AID, THE PUBLIC SECTOR AND THE REAL EXCHANGE RATE: THE CASE OF INDONESIA.

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A thesis submitted for the degree of Doctor of Philosophy

University of Warwick

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October 1997

Abstract

In 1965 the New Order Government took office in Indonesia, following years of severe economic turmoil. Since then the Indonesian economy has performed well, owing much to large oil export revenues and appropriate economic policies. This thesis presents a study of the Indonesian economy focused on three main themes: aid, the public sector and the real exchange rate (RER). In particular, we emphasise aid effectiveness on fiscal behaviour and on the RER.

The thesis is organised in five chapters. Chapter 1 presents a synthetic overview of the main episodes in Indonesian economic history. Chapter 2 reviews theoretical and empirical issues on aid. Chapter 3 presents a dynamic model of government behaviour aimed at assessing aid's impact on fiscal budget and on other real variables in the Indonesian economy. Following Heller's seminal contribution (1975) and White's new insights (1993), we insert the government sector into a simple macroeconomic framework: a constrained utility maximising framework which allows for feedback effects through higher income and dynamic linkages. The model is tested for the Indonesian case over the period 1968-93 and the estimated parameters are used to carry out a simulation exercise. We conclude with a positive assessment of aid giving, provided it is given in loans. Loans are found to encourage tax collection, public and private investment and consumption.

Exchange rate management has played a significant role in Indonesia as an instrument to ensure competitiveness during and after the oil boom. Chapter 4 analyses the behaviour of the RER for the Indonesian rupiah and offers a theoretical and statistical background. Unit root testing has been extensively used to test for stationarity. We have consistently rejected the hypothesis of RER stationarity, except in those cases in which the full sample series have been used and/or two breaks have been allowed. Chapter 5 presents a modelling approach to RER determination. Following Edwards (1989), we present an econometric model of the RER and develop an extension of it in terms of the Error Correction Mechanism (ECM). Central to the analysis is the role of fundamentals, in particular aid and the price of oil, in determining the RER. The estimated parameters are then used to construct the equilibrium RER in order to study RER misalignment. Simulations are also carried out to investigate the impact of exogenous shocks and policy options on the RER. Results show that the Indonesian RER suffered from misalignment especially during the oil boom and until the early 1990's. We also find that aid and the real price of oil do matter: both act as fundamental determinants of RER behaviour and contribute to RER stability, a finding confirmed by the simulation exercise. Interestingly, aid and government consumption appear to influence in differences and not in levels the RER.

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Acknowledgements

The Ph.D. is a long and sometimes painful process. I wish to thank my supervisors Tony Addison and Jeremy Smith for their constant help and support. Also, I remember with gratitude Andrew McKay, Mark McGillivray, Marcus Miller, Oliver Morrissey, Carlo Perroni, Jeffery Round and Howard White for their helpful comments and suggestions.

My friends deserve a special prize for their patience! In particular, I thank Olga Arratibel, Michele Ca'Zorzi, Iorgos Chouliarakis, Clara De Sousa, Monica Giulietti, Shirley Ho, Meloria Meschi, Iannis Sardis and Eu Chye Tan for their sincere friendship.

However, it is to my family that goes my deepest and warmest gratitude. My parents Annamaria and Raffaello and my sisters Maria Adele and Francesca have really been supportive and indispensable to me. My final thoughts go to little Federico and Caterina, although they know nothing about economics!

INTRODUCTION

This thesis presents a study of the Indonesian economy focused on three main themes: aid, the public sector and the real exchange rate (RER). In particular, the emphasis is on the macroeconomic effectiveness of aid on government behaviour and the RER. We analyse the impact of aid on government behaviour using a dynamic fiscal response model, which is subsequently tested empirically for the Indonesian case. After the investigation of the statistical properties of the Indonesian RER, a model of RER determination is then discussed and tested econometrically.

The Role of Aid.

The role which aid plays in influencing fiscal behaviour and the RER provides the logical link between the two issues. The analysis of the macroeconomic effectiveness of aid represents the underlying, though not exclusive, theme in this thesis. Over the past decades a number of studies have been focused on the macroeconomic impact of aid. Despite the fact that aid is commonly well understood to be a transfer of resources from donor to recipient countries whose economies are, generally speaking, underdeveloped, there is not yet a clear idea of what is the role of aid for the recipients' economies. The basic question "Does Aid Work?" has been central in almost all of the recent empirical literature[1]. Although this question seems simple, it needs to be qualified according to what might be the objective of aid policies. Aid effectiveness can be assessed in relationship to a whole range of targets for the recipients' economies, such as the level and/or the growth rate of national income, its distribution, some measure of poverty alleviation. As a result, there is not a straightforward 'yes' or 'no' answer to the question of aid effectiveness.

In fact, the evaluation of the effectiveness of aid is a complex issue. It requires adequate theoretical support and conclusive evidence from empirical research. As for now, both the theory and the empirical research are unable to give an unambiguous answer to the problem of the impact of aid.

The ways in which aid effectiveness has been studied have essentially been either an evaluation of the micro-economic consequences of development projects or an analysis of the macro-economic impact of aid inflows from abroad. An interesting perspective on the so-called 'micro-macro paradox' is presented in Mosley (1986 and 1987), the paradox being the co-existence of positive evaluations from the microeconomic level analyses and of ambiguous answers from the macroeconomic level evidence.

