A natural economic experiment

An analysis of the macroeconomic consequences of the Indian Ocean tsunami in Sri Lanka
Abstract: In this thesis we analyze the macroeconomic impact of the tsunami in 2004 on the Sri Lankan economy. The theoretical framework we use, the Australian model of a developing economy, gives direct or indirect predictions for the development of a number of variables after a natural disaster. In our case, we believe that the main reason for the contradictory developments of the output variables and the exchange rate is the extraordinary large and rapid inflow of foreign aid money. In summary, we find the overall impact of the tsunami on the Sri Lankan economy to be minor.

Keywords: Tsunami, the Australian model of a developing economy, external balance, internal balance, foreign aid, real effective exchange rate, real gross national product, real gross domestic expenditure, current account, inflation, policy interest rates.
'Sociologist, psychologists, historians, and policy planners have all devoted considerable attention to the nature, sources, and consequences of disaster and recovery, but the professional economic literature is distressingly sparse. ...Yet disasters are natural economic experiments; they parallel the tests to destruction from which engineers and physicist learn about the strength of material and machines. Much light would be thrown upon the normal everyday economy if we understood behaviour under conditions of great stress.'

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# TABLE OF CONTENTS

1. Introduction ........................................................................................................ p. 1

2. The Australian model of a developing economy ................................................. p. 4
   2.1 Derivation of the EB- and IB curve .............................................................. p. 5
   2.2 Combining the EB- and IB curve ................................................................. p. 7
   2.3 Course of events for a natural disaster ......................................................... p. 7

3. The Sri Lankan macroeconomic status pre- and post tsunami ......................... p. 9
   3.1 Real Effective Exchange Rate (REER) ....................................................... p. 9
      Pre tsunami .................................................................................................... p. 9
      Post tsunami .................................................................................................. p. 10
      Predictions versus outcomes for the REER .............................................. p. 11
   3.2 Real Gross National Product (GNP) .......................................................... p. 11
      Pre tsunami .................................................................................................... p. 11
      Post tsunami .................................................................................................. p. 12
      Predictions versus outcomes for the real GNP .......................................... p. 12
   3.3 Real Gross Domestic Expenditure (GDE) .................................................... p. 13
      Pre tsunami .................................................................................................... p. 13
      Post tsunami .................................................................................................. p. 13
      Predictions versus outcomes for the real GDE .......................................... p. 14
   3.4 Current Account (CA) .................................................................................. p. 14
      Pre tsunami .................................................................................................... p. 14
      Post tsunami .................................................................................................. p. 15
      Predictions versus outcomes for the CA .................................................... p. 15
   3.5 Inflation .......................................................................................................... p. 16
      Pre tsunami .................................................................................................... p. 16
      Post tsunami .................................................................................................. p. 16
      Predictions versus outcomes for the inflation ........................................... p. 17
   3.6 Policy interest rates ...................................................................................... p. 17
      Pre tsunami .................................................................................................... p. 17
      Post tsunami .................................................................................................. p. 18
      Predictions versus outcomes for the policy interest rates ....................... p. 18
      Summary: predictions versus outcomes in the short- and medium run ...... p. 18

4. Interpreting the outcomes in Sri Lanka in terms of the model ......................... p. 19
   4.1 The position of the Sri Lankan economy pre tsunami ............................... p. 19
   4.2 Analyzing the development of the variables within the model ................. p. 20
      The shifts of the EB curve and their implications for the variables in the short run p. 20
      The shift of the IB curve and its implications for the variables in the short run p. 21
      The impact of the EB- and IB shifts in the medium run ............................ p. 23
   4.3 The position of the Sri Lankan economy post tsunami (short- and medium run) p. 26
5. Conclusions

References

Appendix

Appendix 1. Qualitative Assessment of the Effects of the Earthquake and Tsunami of December 26th 2004 (Predictions from Jan. 2005)

Appendix 2. The Real Effective Exchange Rate

Appendix 3. Current Account and its Components (Rs. mn)

Appendix 4. Preliminary Estimates of Losses (million US dollar)

Figures

Figure 1a. Tradable Market p. 5
Figure 1b. Nontrable Market p. 5
Figure 2a. External Balance p. 6
Figure 2b. Internal Balance p. 6
Figure 3. EB, IB and the zones of imbalance p. 7
Figure 4. Course of events for a natural disaster p. 8
Figure 5. Development of the Real Effective Exchange Rate from 1999 - Nov. 2004 (1999=100) p. 9
Figure 6. Development of the Real Effective Exchange Rate from Dec. 2004 – Dec. 2005 (1999=100) p. 10
Figure 7. The zones of imbalance p. 20
Figure 8. The position of the Sri Lankan economy pre tsunami p. 20
Figure 9. Course of events in the Sri Lankan economy after the tsunami p. 24
Figure 10. The position of the Sri Lankan economy in the short run p. 27
Figure 11. The position of the Sri Lankan economy in the medium run p. 27

Tables

Table 1. Predicted development for the variables p. 8
Table 2. Average REER index value and percent change from 2000-2004 p. 10
Table 3. Average REER index value for the first and second half of 2004 p. 10
Table 4. Average REER index value for the first and second half of 2005 p. 11
Table 5. Real GNP growth from 1996-2004 p. 12
Table 6. GNP at constant (1996) prices (Rs. mn) for the first and second half of 2004 p. 12
Table 7. GNP at constant (1996) prices (Rs. mn) and real GNP growth for the first and second half of 2005 p. 12
Table 8. Real GDE growth from 2002-2004 p. 13
Table 9. Real GDE (Rs. mn) for the first and second half of 2004 p. 13
Table 10. GDE components expressed as percent of GDP for 2003 and 2004 p. 13
Table 11. Real GDE and real GDE growth for the first and second half of 2005 p. 14
Table 12. GDE components expressed as percent of GDP for 2004 and 2005 p. 14
Table 13. CA (Rs. mn), real GNP and CA as percent of GNP for 2001-2004 p. 15
Table 14. CA (Rs. mn) and CA as percent of GNP for the first and second half of 2004 p. 15
Table 15. CA (Rs. mn) and CA as percent of GNP for the first and second half of 2005 p. 15
Table 16. Percent change in the SLCPI from 2001-2004 (1995-1997=100) p. 16
Table 17. Average index value of the SLCPI and the percent change for the first and second half of 2004 (1995-1997=100) p. 16
Table 18. Average index value of the SLCPI and the percent change for the first and second half of 2005 (1995-1997=100) p. 17
Table 19. Changes in the policy interest rates at various dates for 2002-2004 (close of business) p. 17
Table 20. Predictions, short- and medium run outcomes for the selected variables p. 18

Abbreviations
ADB Asian Development Bank
CA Current Account (trade balance, services- and income account, current transfer account)
EB External Balance
GDE Gross Domestic Expenditure (consumption + investment + government expenditure)
GDP Gross Domestic Product
GNP Gross National Product (Gross Domestic Product + net factor income from abroad)
IB Internal Balance
**IMF**  International Monetary Fund

**REER**  Real Effective Exchange Rate

**SLCPI**  Sri Lankan Consumer Price Index
1. Introduction

On 26th of December 2004 one of the worst global natural disasters in human history hit the world. The seismic movement in the sea outside the island of Sumatra in Indonesia induced the tsunami that within a few hours reached the coastlines of Malaysia, Myanmar and Thailand as well as Bangladesh, India, Maldives and Sri Lanka. It also affected the coastal areas of Seychelles, Kenya, Somalia and Tanzania. The death toll, as of December 2005, was approximately 184 233 people, where Indonesia was most affected in terms of loss of human lives.1

The economic effects of the tsunami were insignificant in Indonesia. Maldives and Sri Lanka on the other hand, were pointed out as the two countries where the tsunami was expected to have the greatest impact on the overall economy (Appendix I). According to previous research, some of the main reasons for these two countries vulnerability are the country size and structure of economics.2 For small developing countries, macroeconomic management after a natural disaster is complicated since they often have to rely on massive aid inflow to finance the reconstruction activities.3 Further, the economies of Maldives and Sri Lanka were not in a position to easily overcome the tragedy. For example, the government in Sri Lanka was running a budget deficit of over 8% of GDP at the time of the tsunami. In addition, the International Monetary Fund (IMF) and the World Bank had demonstrated their doubts about the credibility of the new government in Sri Lanka by suspending some of the previously approved credit lines. Under these circumstances there was little degree of freedom for the government to manage the unanticipated devastation and rebuild the economy on its own.4 For Maldives, the major fragility of the economy is the large dependence on tourism, a sector that was badly affected by the tsunami.5

4 Ibid., p. 28
The purpose of this thesis is to analyze the macroeconomic consequences of the tsunami. This will be done by making a single case study of Sri Lanka, focusing on the changes in a number of selected economic variables. The analysis will be divided into short- (first half of 2005) and medium run (second half of 2005) effects. The variables we have chosen to analyze are: the Real Effective Exchange Rate (REER), real Gross National Product (GNP) real Gross Domestic Expenditure (GDE), Current Account (CA), inflation and policy interest rates. The reason for selecting these six variables is their direct or indirect presence in the model we will use for our analysis.

