td>
<td>522.7183</td>
<td>2.687520</td>
<td>0.0090</td>
</tr>
</tbody>
</table>

R-squared 0.493284  Mean dependent var -29.74483
Adjusted R-squared 0.485832  S.D. dependent var 5741.629
S.E. of regression 4117.065  Akaike info criterion 19.51182
Sum squared resid 1.15E+09  Schwarz criterion 19.57607
Log likelihood -680.9138  Hannan-Quinn criter. 19.53734
F-statistic 66.19733  Durbin-Watson stat 1.988142
Prob(F-statistic) 0.000000
Null Hypothesis: $\text{D}(\text{GDPFP})$ has a unit root  
Exogenous: Constant  
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-27.63092</td>
<td>0.0001</td>
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</table>

Test critical values:  
1% level: -3.527045  
5% level: -2.903566  
10% level: -2.589227


Residual variance (no correction): 6213.797  
HAC corrected variance (Bartlett kernel): 2817.631

Phillips-Perron Test Equation  
Dependent Variable: $\text{D}(\text{GDPFP}, 2)$  
Method: Least Squares  
Date: 06/05/11  Time: 13:48  
Sample (adjusted): 372  
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{D}(\text{GDPFP}(-1))$</td>
<td>-1.756574</td>
<td>0.086777</td>
<td>-20.24235</td>
<td>0.0000</td>
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<tr>
<td>C</td>
<td>29.72158</td>
<td>9.643497</td>
<td>3.082033</td>
<td>0.0030</td>
</tr>
</tbody>
</table>

R-squared: 0.857667  
Adjusted R-squared: 0.855574  
S.E. of regression: 79.97847  
Log likelihood: -405.0342  
F-statistic: 409.7528  
Prob(F-statistic): 0.000000

Null Hypothesis: $\text{D}(\text{GDPFS})$ has a unit root  
Exogenous: Constant  
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-5.775280</td>
<td>0.0000</td>
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</tbody>
</table>

Test critical values:  
1% level: -3.527045  
5% level: -2.903566  
10% level: -2.589227


Residual variance (no correction): 2897822.  
HAC corrected variance (Bartlett kernel): 883441.4
Phillips-Perron Test Equation
Dependent Variable: D(GDPFS,2)
Method: Least Squares
Date: 06/05/11   Time: 13:48
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(GDPFS(-1))</td>
<td>-0.870997</td>
<td>0.135360</td>
<td>-6.434677</td>
<td>0.0000</td>
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<tr>
<td>C</td>
<td>444.4243</td>
<td>223.6841</td>
<td>1.986838</td>
<td>0.0510</td>
</tr>
</tbody>
</table>

R-squared: 0.378457
Adjusted R-squared: 0.369316
S.D. dependent var: 2174.826
Akaike info criterion: 17.77449
Schwarz criterion: 17.83873
Log likelihood: -620.1071
Durbin-Watson stat: 1.686140

Phillips-Perron test statistic: -8.178951
Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227

Null Hypothesis: D(GDPFS) has a unit root
Exogenous: Constant
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel


Residual variance (no correction): 4966.780
HAC corrected variance (Bartlett kernel): 1628.075

Phillips-Perron Test Equation
Dependent Variable: D(GDPFT,2)
Method: Least Squares
Date: 06/05/11   Time: 13:49
Sample (adjusted): 3 72
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(GDPFT(-1))</td>
<td>-0.931747</td>
<td>0.123476</td>
<td>-7.545965</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>14.95708</td>
<td>8.708030</td>
<td>1.717619</td>
<td>0.0904</td>
</tr>
</tbody>
</table>

R-squared: 0.455746
Adjusted R-squared: 0.447742
S.D. dependent var: 96.21904
Akaike info criterion: 56.94158
Schwarz criterion: 11.40555
Hannan-Quinn crit.: 11.43107
Durbin-Watson stat: 1.832992
Null Hypothesis: D(GDPFU) has a unit root  
Exogenous: Constant  
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

<table>
<thead>
<tr>
<th>Phillips-Perron test statistic</th>
<th>Adj. t-Stat</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips-Perron test statistic</td>
<td>-4.699487</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.527045
- 5% level: -2.903566
- 10% level: -2.589227


<table>
<thead>
<tr>
<th>Residual variance (no correction)</th>
<th>4192.584</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAC corrected variance (Bartlett kernel)</td>
<td>3749.749</td>
</tr>
</tbody>
</table>

Phillips-Perron Test Equation
Dependent Variable: D(GDPFU,2)
Method: Least Squares  
Date: 06/05/11   Time: 13:49  
Sample (adjusted): 3 72  
Included observations: 70 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(GDPFU(-1))</td>
<td>-0.512030</td>
<td>0.105997</td>
<td>-4.830589</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>36.10406</td>
<td>10.75160</td>
<td>3.358019</td>
<td>0.0013</td>
</tr>
</tbody>
</table>

R-squared: 0.255485  
Adjusted R-squared: 0.244536  
S.E. of regression: 65.69547  
Sum squared resid: 293480.9  
Log likelihood: -391.2632  
Prob(F-statistic): 0.000008

Durbin-Watson stat: 2.207912