The theoretical and empirical literature on aid up to the early 1970's was mainly concerned with the impact of aid on growth. Thereafter, the savings debate flourished. An important turning point is represented by the seminal work of Heller (1975) which

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[1] See Cassen (1986 and 1994) and Riddel (1987).

introduced the fiscal response approach. From the late 1970's up to the current days various approaches have been developed: aid and allocation (Maizels and Nissanke, 1984; Gulhati and Nallari, 1988; McGillivray, 1989), aid and counterparts funds (Roemer, 1989; Bruton and Hill, 1990; Owens, 1991), aid tying (Levy, 1987; Jepma, 1991; Morrissey and White, 1993 and 1994), aid and trade (Michaely, 1981; Van Wijnbergen, 1986b; Morrissey, 1991; Lahiri and Raimondos, 1994), aid and the real exchange rate (Edwards, 1988a and 1989; Wood, 1988; White, 1990; White and Wignaraja, 1991 and 1992), aid and fiscal response (Mosley et al., 1987, Gang and Khan, 1991), among the most relevant ones.

The purpose of this study is to investigate some of the channels through which aid influences the recipient's economy. As mentioned above, we will concentrate our attention on fiscal response in the presence of aid inflows and on RER behaviour. The choice of focusing on the Indonesian economy will be briefly motivated below.

Why Indonesia?

When General Soeharto took office in 1965, Indonesia was in economic and political turmoil. During the subsequent adjustment period, GDP grew at an average annual rate of 7.5% from the early 1970's until 1982, the oil boom era, much higher than the 2.7% average growth rate of the industrial countries over the same period.

Relative political stability and an institutional commitment by the government to pursue balanced budgets allowed for rapid economic growth along with substantial social gains. For instance, poverty incidence, that is the proportion of population living below the poverty line, declined from 60% in the early 1970's to 14% in 1996 and life expectancy rose from 47.6 years in 1970 to 60.2 years in 1992[2].

A period of slower growth followed the oil price shock of 1982-84 and the world recession[3], with GDP growing at an average annual 3.6% In addition, accumulating external debt brought the debt ratio to GDP from 26.8% in 1980 to 52.2% in 1990. The oil price crisis highlighted the existence of some structural problems. Indonesia was very dependent on oil revenues and the debt burden was amplified by international currency fluctuations.

The Indonesian government voluntarily undertook a package of adjustment policies, with the adoption of successive economic plans, starting from 1984. A series of macroeconomic measures, such as budget retrenchment, tax reforms and banking sector deregulation, resulted in financial stability, limited external imbalances and positive growth rates. Most importantly, the restructuring of the economy reduced the dependency from oil revenues. Although the debt service was high, with a peak of 40.2% of the debt service ratio to exports in 1988, the adoption of sound policies and of prudent borrowing strategies allowed Indonesia to still receive strong financial support from official agencies on concessional terms.

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[2] Sources: World Bank, *World Development Report 1996* and *World Tables*, various issues.

[3] The average growth rate in the industrial countries between 1983 and 1992 was 2.8%.

Moreover, foreign reserves and commercial bank credit lines were still widely available. These factors ensured Indonesia was not ranked within the group of highly indebted country with credit access problems.

The World Bank has recently included Indonesia among the 'East Asian miracle economies'[4]: its remarkable economic performance over the past thirty years makes it an interesting case study.

The Role of the Government.

The government has played an active role in Indonesian economic success, while receiving strong external financial support, which accounted for an average of 24% of total fiscal receipts over the period 1965-93. It is therefore interesting to investigate to what extent fiscal behaviour has been influenced by aid inflows.

In particular, this research aims at assessing the impact foreign aid has had on the fiscal budget and other real variables in the Indonesian economy. A number of studies have developed the seminal contribution by Heller of modelling government behaviour in order to capture one of the channels through which aid could displace savings and hence negatively influence growth. Heller imposes an optimising framework on the simple Harrod-Domar set-up, which had since then been used to

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[4] See World Bank (1993) *The East Asian Miracle*, Oxford University Press.

analyse the macroeconomic impact of aid, in order to model the impact of aid on taxation and government expenditure (and thus on public savings). The theoretical result of such model is twofold: on the revenue side, aid may reduce the government's taxation efforts, while on the expenditure side, not all the aid inflow will be allocated to government investment, that is aid is fungible and is deflected away from investment and into consumption[5].

Many empirical studies have adopted the core of Heller's approach (see among others Gang and Khan, 1991; Khan and Hoshino, 1992; McGillivray and Papadopoulos, 1991). The important work by Mosley et al. (1987) incorporated the core of Heller's approach in a wider model which includes also a production and an investment function, although they do not actually estimate a Heller type model. However, the empirical evidence based on the fiscal response approach is mixed.

Following White (1993), we insert the Government sector into a simple demand determined macroeconomic model. The inclusion of dynamic linkages and of static macroeconomic feedback effects in a fiscal response model highlights the complexity of aid's impact. The contribution of our study to the literature is threefold, respectively from a modelling, an empirical and a methodological perspective. From the modelling point of view, three aspects are introduced: a) interaction between the objective variables in the utility function; b) static feedback effects, via a Keynesian like

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[5] The underlying value judgement is that increasing consumption is a 'bad'. This issue is, however, open to debate.

multiplier; c) dynamic effects, mainly through the investment function. From the empirical perspective, a time series econometric estimation is implemented and the impact of

temporary and permanent increases in foreign inflows are simulated. From the methodological point of view, the problems related to the choice of the dataset and to the empirical estimation techniques employed is emphasised.

Real Exchange Rate Behaviour.