Starting with the exchange rate and GDE, these variables appear directly on the axis in the model which makes them natural for us to study. However, there is another reason to focus on the level of GDE. To stabilize an exogenous shock, like the tsunami, a country can use fiscal- and monetary policy. The fiscal policy instruments a government can use are changes in taxes and government spending. Since the impact on the economy, using taxes as a stabilization tool, often is delayed we assume that they are not commonly used as an immediate response to get the economy back into balance after a natural disaster. Government expenditure on the other hand is in our opinion more likely to be affected due to an increased demand for health services and infrastructure restoration.

The kind of economical imbalances a natural disaster often causes is an external deficit and inflation. An external deficit is often measured as a CA deficit. Another way of seeing it is that the expenditure side (GDE) in the economy is greater than income side (GNP). For this reason we find it natural to include the GDE, the GNP as well as the discrepancy between them: the CA. Additionally, the model gives us predictions for GNP which makes this variable interesting to study.

To control the inflation a country can use monetary policy, which provides two instruments to stabilize the economy: exchange rate interventions and interest rates. The main component in the Sri Lankan monetary policy is the interest rate corridor formed by the repo rate

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6 Some economic textbooks use the term ‘absorption’ instead of GDE (Consumption + Investment + Government expenditure).
8 It is hard to determine if the increase in GDE should be seen as an *active* or *passive* operation from the government.
10 We use GNP (GDP + net factor income from abroad) because it tracks national income more closely than GDP, (Krugman, R. P, Obstfeldt, M., (2003), p. 298). In practical matters, as for Sri Lanka, they usually do not differ greatly.
(selling/borrowing rate) and the reversed repo rate (buying/lending rate). We will use the repo and reversed repo rate as the definition of the policy interest rates.

The most frequently used model for analysing goods- and financial markets in a small open economy is the Mundell-Fleming model. Being aware of the more universal field of application of this model, we do not find it to be the most suitable framework for analyzing the unusual circumstances related to a natural disaster. We therefore choose to adopt a model that has previously been used for analyzing natural disasters in developing countries called the Australian model of a developing economy. This model is derived from the markets for tradable- and nontradeable goods and services and illustrates a country’s external- and internal balance. Tradable goods are those whose prices within the country are determined by supply and demand on world markets (exported- and imported goods). Nontradable goods and services are those who are not easily bought or sold outside the country, such as transportation, construction and household services. Prices for nontradables are therefore determined by market forces within the economy.

Due to the short period of time since the tsunami catastrophe occurred, research on the impacts on the affected countries economies has so far been difficult to conduct. The information available at the moment is therefore to a large extent reports and forecasts. The main part of this material is published by the IMF and the Asian Development Bank (ADB). The area of focus for the IMF is the macroeconomic impact of the tsunami and for the ADB to restore the infrastructure. This distribution of responsibility is also reflected in their reports.

Even if the key part of the available material on this subject is reports and forecasts, a small number of papers about the impact of the tsunami have been published. Yet, these papers are written in general terms and none of them use an economic theory or model for their analysis. Athukorala and Resosudarmo (2005) have written a paper which focuses on the impact of the tsunami in Sri Lanka and Indonesia. They take a closer look at the history of natural disasters, preparedness, the economic impact and the crisis management experience in these two countries. Their main conclusion about the economic impact is that they expect the output

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losses due to the tsunami to a large extent will be offset by higher investment growth, which heavily will rely on foreign aid.

Inderfurth, Fabrycky and Cohen (2005) have studied a number of different aspects of the impact of the tsunami such as the international response, economic impact and recovery, health issues, education and the separatist conflicts in Indonesia (Aceh) and Sri Lanka. Their conclusion about the economic impact in Sri Lanka is that the affected areas have suffered major losses in economic assets but due to a surge in donor support the future prospects are bright for the country. As we can conclude, both of these papers stress the importance of foreign aid for the Sri Lankan economy to recover after the tsunami.

Concerning the disposition of this thesis we will in section two present the theoretical framework that will be used for analyzing the impact of the tsunami on the selected macroeconomic variables. This section will also include a presentation of the predicted development for the variables in the model after the tsunami. In section three we will present the data for the variables pre and post tsunami and compare the actual outcomes with the predictions. In section four we use the model to analyze the actual development of the variables. In the conclusion part, section five, we will review some key findings, discuss the advantages and disadvantages of this thesis and also the prospects for generalization of our conclusions to other cases.

2. The Australian model of a developing economy

As previously mentioned, the most widely used model for analyzing changes in goods- and financial markets in an open economy is the Mundell-Fleming model. For our analysis we will use a modification of this more general model called the Australian model of a developing economy. This model is based on two central features of developing economies that provide implications for how macroeconomic imbalances occur and can be corrected. First, they are open economics in the sense that the trade- and capital flows are large enough to have an impact on the country’s economy. Second, these are small economies meaning that their import and export have an insignificant influence on the world prices.

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16 The model was developed by Australian economists, W. E. G. Salter, Trevor. W. Swan, W. Max Corden.
17 China and India are exceptions to the small country rule.
The model consists of two curves, External Balance (EB) and Internal Balance (IB), illustrating equilibrium in the market for tradable- and nontradable goods and services. EB is defined as balance in a country’s Current Account (CA).\textsuperscript{19} This often means that the CA should be in balance over some period of time and not necessarily for one single year.\textsuperscript{20} IB requires full employment of a country’s resources and domestic price level stability.\textsuperscript{21} Price level stability is referred to ‘a situation where the general price level covering consumer goods remains unchanged or if it does change, it happens at a low rate so that it is not strong enough to make any significant influence on economic decisions of participants in an economy’.\textsuperscript{22}

In the following section, 2.1, we will show how to derive the EB- and IB curve. In section 2.2, the two curves are put together and the properties of the full model are discussed. Finally, in section 2.3, the model is used to illustrate the course of events in a country’s economy induced by a natural disaster.

2.1 Derivation of the EB- and IB curve

We start by illustrating the markets for tradable- and nontradable goods and services using conventional supply- and demand diagrams. \textit{Figure 1a} and \textit{1b} show the demand and supply for tradables (\(D_t\) and \(X_t\)) and nontradables (\(D_n\) and \(X_n\)) as a function of the relative price of tradables (\(T\)) in terms of nontradables (\(N\)). This way of measuring the price leads to a reversed supply- and demand curve in the diagram for nontradables.

\textit{Figure 1a. Tradable Market.} \hspace{1cm} \textit{Figure 1b. Nontradable Market.}\textsuperscript{23}

\textsuperscript{19} Krugman, R. P, Obstfeldt, M., (2003), p. 533
\textsuperscript{21} Krugman, R. P, Obstfeldt, M., (2003), p. 533
\textsuperscript{22} Central bank of Sri Lanka, (2005), \textit{Price stability}, \url{http://www.centralbanklanka.org/Price-Stability.pdf} (060423) p. 2
The variables on the axis, price and quantity, are the two conventional variables of microeconomics but can also be seen as two macroeconomic policy tools for a country: the exchange rate ($P = eT/Pn$) and the level of Gross Domestic Expenditure (GDE).\textsuperscript{24} Figure 1a and 1b, are further developed into Figure 2a and 2b, using these two variables explicitly on the axes. The two curves, EB and IB, represent equilibrium in the markets for tradables and nontradables.\textsuperscript{25}

\textit{Figure 2a. External Balance.} \hspace{1cm} \textit{Figure 2b. Internal Balance.}\textsuperscript{26}

Starting with the tradable market, in Figure 2a GDE is at A1 and the equilibrium price is at P1. In Figure 1a, quantity T1 of tradables is produced and consumed. If GDE increases to A2 the demand curve shifts outward and with higher GDE the real exchange rate must depreciate to P2 to attain equilibrium. Put differently, the increased GDE leads to a higher demand for tradables and a raise in output. For this to be achieved the relative price must increase to P2.\textsuperscript{27}

In the nontradeable market, equilibrium occurs when GDE is A1 in Figure 2a, the price is P1 and the produced and consumed quantity in Figure 1b is N1. If GDE increases to A3 the demand curve shifts outward. This requires an appreciated real exchange rate to restore equilibrium, P3. Conversely, an increased GDE leads to a higher demand for nontradables which must be met by a raise in output, N3 and this can only be achieved by a higher relative price, P3.\textsuperscript{28} Summing up, a shift in the demand curves in Figure 1a and 1b is represented by a movement along the EB- and the IB curve in Figure 2a and 2b and a shift in the supply curves are represented by a shift in the EB- and the IB curve.