Another important aspect of Indonesian economic history over the past thirty years is the exchange rate management as a policy instrument to support competitiveness. During the period under analysis, 1960-1993, Indonesia experienced five episodes of major nominal devaluation (1965, 1971, 1978, 1983 and 1986).

The hyperinflation crisis of 1965 caused a massive devaluation and the government gradually moved towards the dismantling of the then prevailing multiple exchange rate system. By 1969 the rupiah became freely convertible and its value remained pegged to the dollar until 1978. By 1971 the rupiah's exchange value versus the dollar was 30% less than it was in 1969 and after a further 50% devaluation in November 1978 the Government opted for a tightly managed float regime. The rupiah was again devalued in March 1983 by 37% and more recently, in September 1986, by 50%, when more flexibility was introduced in exchange rate management. The exchange rate regime remained a managed float regime pegged to the dollar, the yen and the Deutsche Mark until August 1997, when, following the recent turmoil in East Asian financial markets, the government decided to float the rupiah.

The real exchange rate is commonly used as a key indicator of the overall competitiveness of a country. The RER defined as the ratio of tradable to non-tradable prices, i.e. the trade theory defined RER, also signals long run intersectoral growth patterns, for instance the expansion of the tradable sector or the contraction of the agricultural sector.

The link between RER behaviour and economic performance has recently been emphasised in policy discussions and in the literature on economic development. In particular, the role of RER stability and of correct real exchange alignment is increasingly regarded as crucial in development strategies (Edwards and Ahamed, 1986; Cottani, Cavallo and Khan, 1990; Edwards, 1988a, 1989 and 1994; Elbadawi, 1992 and 1994; Harberger, 1986; Khan and Lizondo,1987; Pfeffermann, 1985; Pick and Vollrath, 1994; Serven and Solimano, 1992; White and Wignaraja, 1991 and 1992; Williamson, 1994).

RER stability reduces uncertainty and can thus result in attracting foreign capital and in stimulating domestic investments, given a greater confidence in the domestic and foreign business community in the country's economic performance. Correct RER alignment results in internal and external equilibrium, for given sustainable macroeconomic conditions and economic policies, and can be conducive to greater equality.

The consequences of misalignment can be critical for developing countries. In particular, overvalued exchange rates undermine the profitability of producing exports and import substitutes. Exports are hurt by reduced competitiveness. Incentives to produce import substitutes decline as relatively cheaper imports are stimulated, provided import restrictions are not imposed. If protection against imports is introduced, the costs to subsidise import competing industries can widen the fiscal deficit and resource allocation can be less efficient. Overvaluation, therefore, is particularly detrimental to export-led growth strategies. Widening current account deficits will be also reflected in increased borrowing requirements which exert pressures on the capital account and may worsen the external debt servicing burden. Another important effect of overvalued exchange rates is the negative impact on the agricultural sector. The decline in competitiveness and in relative prices caused by the overvaluation reduces incentives for farmers to produce[6]. This has dramatic welfare effects, given the key role of agriculture in countries at the early stages of development.

RER misalignment occurs when nominal exchange rates are not allowed to adjust fully in response to changes in economic conditions, such as unsustainable monetary and fiscal policies, trade and capital controls, increasing domestic inflation and costs. Determining the correct RER alignment requires the introduction of an equilibrium concept, relative to which misalignment can be established and the appropriate policy adjustments undertaken. Therefore, it is necessary to define an

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[6] Agriculture usually does not enjoy the same level of protection as industry does.

equilibrium level of the RER which reflects a country's economic fundamentals. In practice, the quantification of RER disequilibrium is not easy. Purchasing power parity (PPP) theory provides a simple way to estimating misalignment. However, PPP underestimate the role of economic fundamentals and do not offer a reliable guide to policy makers. An alternative approach is proposed by Edwards (1989) who presents a modelling approach to equilibrium and disequilibrium RER focused on the role of domestic and external determinants of the RER.

Edwards' model includes aid among the fundamental determinants of the RER. The role of aid can therefore be studied under a different perspective than the dynamic fiscal response model presented discussed above. It gives us the possibility of investigating how fundamental are aid and other macroeconomic variables, including the price of oil, for the Indonesian RER. Given that Indonesia is an oil exporting country, the impact of oil prices on the RER exchange rate is of particular relevance. This is why we have explicitly considered the real price of oil among the fundamental determinants of the Indonesian RER.

Structure of the Thesis.

The thesis is structured in five chapters.

Chapter 1 presents a synthetic overview of the main episodes in Indonesian economic history since 1960. The whole period 1960 to the present has been divided into five periods: the turbulent years preceding the New Order Government of

General Soeharto 1960-1965; the stabilisation period 1966-1972; the oil boom era 1973-1982; the years of adjustment to external shocks 1982-1989; and the recent developments of the 1990's. Structural changes following the oil boom are also discussed. A brief description of the Indonesian economy both from an historical and a comparative perspective precedes the discussion of each period in turn.

Chapter 2 represents a brief introduction to aid related issues. It offers a synthetic overview on definition and measurement problems. Recent trends in aid are then described, from both a world and an Indonesian perspective. Finally, a critical survey on the macroeconomic analysis of aid effectiveness is presented, with an emphasis on the aid-growth relationship and on the savings debate.

Chapter 3 analyses the impact of aid on the behaviour of the public sector and the feedback effects on the economy as a whole. We present and test a dynamic model of fiscal response to foreign aid in Indonesia. The chapter is organised in three sections. The first section presents a critical review of the literature on fiscal response. The second part describes the model and its implications. The third section discusses the empirical implementation of the model and the related data and estimation technique issues. It also presents results from a simulation exercise, carried out in order to study the effect that temporary and permanent increases in aid inflows have on fiscal behaviour and on the main macroeconomic variables. A conclusion highlights the main lessons from this particular study and proposes directions for further research.

The result from our empirical study is that on impact aid has a weak negative effect. However, in the long run, once the intra- and intertemporal linkages described in the dynamic model have started multiplier processes, foreign inflows appear to influence the economy. In particular, grants, multilateral and bilateral aid negatively affect all fiscal variable as well as income and consumption. They reduce public consumption more than investment, thus exhibiting a pro-investment bias. On the contrary, loans encourage tax collection, public and private investment and consumption so that the whole economy benefits.

From the simulation exercise we also find, not surprisingly, that permanent increases in aid greatly amplify the effects of a temporary shock, namely beneficial effects from loans and negative effects from grants, bilateral and multilateral aid. These results are in contrast with the widespread negative assessment of aid's impact on public budget and on the recipient economy.

Chapter 4 analyses the behaviour of the real exchange rate for the Indonesian rupiah and offers a theoretical and statistical background for the understanding of the RER. This chapter can be seen as deviating from the main theme, aid effectiveness, but it represents the first necessary step towards the empirical implementation of a model for RER behaviour, which is presented and discussed in the next chapter. The scope of this investigation, which is predominantly statistical, is also to contribute to the debate on whether RERs can be described as stationary processes or not.

The chapter starts with an overview of the theoretical issues underlying RER definition. It then focuses on the measurement of the Indonesian RER and offers some theoretical insights on measurement problems. The statistical behaviour on the Indonesian RER with an emphasis on unit root testing is analysed and final remarks conclude the chapter.

The Indonesian nominal exchange rate has systematically diverged from the RER, due to inflation above that of the rest of the world. As mentioned above, real exchange rates are commonly used as indicators for movements in international competitiveness: this practice needs to be qualified with respect to the informational content of RER indices. In this chapter we discuss theoretical and statistical issues related to the definition and measurement of the RER. The Indonesian RER is calculated and tested for stationarity. A series of unit root tests is then carried out using the Augmented Dickey Fuller (ADF) test. Rolling, recursive, sequential and Perron type ADF tests are also implemented to allow for breaks in the RER behaviour. Most of the tests do not allow us to reject the null hypothesis of the presence of a unit root, i.e. of non stationarity. Opposite results are obtained in two cases: ADF tests over the full sample (1960-1993) and ADF tests which allow for two breaks in the RER. Whether these conflicting results are essentially due to the hyperinflation of the early Sixties and/or to the inclusion of the two 'Indonesian tailored' breaks cannot be assessed with certainty. It is probably true that thirty-three years are too short a time span to ascertain the long run behaviour of the RER. As a result, our unit root test outcome must be interpreted with caution. Nevertheless, we feel more confident in relying on results from unit root tests carried out over a sub-sample which excludes the years 1960-1965.

Chapter 5 presents two strictly related models for RER behaviour and their empirical application for the case of Indonesia. As mentioned above, the debate on real exchange rate modelling has recently flourished[7], although there are relatively few studies on RER determination for Less Developed Countries. We start with the modelling approach proposed by Edwards. A brief description of his model and of its implications precedes the empirical time series estimation for Indonesia. We then present a modified version of Edwards' model, an Error Correction Mechanism (ECM) model, which represents a development of the concept of equilibrium RER. The ECM approach allows to fully capture short run dynamics in the RER as opposed to long run equilibrium movements. Once again the empirical estimation is implemented for Indonesia on a time series basis. The estimated parameters are then used to carry out a series of simulations in order to investigate the role of the fundamentals on RER behaviour over the period 1967-93. For instance, we consider what would have happened had the three oil price shocks of 1973, 1979 and 1982/84 not taken place, what has been the impact of the nominal devaluation episodes of 1978, 1983 and 1986, what has been the role of policy and of aid inflows. As for aid's influence on the real exchange rate, the results from the econometric estimation and from the simulation exercise offer an interesting perspective. Aid is shown to significantly affect RER behaviour in differences and not in levels and to contribute to RER stability. It is important to note that this analysis on RER behaviour is not focused on the possibility of a Dutch disease effect caused by external shocks such as oil bonanza or aid inflows.

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[7] See in particular Williamson (1994).

Sectoral issues are not considered; therefore, an interpretation in terms of the Dutch disease would be inappropriate. The focus is rather on the determination of the RER.

Final Remarks

The original idea for this thesis was to investigate the relationship between aid and growth. As the reading and studying of the literature progressed, we became aware of the complexity of the issue of aid effectiveness. Aid itself takes various forms: food aid, technical cooperation, grants, loans, as do its purposes and motives. Trying to find a straightforward answer to the question "Does Aid Work?" is a simplistic approach. There is no simple answer, but rather a series of answers to a series of questions which need to be analysed and confronted.

This thesis attempts to shed some light on issues related to aid effectiveness. In this research process, other problems are also raised and investigated. Finally, methodological aspects are considered, given their importance in refining heuristic procedures.

CHAPTER 1

AN OVERVIEW OF THE INDONESIAN ECONOMY 1960 - 1997.