\textsuperscript{25} Ibid., p. 741  
\textsuperscript{26} Ibid., p. 741  
\textsuperscript{27} Ibid., pp. 741  
\textsuperscript{28} Ibid., p. 742
2.2 Combining the EB- and IB curve

The two curves, EB and IB, are put together in Figure 3. The only point where there is equilibrium in both markets is where the two curves intersect. The purpose of macroeconomic policy is to regulate the exchange rate and GDE to keep the overall economy in balance.\(^{29}\) Figure 3 also illustrates the four zones of imbalance. Zone A is a region of external surplus (the supply for tradables is greater than the demand) and inflation (the demand for nontradables is greater than the supply). In this zone the exchange rate is undervalued. In zone B we have external deficit and inflation as well as principally excessive expenditure (GDE>GNP). In zone C the exchange rate is overvalued and unemployment and external deficit prevail. In zone D, due to insufficient GDE, there is unemployment but an external surplus.\(^{30}\)

\[\text{Figure 3. } \text{EB, IB and the zones of imbalance.}\] \(^{31}\)

2.3 Course of events for a natural disaster

The combined model of EB and IB can be used to illustrate the course of events for the economy after a natural disaster.\(^{32}\) A natural disaster, like the tsunami, reduces a country’s ability to produce both tradables and nontradables (\(\Delta Y<0\)). This decrease in supply is illustrated by a leftward shift in both the EB- and IB curve. The reduced output of nontradeables at any given price leads to a larger area (zone A and B) which means a higher inflation rate. Reduced output of tradables also causes an excess demand in the tradable market which enlarges the area of external deficit (zone B and C).\(^{33}\) Since zone B is enlarged by both shifts, a natural disaster severely increases the risk for inflation and external deficit.

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\(^{30}\) Ibid., p. 743

\(^{31}\) Ibid., p. 743

\(^{32}\) Our source of origin uses a drought for illustrating the impact on a country’s economy of a natural disaster. We assume that the course of events in a country’s economy will be similar for the tsunami.

The leftward shift of the EB- and IB curve leads to a lower level of GDE.\textsuperscript{34} The EB curve shifts back to the right as an effect of foreign aid coming into the country and the aid package adds to the economy’s capacity to produce tradables. The decrease in GDE is also offset by an increase in government expenditure due to a raise in demand for health services and other necessities ($\Delta G>0$).\textsuperscript{35}

**Figure 4. Course of events for a natural disaster.\textsuperscript{36}**

In *Figure 4* the economy begins in equilibrium at point 1. As the natural disaster strikes, both curves shift leftward and a depreciation of the real exchange rate occurs, point 2. In the model the real exchange rate is restored when foreign aid comes into the country (the EB curve shifts to the right) at point 3. This course of events for a natural disaster is expected to proceed for about one year.\textsuperscript{37} In summary, this leads us to the following hypothesis about the development of the six selected variables:

**Table 1. Predicted development for the variables.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Predicted development</th>
</tr>
</thead>
<tbody>
<tr>
<td>REER</td>
<td>$\uparrow$ depreciate, $\downarrow$ appreciate, ($\rightarrow$ unchanged)</td>
</tr>
<tr>
<td>Real GNP</td>
<td>$\downarrow$</td>
</tr>
<tr>
<td>Real GDE</td>
<td>$\downarrow$ ($G\uparrow$)</td>
</tr>
<tr>
<td>CA</td>
<td>$\uparrow$ increased deficit</td>
</tr>
<tr>
<td>Inflation</td>
<td>$\uparrow$</td>
</tr>
<tr>
<td>Policy interest rates</td>
<td>$\uparrow$\textsuperscript{38}</td>
</tr>
</tbody>
</table>

\textsuperscript{34} Decreased capacity for a country to produce tradables and nontradables also means decreased capacity to buy tradables and nontradables. The opposite situation causes a rightward shift of the curves.

\textsuperscript{35} Perkins D. H, et al., (2001), pp. 759

\textsuperscript{36} Ibid., p. 759

\textsuperscript{37} Ibid., p. 760

\textsuperscript{38} Assuming that the Central Bank stresses the importance of controlling the inflation ahead of stimulating the GNP growth.
Notice, the prediction for the development of the real exchange rate and GDE is a result of the shape of the curves and the shifts in this particular model.

### 3. The Sri Lankan macroeconomic status pre- and post tsunami

In order to produce an accurate analysis of the economic impact of the tsunami we find it essential to picture the economic situation in Sri Lanka before and after the 26\textsuperscript{th} of December 2004. We will in the following sections (3.1-3.6) present data over the six variables pre- and post tsunami and compare the actual outcomes in the short- and medium run with the predictions from the model. To avoid problems with seasonal bias, we will make a comparison between the same periods in 2004 and 2005.

#### 3.1 Real Effective Exchange Rate (REER)

**Pre tsunami**

The Sri Lankan currency has been under a highly flexible, managed floating regime since 2001. The REER will be used as our measurement for the exchange rate (Appendix 2). An appreciation/depreciation of the Sri Lankan currency, the rupee, against other currencies is directly reflected by a raise/fall in the REER index value.\(^{39}\)

*Figure 5. Development of the Real Effective Exchange Rate from 1999-Nov. 2004 (1999=100).*\(^{40}\)

Notice, an appreciation of the REER is illustrated by an upward movement on the y-axis in this diagram, while it is illustrated by a downward movement on the y-axis in the Australian model of a developing economy.

As can be observed in *Figure 5* the changes in the Sri Lankan exchange rate have been quite moderate from 2001 to 2003. Even if instability in the exchange rate would occur it is not

\(^{39}\) Central Bank of Sri Lanka, (2006), *Real Effective Exchange Rate (REER).*

\(^{40}\) Ibid.
unusual for weak economies with floating exchange rates. As Table 2 presents, the REER index was also quite stable in terms of annual average values during the period of 2001-2003. In 2004 the index value made a noteworthy drop, but as the table shows the depreciation started already in 2003. Table 3 contains average values for the REER index in the first and second half of 2004. These values will be used for making a comparison with the same periods in 2005.

### Table 2. Average REER index value and percent change from 2000-2004.

<table>
<thead>
<tr>
<th>Year</th>
<th>REER average index value</th>
<th>Percent change in REER from the year before</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>98.40</td>
<td>n/a</td>
</tr>
<tr>
<td>2001</td>
<td>99.19</td>
<td>0.80</td>
</tr>
<tr>
<td>2002</td>
<td>99.33</td>
<td>0.14</td>
</tr>
<tr>
<td>2003</td>
<td>97.25</td>
<td>-2.09</td>
</tr>
<tr>
<td>2004</td>
<td>93.73</td>
<td>-3.62</td>
</tr>
</tbody>
</table>

### Table 3. Average REER index value for the first and second half of 2004.

<table>
<thead>
<tr>
<th>Half-year</th>
<th>Average REER</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2004</td>
<td>93.87</td>
</tr>
<tr>
<td>Second half of 2004</td>
<td>93.35</td>
</tr>
</tbody>
</table>

**Post tsunami**

The Sri Lankan rupee began to appreciate strongly right after the tsunami. As a response to the appreciation, exporters started to put pressure on the Central Bank to intervene in the foreign exchange market. In the initial phase the Central Bank resisted these demands but from about the third week in January 2005 it began to “lean against the wind”.

**Figure 6. Development of the Real Effective Exchange Rate from Dec. 2004 - Dec. 2005 (1999=100).**

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42 Central Bank of Sri Lanka, (2006), *Real Effective Exchange Rate (REER)*.
43 Ibid.
44 To ‘lean against the wind’ means to buy assets when selling pressure in the market is large and creating liquidity, Weill P-O, *Leaning against the wind*, (NYU Stern School of Business) [www.u-cergy.fr/IMG/pdf/doc-3381.pdf](http://www.u-cergy.fr/IMG/pdf/doc-3381.pdf) (060329).
45 Central Bank of Sri Lanka, (2006), *Real Effective Exchange Rate (REER)*.
As illustrated in Figure 6 the initial strong appreciation of the exchange rate was moderated in February 2005. The Central Bank explains the moderation by the interventions in the foreign exchange market. Nevertheless, as we can read out from Table 4, the development of the REER index exhibits a positive trend all through 2005.

**Table 4. Average REER index value for the first and second half of 2005.**

<table>
<thead>
<tr>
<th>Half-year</th>
<th>Average REER</th>
<th>Percent change from the same period in 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2005</td>
<td>100.50</td>
<td>7.06</td>
</tr>
<tr>
<td>Second half of 2005</td>
<td>103.52</td>
<td>10.89</td>
</tr>
</tbody>
</table>

**Predictions versus outcomes for the REER**

According to the model the EB- and the IB curve both shift to the left which leads to a depreciation of the exchange rate. When foreign aid comes into the country the EB curve shifts to the right and causes an appreciation. Comparing the average REER index value for the first six months in 2004 with the average REER index value for the same period in 2005 we notice an appreciation of the real exchange rate by 7.06% (*Table 4*). Comparing the average REER index value for the last six months in 2004 and the value for the same period in 2005 the real exchange rate has appreciated by 10.89% (*Table 4*). Hence, we can conclude that the actual development of the REER in the short- and medium run contradicts the predictions from the model since the rupee appreciated all through 2005. However, looking at the annual average REER values from 2000 to 2004 (*Table 2*) the appreciation can be seen as a return to a ‘normal’ value after the depreciation in 2003 and 2004. This makes the development of the REER after the tsunami less extraordinary than it first appears to be.