1.1. Introduction.

This chapter presents a synthetic overview of the main episodes in Indonesian economic history since 1960. The whole period 1960 to the present has been divided into five periods: the turbulent years preceding the New Order Government of General Soeharto 1960-1965; the stabilisation period 1966-1972; the oil boom era 1973-1982; the years of adjustment to external shocks 1982-1989; and the recent developments of the 1990's. A brief description of the Indonesian economy both from an historical and a comparative perspective precedes the discussion of each period in turn.

Indonesia has the fourth largest population in the world at 193.3 millions inhabitants in 1995[1] and its islands span an area comparable to that of Europe. After the economic and political turmoil of the early 1960's and the subsequent adjustment period, GDP grew at a remarkable average annual rate of 7.5% from the early 1970's until 1982, the oil boom era (see table 1.1.1), much higher than the 2.7% average growth rate of the industrial countries over the same period. Relative political stability and an institutional commitment by the Government to pursue balanced budgets allowed for rapid economic growth along with substantial social gains. For

[1] World Bank estimate (World Bank, *World Development Report 1996*).

instance, poverty incidence, that is the proportion of population living below the poverty line, declined from 60% in the early 1970's to 14% in 1996 and life expectancy rose from 47.6 years in 1970 to 60.2 years in 1992[2].

The oil price shock of 1982-84 coupled with the world recession[3] inaugurated a period of slower growth, with GDP growing at an average annual 3.6%, and of accumulating external debt, with the debt ratio to GDP rising from 26.8% in 1980 to 52.2% in 1990. The oil price crisis highlighted the existence of some structural problems. Indonesia was very dependent on oil revenues and the debt burden was amplified by international currency fluctuations. The Indonesian government voluntarily undertook a package of adjustment policies, with the adoption of successive economic plans, Repelita 3 and 4, starting from 1984. A series of macroeconomic measures, such as budget retrenchment, tax reforms and banking sector deregulation, resulted in financial stability, limited external imbalances and positive growth rates. Most importantly, the restructuring of the economy reduced the dependency from oil revenues. Although the debt service was high, with a peak of 40.2% of the debt service ratio to exports in 1988, the adoption of sound policies and of prudent borrowing strategies allowed Indonesia to still receive strong financial support from official agencies on concessional terms. Moreover, foreign reserves and commercial bank credit lines were still widely available. These factors ensured Indonesia was not ranked within the group of highly indebted countries with credit access problems.

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[2] Sources: World Bank, *World Development Report 1996* and *World Tables*, various issues.

[3] The average growth rate in the industrial countries between 1983 and 1992 was 2.8%.

Thanks to the government ability to respond quickly to adverse external shocks, Indonesia is now included by the World Bank among the 'East Asian miracle economies'[4]. The pattern of Indonesian economic growth is illustrated in the graph below: the early 1960's economic uncertainty, the rapid expansion of the oil boom era and the recovery after the 1982-84 oil price shock.

Graph 1.1.1. Real GDP Growth 1961-1993. (Percentages)

Source: IMF, *International Financial Statistics*, various issues.

Table 1.1.1 offers an international perspective on Indonesia's performance in comparison with Mexico, Nigeria, Malaysia, Philippines and Thailand. Mexico and Nigeria have been selected because they are, like Indonesia, two large oil-exporting developing countries. The other comparator countries, Malaysia, Philippines and Thailand, have been chosen in order to offer a comparison with three neighbouring emerging South-East Asian countries.

While during the oil boom (1973-83) inflation in the three oil-exporting countries has been of a comparable level, in the subsequent period Indonesia

[4] See World Bank, (1993), *The East Asian Miracle*, Oxford University Press.

experienced much lower inflation than Mexico and Nigeria. However, despite Indonesia's success in stopping the early 1960's hyperinflation, the persistence of chronic inflation compares Indonesia less favourably with the other Asian countries selected here.

Table 1.1.1. Comparative Macroeconomic Indicators.

	Indonesia	Mexico	Nigeria	Philippines	Thailand	Malaysia
Inflation %						
1972-82	17.9	18.3	15.4	13.7	10.6	6.7
1983-92	8.6	66.3	25.7	15.1	3.6	2.6
GNP per capita [a]						
1970	80	730	170	220	210	390
1980	470	2460	1100	650	670	1690
1992	670	3470	320	770	1840	2790
Real Growth %						
1970-82	6.8	4.0	3.3	2.3	2.9	5.3
1983-92	3.4	-0.5	-2.3	-0.8	6.4	4.0
GDP Real Growth						
1970-82	7.5	6.1	4.5	5.4	6.8	7.7
1983-92	5.7	1.7	3.2	2.5	8.6	6.5
Exports/GDP %						
1970	13	6.2	8.9	21.5	15	41.9
1980	33	11.1	29.1	23.6	24.2	57.6
1992	29.3	12.6	39.1	29	35.7	78.4
Fuel Exports/Export %						
1980	71.7	66.9	93.1			
1992	33.4	29.8	95.8			
Terms of Trade [b]						
1970	46.6	147.8	43.6	175.6	172.2	139.3
1980	142.9	136.6	186	101.7	123.1	134.7
1992	92	119.5	84.5	104.7	91.2	94.3
Debt/GDP %						
1970	35	18.3	6.4	32.8	13	11.9
1980	26.8	29.5	9.6	53.5	25.8	26.9
1992	66.8	34.5	101.3	61.9	35.7	34.4
Debt Service/Export %						
1992	32	44	29	28	14	n.a.
Life Expectancy [c]						
1970	47.4	61.9	41.2	57.2	58.4	61.6
1992	60.2	70.3	51.8	65.8	69.3	70.8

Sources: World Bank, *World Tables*, various issues and IMF, *International Financial Statistics*, various issues.
a: GNP per capita Atlas method, as calculated from the World Bank.
b: 1987=100; US dollar based.
c: Life expectancy at birth, years.

GNP per capita is consistently lower in Indonesia than in the other countries, with the exception of Nigeria in 1992) during the period considered. However, it has grown at the highest rate during the oil boom and at a respectable 3.4% in the subsequent period. The fall in GNP per capita after the oil boom in Mexico and in Nigeria is a good indicator of the comparatively better management of the oil bonanza in Indonesia[5]. Real GDP growth rate figures show the good performance of Indonesia especially in comparison with Nigeria and Mexico after the oil boom.

Trade indicators demonstrate how the Indonesian economy shifted to non-fuel exports and maintained competitiveness in international trade despite the oil price fall of the 1980's, contrary to what happened in Nigeria. Malaysia, however, stands as a threatening strong competitor, with a ratio of export to GDP of 78.4% in 1992.

As for debt indicators, these are a cause for worry not only for Indonesia, but also for Mexico, Nigeria and the Philippines. Nevertheless, two features of Indonesian external debt composition are noteworthy: the low proportion of short term borrowing, never exceeding 13.2% of total debt during the 1980's, and the high proportion of debt on concessional terms, ranging between 36.4% and 26.9% of total debt throughout the 1980's. These features coupled with high levels of exports, which provide readily available foreign exchange to service the debt, have helped Indonesia in its debt management in contrast to Mexico, which suffered a major debt crisis in 1982, and Nigeria, which faced strong threats of debt rescheduling after the 1982-84 oil price shock.

[5] For an interesting comparative study between Indonesia and Nigeria see Pinto (1987).

Finally, all the countries experienced a rise in life expectancy at birth, which is a positive social achievement. Once again Nigeria has experienced the lowest improvement.

As a conclusion, Indonesia has performed well by almost all indicators. During the oil boom, the comparison with Mexico and Nigeria show similar achievements. In the next sub-period, Indonesia moved towards new strategies for development with results comparable to those of its neighbouring emerging Asian countries.

The Indonesian experience makes it an interesting case study. In particular, we will focus on fiscal and exchange rate policies in order to provide background information for the studies presented in the subsequent chapters. However, it is beyond the scope of the whole thesis to provide a comprehensive and detailed history of the Indonesian economy[6].

1.2. From Chaos to the New Order: 1960-1965.

Following a bitter war for independence, in December 1949, nationalist and anti-colonialist feelings shaped policy regimes towards increasing interventionism and inward-oriented options. In 1958 President Soekarno inaugurated a period of "Guided Democracy and Guided Economy", characterised by centralised power, direct state control on trade and production and extensive programs of nationalisation

[6] There is a rich literature on the Indonesian economy written in English. The following references give excellent insights and information on the Indonesian performance during the past decades: Ahmed (1989 and 1993), Booth (1988 and 1992), Gillis (1984), Gillis and Dapice (1988), Hill (1996), McLeod (1997), Sabirin (1993), Thorbecke (1991 and 1992), Warr (1986 and 1992), Woo and Nasution (1989), Woo, Glassburner and Nasution (1994), World Bank (1993).

of Dutch enterprises. A complex multiple exchange rate system was enforced, coupled with various trade restrictions and capital controls. Apart from the many changes in the naming, the following basic devices were incorporated: basic selling and buying exchange rates, a tax on exchange receipts, the export inducement certificate[7] and taxes on foreign exchange sales. In addition, the official main exchange rate was fixed[8]. During the period 1960 to 1965 the combination of accelerating inflation, which peaked 635% in 1965 (see also table 1.3.3 and graph 1.3.1.), increasing monetised government deficit (see graph 1.4.2.) and foreign debt[9], unrealistic and overvalued multiple exchange rates, dwindling foreign exchange reserves, restrictive trade regulations and a shrinking export sector resulted in economic turmoil. The situation was further aggravated by the military confrontation with Malaysia, which had started in the early 1960s. By 1965 widespread political and social unrest resulted in a civil war and a coup attempt by the communists. The year 1965 marked the fall of Soekarno's leadership and inaugurated the Soeharto's era.

1.3. The Stabilisation Period: 1966-1972.

The new President, General Soeharto, inherited a chaotic economic situation plagued by hyperinflation and stagnant economic growth. Political and economic

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[7] Export inducement certificates were related to the issue of export certificates which could be then sold to importers to pay for their foreign exchange.

[8] Kanesa-Thasan (1966) argues that the effectiveness of the Indonesian multiple exchange rate system was also influenced by exogenous factors, such as the deterioration of Indonesia's terms of trade.

[9] Indonesia defaulted its foreign debt in 1965.

stability were quickly restored thanks to an outward-oriented policy regime and the balanced budget law (enforced in 1967)[10]. Moreover, debt rescheduling and generous official assistance plans offered by international organisations and Western countries enabled the New Order government to overcome the debt crisis and to stimulate investment and growth. The table below shows the rapid increase of GDP growth from 0% in 1965 to 10.7% in 1972, following an erratic pattern in the early 1960's.

Table 1.3.1. Real Growth 1961-1972. (Percentages)

1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
5.1	2.5	-2.4	4.9	0.0	2.3	2.3	11.1	6.0	7.3	6.6	10.7

Source: IMF, *International Financial Statistics*, various issues.