### 3.2 Real Gross National Product (GNP)

**Pre tsunami**

The GNP grew by 5.22% in real terms in 2004. In comparison to the year before (6.63%) this was a minor reduction in growth. *Table 5* presents the real GNP growth for 1996-2004. As we can see in the table, the level of economic growth has been stable around 4-6% in the latest three years. *Table 6* presents the level of GNP for the first and second half of 2004.

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46 Central Bank of Sri Lanka, (2006), *Real Effective Exchange Rate (REER).*
Tabel 5. Real GNP growth from 1996-2004.47

<table>
<thead>
<tr>
<th>Year</th>
<th>Real GNP growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>3.2</td>
</tr>
<tr>
<td>1997</td>
<td>6.8</td>
</tr>
<tr>
<td>1998</td>
<td>4.6</td>
</tr>
<tr>
<td>1999</td>
<td>3.8</td>
</tr>
<tr>
<td>2000</td>
<td>5.8</td>
</tr>
<tr>
<td>2001</td>
<td>-1.0</td>
</tr>
<tr>
<td>2002</td>
<td>4.13</td>
</tr>
<tr>
<td>2003</td>
<td>6.63</td>
</tr>
<tr>
<td>2004</td>
<td>5.22</td>
</tr>
</tbody>
</table>

Tabel 6. GNP at constant (1996) prices (Rs. mn) for the first and second half of 2004.48

<table>
<thead>
<tr>
<th>Half-year</th>
<th>Real GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2004</td>
<td>459 229</td>
</tr>
<tr>
<td>Second half of 2004</td>
<td>509 396</td>
</tr>
</tbody>
</table>

Post tsunami

In 2005 the GNP grew by 4.90%49 in real terms, which was a minor decrease in the level of growth from the year before. According to the forecasts, the tsunami was expected to slowdown the economic growth in 2005 by 0.6%.50 Table 7 presents the level of GNP for the first and second half of 2005 and the economic growth.

Tabel 7. GNP at constant (1996) prices (Rs. mn) and real GNP growth for the first and second half of 2005.51

<table>
<thead>
<tr>
<th>Half-year</th>
<th>Real GNP</th>
<th>Real GNP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2005</td>
<td>482 204</td>
<td>5.00</td>
</tr>
<tr>
<td>Second half of 2005</td>
<td>533 884</td>
<td>4.81</td>
</tr>
</tbody>
</table>

Predictions versus outcomes for the real GNP

According to theory a natural disaster, like the tsunami, reduces a country’s ability to produce both tradables and nontradebles. This decrease in the supply can be illustrated as a leftward shift in both the EB- and IB curve and causes a decrease in the GNP. Comparing the GNP for the first six months in 2004 with the same period in 2005 we notice an economic growth of 5.00% (Table 7) and for the last six months in 2005 the growth is 4.81% (Table 7). Hence, the actual development of the GNP in the short- and medium run is not consistent with the predictions from the model. Moreover, these levels of growth do not differ significantly from

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48 Central Bank of Sri Lanka, Bulletin (Apr. 05), Balance of Payment.
49 (1 016 088(total GNP 2005)-968 625 (total GNP 2004)) / 968 625=0.0490
51 Central Bank of Sri Lanka, Bulletin (Nov. 05) for quarter 1 and (Jan. 06) for quarter 2-3, Balance of Payment.
the annual GNP growth for previous years (Table 5) which means that the impact of the tsunami on the economic growth was minor, at least during 2005.

3.3 Real Gross Domestic Expenditure (GDE)

Pre tsunami

Table 8 presents the real GDE growth for 2002-2004, and Table 9 the level of GDE for the first and second half of 2004. As we can see in Table 8 the GDE grew by 10.98% in 2004, which was a remarkable increase in comparison to the previous two years.

Table 8. Real GDE growth from 2002-2004.

<table>
<thead>
<tr>
<th>Year</th>
<th>Real GDE growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>2.78</td>
</tr>
<tr>
<td>2003</td>
<td>5.48</td>
</tr>
<tr>
<td>2004</td>
<td>10.98</td>
</tr>
</tbody>
</table>

Table 9. Real GDE (Rs. mn) for the first and second half of 2004.

<table>
<thead>
<tr>
<th>Half-year</th>
<th>Real GDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2004</td>
<td>502 801</td>
</tr>
<tr>
<td>Second half of 2004</td>
<td>533 637</td>
</tr>
</tbody>
</table>

Table 10 presents the GDE components as percent of GDP for 2003 and 2004. As the table shows there was only a marginal change in consumption and government expenditure, while the growth in investment was relatively strong.

Table 10. GDE components expressed as percent of GDP for 2003 and 2004.

<table>
<thead>
<tr>
<th>GDE as percent of GDP</th>
<th>2003</th>
<th>2004</th>
<th>Percent unit change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>76.2</td>
<td>76.0</td>
<td>-0.2</td>
</tr>
<tr>
<td>Investment</td>
<td>16.8</td>
<td>19.8</td>
<td>3.0</td>
</tr>
<tr>
<td>Government expenditure</td>
<td>13.2</td>
<td>13.4</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Post tsunami

The GDE increased by 8.27% in 2005 which was a smaller growth than in 2004. However, this level of growth can be seen as high in comparison to previous years (Table 8). Table 11 presents the level of GDE for the first and second half of 2005 and the percent change from the same period in 2004. Since the real GDE growth in the first half of 2005 is small, we can conclude that most of the total growth in 2005 happened in the second half of the year.

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52 The values for GDE are approximations counted from the definition of GDE=GNP-CA, Krugman, R. P, Obstfeldt, M., (2003), pp. 300.


54 The values in this part are expressed as percent of GDP instead of percent of GNP. This is the data available from the Central Bank of Sri Lanka. We regret this but find the data still usable due to the small difference between GNP and GNP in reality.

55 \((1 122 108 \text{ (total GDE 2005)} - 1 036 438 \text{ (total GDE 2004)}) / 1 036 438 = 0.0827\)
Table 11. Real GDE and real GDE growth for the first and second half of 2005.

<table>
<thead>
<tr>
<th>Half-year</th>
<th>Real GDE</th>
<th>Real GDE growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2005</td>
<td>512 258</td>
<td>1.88</td>
</tr>
<tr>
<td>Second half of 2005</td>
<td>609 850</td>
<td>14.28</td>
</tr>
</tbody>
</table>

Table 12 presents the GDE components as percent of GDP for 2004 and 2005. We can observe in the table that the investment and the government expenditure increased as a percent of GDP, while the consumption decreased.

Table 12. GDE components expressed as percent of GDP for 2004 and 2005.56

<table>
<thead>
<tr>
<th>GDE as percent of GDP</th>
<th>2004</th>
<th>200557</th>
<th>Percent unit change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>76.0</td>
<td>74.9</td>
<td>-1.1</td>
</tr>
<tr>
<td>Investment</td>
<td>19.8</td>
<td>21.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Government expenditure</td>
<td>13.4</td>
<td>14.1</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Predictions versus outcomes for the real GDE

In the model the real GDE is expected to decrease as a result of the leftward shift of the curves. The decrease is partly offset by an increase in government expenditure due to an increased demand for necessities. In the Sri Lankan case the real GDE increased by 1.88% in the first half of 2005 and by 14.28% in the second half (Table 11). The government expenditure, as percent of GDP, increased by 0.7% in 2005 (Table 12) and the GDP grew by 5.3%.58 This leads us to the conclusion that the government expenditure must have increased more in relative terms than the total GDP. The total increase in GDE in the short- and medium run is not in accordance with the predictions while the raise in government expenditure is.

3.4 Current Account (CA)

Pre tsunami

As illustrated in Table 13 the CA59 deficit increased remarkably from -1.45% of GNP to -7.00% in 2004. The surpluses in the service- and income account and transfer accounts were not sufficient to offset the widened deficits in the trade balance.60 Table 14 contains the level of CA for the first and second half of 2004 CA and the CA as percent of GNP.