In order to manage the large fiscal deficits of the hyperinflation years, austere public expenditure measures were adopted, such as controlling current expenditure, halting the construction of government buildings and of various public propaganda industrial projects inherited from previous governments and reducing price subsidies to state enterprises. Despite the cuts in public investment, the larger weight of fiscal austerity fell on routine expenditure. As a matter of fact, the proportion of current expenditure on total government expenditure rapidly declined from 87% in 1968 to 59% in 1972 to favour development expenditure. On the revenue side, domestic tax collection was intensified, after the dramatic fall in the tax ratio of the preceding years (from 13.7% of GDP in 1960 to 4.2% of GDP in 1966). These efforts led to a steady rise in the tax ratio from 7.2% in 1968 to 13% in 1972, as illustrated in graph 1.4.2. Foreign aid rapidly became an important source for government financing.

[10] Hal Hill (1996) correctly argues that the balanced budget rule is a fiction in economic terms. A slogan central to the New Order's economic policy, the balanced budget law, simply dictates the balance between expenditures and revenues. Note, however, that aid and foreign borrowing are counted as revenues, although they actually finance the deficit.

Prior to 1966, the extreme nationalism of Soekarno's regime had strongly opposed any interference of the Rest of the World in the Indonesian economy[11]. The underlying assumption was that there was an 'Indonesian Economics' which was unique and "defied the rules of conventional economics"[12]. The implication for foreign inflows had been prohibition or tight controls, which resulted in very limited foreign savings[13]. Table 1.3.2 shows the importance of aid for government finances during the pre-boom adjustment period (see also graph 1.4.1).

Table 1.3.2. Aid Inflows Ratio to Total Government Revenues 1967-1972[14]. (Percentages)

1967	1968	1969	1970	1971	1972
29.4	18.9	27.2	27.2	26.0	24.1

Source: Bank of Indonesia, *Report for the Financial Year*, various issues.

Thanks to the control over the budget deficit, which had been the major cause for the early 1960's triple digit inflation, the government managed to quickly slow down inflation from 112.2% in 1967 to a low 4.4% in 1971, as illustrated in the graph and table below.

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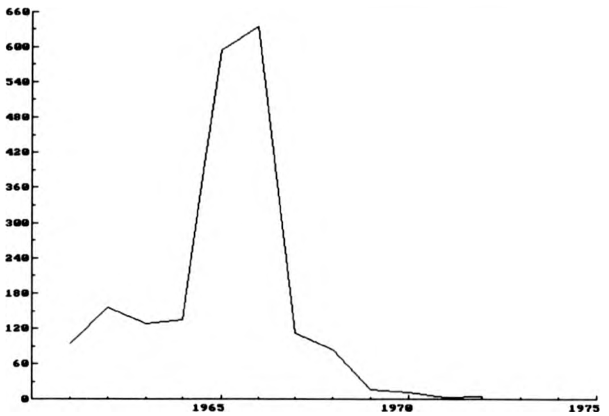
[11] An example of this attitude is the withdrawal of Indonesian from the International Finance Corporation in 1961. Indonesia rejoined the IFC in 1968. Also, Indonesia joined the Asian Development Bank only in 1966 and International Bank for Reconstruction and Development in 1967.

[12] Gillis (1984), p.240.

[13] The late Soekarno is known to have told Western countries "to go to hell with your aid" (Hill, 1996, pp.78-79).

[14] Data refer to fiscal year data. This coincided with solar year for 1967 and 1968. Afterwards fiscal year begins 1st April. For the transition period January-March 1969 the aid ratio is 22%.

Graph 1.3.1. Inflation 1961-1972. (Percentages)



Source: IMF, *International Financial Statistics*, various issues.

Table 1.3.3. Inflation 1961-1972. (Percentages)

1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
95.2	155.9	128.8	135.3	594.5	635.4	112.2	84.8	17.4	12.3	4.4	6.4

Source: IMF, *International Financial Statistics*, various issues.

Foreign exchange policy was set to reinforce the pro-export stance of the New Order and encourage foreign investment. Soeharto's first foreign exchange intervention was an immediate large devaluation of the rupiah in 1965. Within three years the official main rupiah/dollar rate changed from .045 to 326[15]. A major reform of the exchange rate system took place between 1968 and 1971, during which the

[15] It should be noted that in 1965 the new rupiah was introduced. The value of one new rupiah was set equal to 1,000 old rupiahs, so that the devaluation was actually from 45 old rupiahs to 326 new rupiahs.

government gradually simplified the system and unified the exchange rates. In particular, in 1968 the import licensing system[16] was abolished and trade and incentive regimes were subject to reforms, although tariffs remained largely unchanged. In 1969 the Indonesian rupiah became freely convertible and in 1971 government controls on capital movements into and out of the country were practically abolished, except for some limitations on direct and portfolio investments through the domestic capital market.

At this stage of the foreign exchange deregulation process, two features are noteworthy. First, a degree of exchange restrictions were still enforced on the current account: exporters had to sell their foreign exchange export earnings to the banks, which in turn had to sell their foreign exchange to the central bank, Bank Indonesia. Secondly, capital account liberalisation had been implemented and capital into and out of the country was freely transferable. This departure from 'conventional wisdom'[17] in the policy sequencing of foreign exchange liberalisation, that is first current account and then capital account liberalisation, was motivated by the magnitude of the initial tightness and imbalance of the system. Also, domestic interest rate adjustment and inflation control were part of a comprehensive policy strategy, which included strict fiscal discipline, and help explain the Indonesian policy sequencing experience[18].