57 Provisional based on information available at end July 2005.
58 Since data for the development of the three components of GDE only is available for the whole year of 2005 it is hard for us to determine if the increase in government expenditure has happen mostly in the short- or in the medium run. According to previous reports the delivery of aid and implementation of projects have been delayed in Sri Lanka (Inderfurth et al., (2005), p. 20). This leads us to the conclusion that the main part of the increase in government expenditure probably has happen in the medium run.
59 The CA balance includes trade balance, services- and income account (net), current private transfers (net) and current official transfers (net).
Table 13. CA (Rs. mn), real GNP and CA as percent of GNP for 2001-2004.61

<table>
<thead>
<tr>
<th>Year</th>
<th>CA</th>
<th>Real GNP</th>
<th>Percent of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>-32 447</td>
<td>829 056</td>
<td>-3.91</td>
</tr>
<tr>
<td>2002</td>
<td>-22 148</td>
<td>863 281</td>
<td>-2.57</td>
</tr>
<tr>
<td>2003</td>
<td>-13 350</td>
<td>920 558</td>
<td>-1.45</td>
</tr>
<tr>
<td>2004</td>
<td>-67 813</td>
<td>968 625</td>
<td>-7.00</td>
</tr>
</tbody>
</table>

Table 14. CA (Rs. mn) and CA as percent of GNP for the first and second half of 2004.64

<table>
<thead>
<tr>
<th>Half-year</th>
<th>CA</th>
<th>Percent of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2004</td>
<td>-43 572</td>
<td>-9.49</td>
</tr>
<tr>
<td>Second half of 2004</td>
<td>-24 241</td>
<td>-4.76</td>
</tr>
</tbody>
</table>

Post tsunami

The CA deficit increased further in 2005 reaching -10.43%65 of GNP. When studying Table 13, we can conclude that the deficits in 2004 and 2005 stand out from previous years. Table 15 presents the level of CA for the first and second half of 2005 and the CA as percent of GNP.

Table 15. CA (Rs. mn) and CA as percent of GNP for the first and second half of 2005.66

<table>
<thead>
<tr>
<th>Half-year</th>
<th>CA</th>
<th>Percent of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2005</td>
<td>-30 054</td>
<td>-6.23</td>
</tr>
<tr>
<td>Second half of 2005</td>
<td>-75 966</td>
<td>-14.23</td>
</tr>
</tbody>
</table>

Predictions versus outcomes for the CA

According to the model, a natural disaster increases the risk for an external deficit. For the first half in 2005 we observe an opposite situation than the one predicted in the model. The CA deficit decreased from -9.49% of GNP in the first half of 2004 (Table 14) to -6.23% in the same period 2005 (Table 15). Nonetheless, in the second half of 2005 the CA deficit increased from -4.76% (Table 14) to -14.23% of GNP (Table 15), a change that is remarkably large. Hence, the actual development of the CA contradicts the predictions from the model in the short run while it is in accordance with the predictions in the medium run.

---

62 Central Bank of Sri Lanka, Bulletin (Dec. 05) for 2001, (Jan.06) for 2002-2004
63 Since the value for the third quarter of 2002 is not available, this value is calculated from available data over the total values for 2002. The CA balance constitutes -1.4% of GDP in 2002 and the total value of GDP is 1 582 000 Rs. mn, this makes the CA for 2002, -22 148 (-0.014*1 582 000). Central Bank of Sri Lanka, (2006), Recent economic developments highlights of 2005 and prospects for 2006, Key economic variables.
64 Central Bank of Sri Lanka, Bulletin (Dec. 04) for quarter 1-3 and (Dec. 05) for quarter 4, Balance of Payment.
65 -106 020 (total CA 2005) / 1 016 088 (total GNP 2005) = 0.1043
66 Central Bank of Sri Lanka, Bulletin (Dec. 05) Balance of Payment.
3.5 Inflation

Pre tsunami

Table 16 presents the percent change in the Sri Lankan Consumer Price Index\textsuperscript{67} (SLCPI) from 2001 to 2004.

Table 16. Percent change in the SLCPI from 2001-2004 (1995-1997=100).\textsuperscript{68}

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent change in SLCPI from the year before</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>12.01</td>
</tr>
<tr>
<td>2002</td>
<td>10.15</td>
</tr>
<tr>
<td>2003</td>
<td>2.61</td>
</tr>
<tr>
<td>2004</td>
<td>7.92</td>
</tr>
</tbody>
</table>

As we can observe in Table 16 the inflation in Sri Lanka exceeded 10% in the beginning of the new millennium, but throughout 2003 the inflation was relatively moderate, reaching 2.61% on an annual average basis. During 2004 the inflation accelerated sharply reaching 7.92%. A higher global oil price was pointed out as one of the main reasons for the increase in the inflation rate. The country suffered from drought in the first half of 2004 and floods later on which caused problem in food production. This had a major impact on the price of certain foods. For example the price of rice surged by over 40%.\textsuperscript{69} Like for many developing countries, the price on food and beverages has a major impact on the overall price level in Sri Lanka.\textsuperscript{70} Table 17 presents the half-year average values for the SLCPI and the percent change in 2004.

Table 17. Average index value of the SLCPI and the percent change for the first and second half of 2004 (1995-1997=100).\textsuperscript{71}

<table>
<thead>
<tr>
<th>Half-year</th>
<th>Average SLCPI</th>
<th>Percent change from the same period in 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2004</td>
<td>163.67</td>
<td>2.41</td>
</tr>
<tr>
<td>Second half of 2004</td>
<td>178.20</td>
<td>13.54</td>
</tr>
</tbody>
</table>

Post tsunami

The early forecasts about the inflation development in 2005 stressed a continuously increased overall price level. Supply shortages on certain food items, increased demand for construction materials and high prices of steel were assumed to be some of the reasons for the higher

\textsuperscript{67} The index is based on prices collected from 20 districts. The northern- and eastern province is excluded from the index due to problems with getting the information on time, Department of Census and Statistics, (2005), http://www.statistics.gov.lk/price/slcpi/exec_summary_slcpi.pdf (060329).
\textsuperscript{70} Central bank of Sri Lanka, (2005), Price stability, p. 3
inflation rate. As a response to labour shortages the increased wage level also might add to this expected upward trend.\textsuperscript{72} Studying the percent change for the average SLCPI for the first and second half in 2005 (\textit{Table 18}) we observe an increase in the overall price level, which is in accordance with these forecasts.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
Half-year & Average SLCPI & Percent change from the same period in 2004 \\
\hline
First half of 2005 & 188.58 & 15.22 \\
Second half of 2005 & 189.67 & 6.44 \\
\hline
\end{tabular}
\caption{Average index value of the SLCPI and the percent change for the first and second half of 2005 (1995-1997=100).\textsuperscript{73}}
\end{table}

\textit{Predictions versus outcomes for the inflation}

In the model the reduced output of nontradeables causes an increase in the inflation rate. In the first half of 2005 the inflation rate was 15.22\%, and in comparison to the same period in 2004, 2.41\%, this can be seen as a noteworthy increase. However, looking at the inflation rate in the second half of 2005, 6.44\%, in relation to the same period in 2004, 13.54\%, we notice a decrease. Consequently, the actual development of the inflation is in accordance with the predictions in the short run but contradicts the predictions in the medium run. In comparison to the average level of inflation in 2000-2004 (8.19, \textit{Table 16}) the change in the first half of 2005 is high above the average value and the second half in 2005 is somewhat below the average value.

3.6 Policy interest rates

\textit{Pre tsunami}

As mentioned in the introduction section, the key policy tool used by the Central Bank of Sri Lanka is the interest rate corridor formed by the repo rate and the reversed repo rate. The primary goal for the monetary policy in Sri Lanka is to maintain price stability.\textsuperscript{74} The trend with declining policy interest rates since November 2002 was reversed in 2004 (\textit{Table 19}) when the Central Bank increased the policy interest rates to stabilize the economy. The adjustment of the rate policy of the Central Bank was required in order to tackle the rising inflation, inflation expectations and increasing credit demands.\textsuperscript{75}

\textsuperscript{72} World Bank, (2005), \textit{The Tsunami: Impact, Responses, and Issues}, p. 12
\textsuperscript{73} Central Bank of Sri Lanka, (2006), \textit{Consumer Price Indices and Inflation}.
\textsuperscript{75} Central Bank of Sri Lanka, (2005), \textit{Annual Report 2004}, p. 120
Table 19. Changes in the policy interest at various dates for 2002-2004 (close of business).\textsuperscript{76}

<table>
<thead>
<tr>
<th>Date</th>
<th>Repo Rate</th>
<th>Reverse Repo Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002.11.22</td>
<td>9.75</td>
<td>11.75</td>
</tr>
<tr>
<td>2003.01.17</td>
<td>9.00</td>
<td>11.00</td>
</tr>
<tr>
<td>2003.05.09</td>
<td>8.25</td>
<td>10.25</td>
</tr>
<tr>
<td>2003.08.15</td>
<td>7.50</td>
<td>9.50</td>
</tr>
<tr>
<td>2003.10.16</td>
<td>7.00</td>
<td>8.50</td>
</tr>
<tr>
<td>2004.11.10</td>
<td>7.50</td>
<td>9.00</td>
</tr>
</tbody>
</table>

Post tsunami

Generally the monetary policy in 2005 was tightened as a continuation of the policy stance since the emergence of the first signs of inflationary pressure in mid 2004. However, the tsunami’s devastation prompted a more cautious monetary policy in the beginning of 2005 and the Central Bank left the policy interest rates unchanged during the first four months of the year. In May the Central Bank returned to their more strict monetary policy and the policy interest rates were raised on three occasions during 2005 (May, June and September). The repo rate increased from 7.50% at the end of 2004 to 9.15% at the end of September 2005.\textsuperscript{77}

Predictions versus outcomes for the policy interest rates

To counterbalance the increase in inflation an increase in the policy interest rate is expected to stabilize the economy, assuming that the primary goal for the Central Bank is to maintain price stability. Although the first increase in the repo rate is made in the end of the short run period we find the actual development of this variable to be consistent with the predictions from the model both in the short- and medium run.

Summary: predictions versus outcomes in the short- and medium run

When comparing the predicted developments for the selected variables in the model with the actual outcomes in the short- and medium run we get the following results:

Table 20. Predictions, short- and medium run outcomes for the selected variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Predicted development</th>
<th>Actual development short run</th>
<th>Actual development medium run</th>
</tr>
</thead>
<tbody>
<tr>
<td>REER</td>
<td>↑ depreciate, ↓ appreciate, (→ unchanged)</td>
<td>↓ appreciate,</td>
<td>↓ appreciate,</td>
</tr>
<tr>
<td>Real GNP</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Real GDE</td>
<td>↓ (G↑)</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>CA</td>
<td>↑ increased deficit</td>
<td>↓ decreased deficit</td>
<td>↑ increased deficit</td>
</tr>
<tr>
<td>Inflation</td>
<td>↑</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Policy interest rates</td>
<td>↑</td>
<td>↑ (May)</td>
<td>↑ (June and September)</td>
</tr>
</tbody>
</table>

\textsuperscript{76} Central Bank of Sri Lanka, (2005), \textit{Annual Report 2004}, p. 120

As Table 20 shows the inflation and the policy interest rate were the only variables that had developed in accordance with the predictions from the model in the short run. Studying the actual outcomes for the variables in the medium run the CA had joined this group. The inflation, on the other hand, had in the medium run developed in a manner that is not in accordance with the predictions. During 2005 the government expenditure had also developed in compliance with the predictions, and most of the increase is assumed to have taken place in the second half of the year.

4. Interpreting the outcomes in Sri Lanka in terms of the model

In the previous section we made a comparison between the actual outcomes in Sri Lanka in the short- and medium run and the predicted development for the variables in the model. In this section we intend to analyze the economic development after the tsunami within the model. In section 4.1 we will determine the position of the Sri Lankan economy before the tsunami in the model (point 1). In section 4.2, the actual outcomes for the variables will be analyzed by studying the shifts of the curves. Finally, in section 4.3, we will determine the position of the Sri Lankan economy in the short- and medium run (point 2 and 3).

4.1 The position of the Sri Lankan economy pre tsunami

As previously mentioned an economy in overall balance is positioned in the point where the EB- and IB curve intersect. If the economy is in disequilibrium it can be positioned in one of the four zones of imbalance illustrated in Figure 7. To determine the location of the Sri Lankan economy in the model before the tsunami we start by looking at the EB. Judging by the deficit in the CA in 2004, -7.00% of GNP (Table 13), the country had an external deficit. Studying the IB, the inflation rate of 7.92% in 2004 (Table 16) is in our opinion not in accordance with price stability. Our conclusion is therefore that the Sri Lankan economy pre tsunami was located in zone B with an external deficit and inflation.

78 Even if this determination is based on one single year, which is a very narrow definition of external deficit, our conclusion would have been the same if the previous years were included (Table 13).
Figure 7. The zones of imbalance.

To be more specific about the location within zone B we will have to study the level of GDE in relation to the level of GNP and the average value of the REER. We will express the GDE in relative terms, where the intersection equals 100 (GDE is 100% of GNP). In 2004 the GDE was 1,036,438 million rupees\(^79\) and the GNP was 968,625 million rupees\(^80\). When dividing the level of GDE by the level of GNP we get 1.07 which means than the GDE is 107% of GNP. In the point of intersection between EB and IB the REER index value is 97.58\(^81\) and in 2004 the REER index value was at average 93.73 (Table 2). Figure 8 illustrates the position of the Sri Lankan economy pre tsunami.

Figure 8. The position of the Sri Lankan economy pre tsunami.

4.2 Analyzing the development of the variables within the model

In the following section we will try to explain the reasons behind the actual developments of the variables by analyzing the shifts of the curves in the model.

---

\(^{79}\) GDE=GNP-CA = 968 625 – (- 67 813) = 1 036 438, Central Bank of Sri Lanka, \textit{Bulletin} (Jan 05 and Jan.06), Balance of Payments

\(^{80}\) Central Bank of Sri Lanka, \textit{Bulletin} (Jan. 06), Balance of Payments

\(^{81}\) 97.58 is an average value for the REER 2000-2004. We will use this as our equilibrium value for the REER. For a more trustworthy equilibrium value, data for earlier years would be needed but is unfortunately not available.
The shifts of the EB curve and their implications for the variables in the short run

To start with the EB curve, a position on the curve means that the CA is in balance. As stated previously, the Sri Lankan economy before the tsunami was positioned in zone B which means that the country had an external deficit and inflation. Hence, a leftward shift of the EB curve, in accordance with the theory, would generate an even larger external deficit. When comparing the first half of 2004 with the same period in 2005 we observe an opposite situation. This leads us to the conclusion that the final position of the EB curve must be to the right of its initial position, and not to the left as predicted in the model. To understand this development we have to look closer into the different components of the CA.

The CA includes the trade balance, services- and income account, current private transfers and current official transfers. Focusing on the trade balance separately we observe an increase in the trade balance deficit in the first half of 2005 by approximately 8.76%82, which would cause an increase in the CA deficit.83 We are illustrating this by a leftward shift of the EB curve. This leads us to the conclusion that at least one of the other two components in the CA, the service- and income account and the current transfer account, has improved more than what is necessary to counterbalance the development of the trade balance for an overall decrease in the CA deficit to be achievable. Looking closer at the service- and income account we notice an increased surplus in the first half of 2005 by 27.30%84 which is working for an improvement in the CA. However, the service- and income account is not large enough in total value to counterbalance the change in the trade balance. This means that we must study the development of the current transfer account to fully understand the total increase in the CA deficit.

We find a large improvement in the private and official transfers rather logical due to the massive inflow of foreign aid money. The international response after the tsunami has been described as ‘swift and remarkable’.85 The ADB allocated 240.93 million US dollar for rehabilitation work86 and the IMF provided 158.4 million US dollar in emergency assistance. The large amount provided by IMF makes Sri Lanka the second largest foreign aid receiver

82 (-120 803.7 - (-111 076.5))/ -111 076.5 = 0.0876 (Appendix 3).
84 (5 027.9 - 3 949.5)/ 3 949.5 = 0.273 (Appendix 3).
85 Athukorala, P, Resosudarmo, B.P, (2005), p. 28
related to a natural disaster.\(^{87}\) The total funds pledged for Sri Lanka sum up to 2.95 billion US dollar while the estimated needs sum up to 2.15 billion US dollar. Furthermore, in comparison to previous disasters in the world, the requirements covered for all the tsunami affected countries appear to be extraordinary high (84\% in comparison to an average of 52\% in 2005). Even among the affected countries, Sri Lanka is an unusual case since the country received more than enough money to cover the estimated needs.\(^{88}\)

The theory about the major impact of the foreign aid money in the CA is supported when studying the current transfer account. Comparing the current transfers, private and official, in the first half of 2004 with the same period in 2005 the account improved by approximately 34.88\%.\(^ {89}\) As total values, the increase in the transfers more than counterbalance the adverse impact of the development of the trade balance in the CA. The previously described situation can be illustrated in the model. As a reminder, in the original model the EB curve shifts twice and the final position of the EB curve is to the left from its initial position. In the Sri Lankan case the rightward shift of the EB curve dominates the leftward shift. The reason for this is, as previously mentioned, that the inflow of foreign aid money was larger than the estimated needs for replacing losses in tradables.\(^ {90}\) The inflow of aid money was also remarkably fast. By the middle of January the total aid pledges to Sri Lanka had passed 1.5 billion US dollar\(^ {91}\) which is about half of the total pledges. Hence, the increase in the trade balance deficit was quickly offset by the inflow of foreign aid money. The final result was, as previously mentioned, a decrease in the CA deficit and therefore a final position of the EB curve to the right from its initial position.

The dominating shift of the EB curve to the right also had \textit{indirect} implications for the development of the REER, real GNP, real GDE and the policy interest rates. The reason these were not \textit{direct} consequences of the shift in the EB curve is that the Sri Lankan economy before the tsunami was positioned in a zone of disequilibrium. This means that the impacts of the EB shift on the other variables were working via the direct impact on the CA, and were not direct results of the shift as in the original model where the economy is assumed to be positioned on the EB curve.

\(^{87}\) The largest receiver was Turkey due to the earthquake in 1999 (received 510 million US dollar). IMF, (2005), \textit{Emergency Assistance: Supporting Recovery from Natural Disasters and Armed Conflicts} \url{http://www.imf.org/external/np/exr/facts/conflict.htm} (060315).

\(^{88}\) Inderfurth K. F, et al., (2005), pp. 10

\(^{89}\) \((85 721.7 - 63 554.7)/63 554.7= 0.349 (Appendix 3)\).

\(^{90}\) Inderfurth K. F, et al., (2005), p. 10

\(^{91}\) Athukorala, P, Resosudarmo, B.P, (2005), p. 28
To start with the REER, as the deficit in the CA decreases it normally leads to an appreciation of the exchange rate since an improvement in the CA means an increased demand for the country’s currency. This seems to be a possible explanation for the development of the REER in Sri Lanka due to the massive inflow of foreign aid money. This conclusion is also supported by previous research. We also believe that the positive development of the real GNP and the real GDE can partially be explained by looking at how the tsunami affected the CA. Since the main part of the assets destroyed were nontradables, the decrease in the supply of tradables was minor. At the same time the major inflow of foreign aid had a great impact on the improvement in the CA. Hence, the minor negative impact and the major positive impact on the CA invoked an increase in the real GNP and the real GDE.

Finally, the dominating rightward shift of the EB curve also seems to have affected the Central Bank's rate policy. As mentioned earlier, the primary goal for the monetary policy in Sri Lanka is to maintain price stability. Still, the positive real GNP growth in the first half of 2005 gives the Central Bank even stronger incentives to increase the policy interest rates rather than stimulate economic growth. Moreover, a stimulus of the real GNP growth might be inflationary and hence a counterproductive action.

The shift of the IB curve and its implications for the variables in the short run
A position on the IB curve requires full employment of a country’s resources and domestic price level stability. A leftward shift of the IB curve means that an economy will reach a level of inflation above the level that is consistent with price stability more easily due to the enlargement of zone B. The decrease in the supply of nontradables causes an excess demand at the old equilibrium price which leads to an increase in the price of nontradables. As a reminder, the Sri Lankan economy before the tsunami was considered to have a higher inflation rate than what could be defined as price stability and a leftward shift of the curve would cause an even higher inflation rate. Looking at the inflation rate in the first half of 2005 in comparison to the first half of 2004, the actual outcome complies with this prediction. This leads us to the conclusion that the IB curve must be shifted leftward in accordance with the original model.

When studying the development of the supply of nontradables in Sri Lanka the raise in inflation is logical. According to reports the country has been hard-hit in terms of economic assets where the main portion of the losses can be counted as nontradables such as housing.

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93 Athukorala, P, Resosudarmo, B.P, (2005), p. 31
roads, water and sanitation, railways and fisheries (Appendix 4). Our conclusion about the course of events in the Sri Lankan economy after the tsunami is illustrated in Figure 9.

Figure 9. Course of events in the Sri Lankan economy after the tsunami.

As already stated, the exchange rate in Sri Lanka appreciated during the first six months after the tsunami. As for the shift in the EB curve, the real appreciation of the exchange rate can be explained indirectly by the leftward shift of the IB curve. According to theory, the leftward shift of the IB curve and the raise in inflation can contribute to an appreciation of the exchange rate if the exchange rate does not depreciate enough to counterbalance the inflation.\(^94\) This is consistent with the outcomes for the REER index value in Sri Lanka during the first half of 2005 and is also supported in reports from the Central Bank.\(^95\)

The indirect impact of the increase in inflation on the other studied variables is somewhat harder to interpret. According to some theories a raise in inflation normally tends to discourage investments, which often are pointed out as the major catalyst behind economic growth after a natural disaster.\(^96\) The inflation is assumed to lead to higher uncertainty about the future economic development and this will have a negative impact on the economic growth.\(^97\) On the other hand, some economists argue that inflation would help to speed up the reallocation of labor and capital out of subsistence sectors into sectors with more development potential, which would encourage investment projects.\(^98\) In Sri Lanka, investment increased in 2005 and was also the main reason for the total increase in both real GNP and real GDE. As an example the fixed investment growth was predicted to 8.5% in 2005 but the actual growth

\(^{96}\) ADB, (2005), An initial assessment of the impact of the earthquake and Tsunami of December 26, 2004 on south and southeast Asia, p. 4
ended up being 18.5%. The massive inflow of foreign aid money to finance the reconstruction work seems to have had a larger impact on the investments (and so on real GNP and real GDE) than the potential adverse impact of the increase in inflation. However, it is hard for us to determine if the inflation had a positive impact on the investments due to more favourable allocation of the factors of production or if the investments increased independently from the inflation.

Finally studying the impact of the raise in the overall price level on the monetary policy, it seems to have had implications for the decisions of the Central Bank. After leaving the policy interest rates unchanged during the first months of 2005 in favour for a more GNP stimulating monetary policy, the Central Bank returned to their primary goal of price stability by increasing the repo rates in May 2005.

The impact of the EB- and IB shifts in the medium run
In the original model the course of events for a natural disaster is, as already mentioned, expected to proceed for about one year. The first shifts of the EB- and IB curve happen shortly after a natural disaster strikes. The second shift of the EB curve to the right takes place within one year but a more exact time schedule for this shift is undetermined in the model. Since the foreign aid money reached Sri Lanka shortly after the tsunami, which induced the rightward shift of the EB curve, we assume that all the shifts of the curves are made within the first half of 2005. Regardless, we believe that the development in the CA and inflation in the short run have implications for the development of the variables in the medium run as well. We also find it interesting to study the reversed causality, in other words, how the development in the short run of some of the other variables affect the CA and the inflation in the medium run.

Starting with the development in the CA, in the short run the development of this variable contradicted the predictions from the model while in the medium run the situation was the opposite. There are many possible explanations for this conversion. Firstly, it is not unusual that the negative impact on the CA from an appreciated real exchange rate is delayed. This might explain why the CA deficit started to increase, once the initial positive impact from the foreign aid had faded out and was replaced by the negative impact of an appreciated real exchange rate. Secondly, in the medium run the growth in investments, which continued to be the main prompter of the GNP and GDE growth, also had implications for the development in

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the CA. The Central Bank explains the major widening of the CA deficit with an increased import of reconstruction activities and rehabilitation of tsunami-hit infrastructure facilities.\textsuperscript{101}

Continuing with the development of the inflation rate, the overall price level increased further in the medium run but in a moderate pace in comparison to the short run. The Central Bank stresses that imported intermediate goods, particularly crude oil, imposed an indirect pressure on consumer prices.\textsuperscript{102} We believe that the supply-side inflation, illustrated by the leftward shift of the IB curve in the short run, also can explain much of the inflation in the medium run. Some of the key sectors for nontradeables, such as fishery and housing, had in the end of July only received small amounts of the total aid assigned for these areas\textsuperscript{103} and this might have contributed to the continuous increase in the overall price level.

The continued inflation pressure also had implications for the monetary policy. In the medium run the Central Bank increased the policy interest rates two times. This indicates that they more or less had returned to their primary goal of maintaining price stability. This might also explain the moderation of the inflation rate in the medium run.

4.3 The position of the Sri Lankan economy post tsunami (short- and medium run)

Since the Sri Lankan economy pre tsunami was positioned in a zone of disequilibrium, the change in position of the Sri Lankan economy in the model (point 2 and 3) must be analyzed separately from the shifts and this will be done in the following section.

To determine the position of the Sri Lankan economy in the model six months after the tsunami we follow the same procedure as before. When dividing the level of GDE by the level of GNP we find that the GDE is 106.2\textsuperscript{104} of GNP. We can conclude that the Sri Lankan economy still is positioned to the right of the point of overall equilibrium. However, the economy has in comparison to the first half in 2004 moved closer to the point where income equals expenditure. The average REER index value for the first half of 2005 was 100.50 (\textit{Table 4}). This is a real appreciation of the exchange rate since 2004 and a movement downward on the \(y\)-axis in the figure. The position of the Sri Lankan economy in the short run is illustrated in \textit{Figure 10}.

\textsuperscript{102} Ibid., p. 27
\textsuperscript{103} For example only 11.2\% of the total 312 million US dollars assigned for housing and 8.2\% of 121 million US dollar assigned for fisheries (Inderfurth K. F, et al., (2005), p. 20).
\textsuperscript{104} \((512\ 258 \text{ (table 11)} / 482\ 204 \text{ (table 7)}) = 1.062\)
Figure 10. The position of the Sri Lankan economy in the short run.

To determine the position of the Sri Lankan economy in the model in the medium run we follow the same routine. Looking at the level of GDE in relation to GNP the GDE is 114% \[^{105}\] of GNP. We can conclude that the Sri Lankan economy has moved further to the right from the point of overall equilibrium. The average value for the REER index in the second half of 2005 increased further and reached a level of 103.52 (Table 4). The position of the Sri Lankan economy in the medium run is illustrated in Figure 11.

Figure 11. The position of the Sri Lankan economy in the medium run.

\[^{105}\] (609 850 (table 11) / 533 884 (table 7)) = 1.14
5. Conclusions

In this thesis we have analyzed the macroeconomic consequences of the tsunami in Sri Lanka. We have focused on the development in the short- and medium run of a number of economic variables: the REER, real GNP, real GDE, CA, inflation and policy interest rates. The model we have used as our theoretical framework provides predictions for the development of the selected variables. In the short run only two out of the six variables, inflation and policy interest rates, have developed in accordance with the predictions from the model. In the medium run the CA has added to this group, while the development of the REER, real GNP and real GDE still contradict the predictions. We also noticed a conversion of the development of the inflation in the medium run, which was not in compliance with the predictions. We believe that the main reason for the contradictory developments of the real GNP and real GDE is the extraordinary large and rapid inflow of foreign aid money. The funds pledged were quickly translated into investment projects which offset a possible slowdown in the economic growth due to losses in tradables and nontradables. In this way Sri Lanka could maintain a positive economic growth in 2005 and the overall macroeconomic impact of the tsunami can be determined as minor. Our conclusions about the great importance of the foreign aid and the new investments for the quick recovery of the Sri Lankan economy after the tsunami are supported in previous research.

The massive inflow of foreign aid money can probably also explain the strong appreciation of the REER. However, we believe that the appreciation in 2005 partly can be seen as a return to a ‘normal’ value of the REER after the major depreciation in 2003 and 2004.

The decrease of the inflation rate in the second half of 2005 can most likely be explained by the raises in the policy interest rates, starting in November 2004. It seems reasonable to believe that once the most acute phase after the tsunami was over, the economy started to respond to the more strict monetary policy.

Turning to the long run effects on the Sri Lankan economy, we expect them to be even more insignificant than in the short- and medium run. This is due to the fact that the impact of a natural disaster is assumed to proceed for about one year. Further, the impact from the tsunami on the overall economy in Sri Lanka was considered to be small during the first year and hence the long run effects will most likely be negligible. However, the actual effects of the tsunami in the long run are a potential topic for future research.
The main weakness in our study as we see it is that the definitions of EB and IB tend to be a bit narrow for a developing economy. They also contain normative features for how a country should respond to economic imbalances, from a developed country’s perspective. For example, having an external deficit is normal for developing countries in certain stages and should not necessarily be seen as a problem in the short run. Studying a developing country also causes some difficulties in itself. The main problem, in our opinion, is in finding reliable data.

Concerning our research method, a single case study has both its advantages and disadvantages. The key advantage is a high reliability regarding the conclusions about the specific case. The key disadvantage is the lack of opportunity for generalization. On the other hand, by choosing an appropriate case we can reduce this problem. The impact on the Sri Lankan economy was expected to be significant in comparison to the economies in the other tsunami affected countries. Since the overall impact on the Sri Lankan economy in our opinion can be determined as minor, except for the development of the CA in the medium run, there are reasons to believe that this conclusion is valid for the other tsunami affected countries as well. However, we consider the opportunities for generalizations to other countries suffering from natural disasters to be limited due to the extraordinary large inflow of foreign aid money after the tsunami.

As a closure, we suggest that economists should pay more attention to the implications of natural disasters. Returning to the quotation in the beginning of this thesis, we believe that studying an abnormal situation can help us to understand the everyday economy.
References


Appendix 1. Qualitative Assessment of the Effects of the Earthquake and Tsunami of December 26th 2004\textsuperscript{106} (Predictions from Jan. 2005)

<table>
<thead>
<tr>
<th>Country</th>
<th>Tourism\textsuperscript{a}</th>
<th>Agriculture and Fisheries\textsuperscript{b}</th>
<th>Poverty</th>
<th>Overall Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maldives</td>
<td>HIGH</td>
<td>HIGH</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>HIGH</td>
<td>HIGH</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
<tr>
<td>Indonesia</td>
<td>LOW</td>
<td>HIGH</td>
<td>HIGH</td>
<td>LOW</td>
</tr>
<tr>
<td>Thailand</td>
<td>MEDIUM</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>India</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Malaysia</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Myanmar</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
</tbody>
</table>

\textsuperscript{a} This refers to the impact on the overall economy.
\textsuperscript{b} This refers to the impact on the affected areas.

Appendix 2. The Real Effective Exchange Rate\textsuperscript{107}

The REER is obtained by adjusting for price level differentials between the countries whose currencies are included in the basket. The basket contains 24 countries\textsuperscript{108} and is partly based on bilateral trade shares. The importance in terms of competitiveness also plays an important role in selecting the different countries.\textsuperscript{109} The formula for calculating the REER index value is:

$$REER = \frac{\prod_{i=1}^{24} (e_i / e_j)(P_i / P_j)^{w_i}}{\prod_{i=1}^{24} (P_i / P_j)}$$

Where

- $e$: exchange rate of the Sri Lankan rupee against the US dollar (US dollar per rupee in index form).
- $e_i$: exchange rates of currency $i$ against the US dollar (US dollar per currency $i$ in index form).
- $w_i$: weights attached to the country/currency $i$ in the index.
- $P$: Consumer Price Index (CPI) of Sri Lanka.
- $P_i$: Consumer Price Index (CPI) of country $i$.

\textsuperscript{106} ADB, (2005), An initial assessment of the impact of the earthquake and Tsunami of December 26, 2004 on south and Southeast Asia, p. 10
\textsuperscript{107} Central Bank of Sri Lanka, (2006), Real Effective Exchange Rate (REER).
\textsuperscript{108} Japan, United Kingdom, United States, Germany, India, Singapore, France, China, Korea, Hong Kong, Netherlands, Italy, Malaysia, Indonesia, Taiwan, Canada, Belgium, Sweden, South Africa, Denmark, Bangladesh, Kenya, Philippines and Thailand.
\textsuperscript{109} For instance the bilateral trade share between Kenya and Sri Lanka is not within the largest 24 trade shares, but Kenya is a major competitor of Sri Lankan tea and is therefore included in the basket. Central Bank of Sri Lanka, (2006), Real Effective Exchange Rate (REER).
### Appendix 3. Current Account and its Components (Rs. mn)

<table>
<thead>
<tr>
<th>Period</th>
<th>Trade balance 110</th>
<th>Service-and income account 111</th>
<th>Current transfers (net) 112</th>
<th>Current account</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of 2004</td>
<td>-111 076.5</td>
<td>3949.5</td>
<td>63 554.7</td>
<td>-43 572.3</td>
</tr>
<tr>
<td>Second half of 2004</td>
<td>-116 094.2</td>
<td>18 948.2</td>
<td>72 904.8</td>
<td>-24 241.2</td>
</tr>
<tr>
<td>First half of 2005</td>
<td>-120 803.7</td>
<td>5027.9</td>
<td>85 721.7</td>
<td>-30 054.1</td>
</tr>
<tr>
<td>3rd quarter 2005</td>
<td>-67 135.8</td>
<td>4 052.4</td>
<td>43 997.6</td>
<td>-19 085.8</td>
</tr>
<tr>
<td>4th quarter 2005</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>-56 880.2</td>
</tr>
</tbody>
</table>

(tot. -75 966.0)

### Appendix 4. Preliminary Estimates of Losses (million US dollar) 113

<table>
<thead>
<tr>
<th>Sector</th>
<th>Asset Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>306-341</td>
</tr>
<tr>
<td>Roads</td>
<td>60</td>
</tr>
<tr>
<td>Water and Sanitation</td>
<td>42</td>
</tr>
<tr>
<td>Railways</td>
<td>15</td>
</tr>
<tr>
<td>Education</td>
<td>26</td>
</tr>
<tr>
<td>Health</td>
<td>60</td>
</tr>
<tr>
<td>Agriculture*</td>
<td>3</td>
</tr>
<tr>
<td>Fisheries*</td>
<td>97</td>
</tr>
<tr>
<td>Tourism*</td>
<td>250</td>
</tr>
<tr>
<td>Power</td>
<td>10</td>
</tr>
<tr>
<td>Environment</td>
<td>10</td>
</tr>
<tr>
<td>Excluded Items</td>
<td>90</td>
</tr>
<tr>
<td>Total (million US dollar, rounded)</td>
<td>970-1000</td>
</tr>
<tr>
<td>Percent of GDP</td>
<td>4.4-4.6</td>
</tr>
</tbody>
</table>

* Includes estimates from livelihoods damage assessments of fishermen, small farmers and small businesses in tourism totalling 140 million US dollar.

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111 Ibid.
112 Ibid.
113 World Bank, (2005), *The Tsunami: Impact, Responses and Issues*, p. 11