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[16] Import licensing was a cause for great uncertainty for those domestic producers who used imported intermediate inputs. The importation of inputs was subject to an application with the authorities for buying the necessary foreign exchange. Foreign exchange controls could thus mean long waiting periods and even the rejection of the application. As a result the production was adversely affected.

[17] See World Bank (1993), p.238.

[18] For more details on capital account liberalisation in Indonesia see Sabirin (1993).

1.4. The Oil Boom: 1973-1981.

The dramatic surge in oil prices inaugurated the oil boom era (1973-1981). The quadrupling of the price of oil in 1973 resulted in an unexpected and growing source of revenues for the government. In fact, oil revenues had started to rise since the late 1960's. In 1967 the ratio of oil revenues to total government revenues was 8% and grew subsequently to 14.8% in 1970, 20% in 1971 and 26.6% in 1972. A sudden jump in the absolute and relative importance of oil revenues occurred during the oil boom, from 1973 onwards, with peaks in 1974 and 1981, as shown in the table below and in graph 1.4.1. The side effects of this increasing reliance on oil revenues were on the one hand a fall in aid inflows and in the dependence on them, and on the other hand a decline in the efforts to intensify non-oil tax collection.

Table 1.4.1. Composition of Total Government Revenues: Oil Revenues, Aid Inflows and Non-Oil Tax Revenues (NOTR) Ratios to Total Government Revenues 1973-1981[19]. (Percentages)

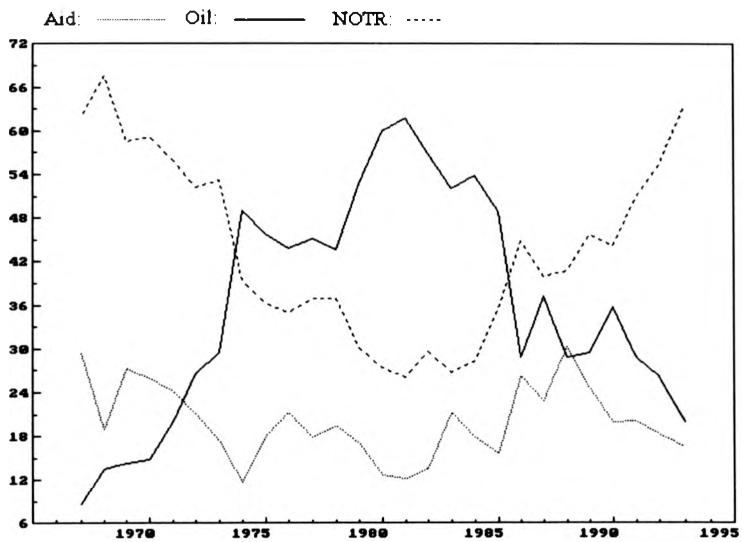
	1973	1974	1975	1976	1977	1978	1979	1980	1981
Oil	29.4	49.0	45.7	43.9	45.2	43.6	52.7	59.9	61.7
Aid	17.4	11.7	18.0	21.2	17.9	19.5	17.1	12.7	12.2
NOTR	53.2	39.3	36.3	34.9	36.9	36.9	30.2	27.4	26.1

Source: Bank of Indonesia, *Report for the Financial Year*, various issues.

Graph 1.4.1 illustrates the revenue structure of the Indonesian central government. The rising and large oil revenue ratio can be observed in contrast to a declining share of non-oil tax revenues during the oil boom era. This trend is visibly reversed in subsequent years (1983-1993).

[19] Figures refer to fiscal year beginning 1st April.

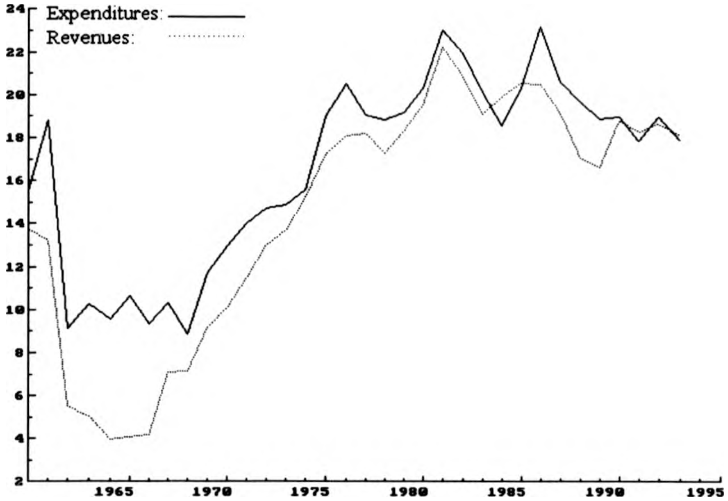
Graph 1.4.1. Revenue Structure: Aid Inflows, Oil Revenues and Non-Oil Tax Revenues (NOTR) Ratios to Total Government Revenues 1960-93. (Percentages)



Source: Bank of Indonesia, *Report for the Financial Year*, various issues.

The oil bonanza also fuelled the increase in the size of the government sector. A growing proportion of public expenditure, and especially of development projects, ended up being financed from oil revenues instead of from aid inflows. Between 1966 and 1974, real government expenditure doubled, their ratio to GDP increasing from 9.3% to 15.6%. This trend continued during the oil boom era: the ratio of government expenditure to GDP ranged between a low 15.6% in 1973 and a peak 23% in 1981 (see graph below).

Graph 1.4.2. Government Expenditures and Revenues Ratios to GDP 1960-93. (Percentages)[20]

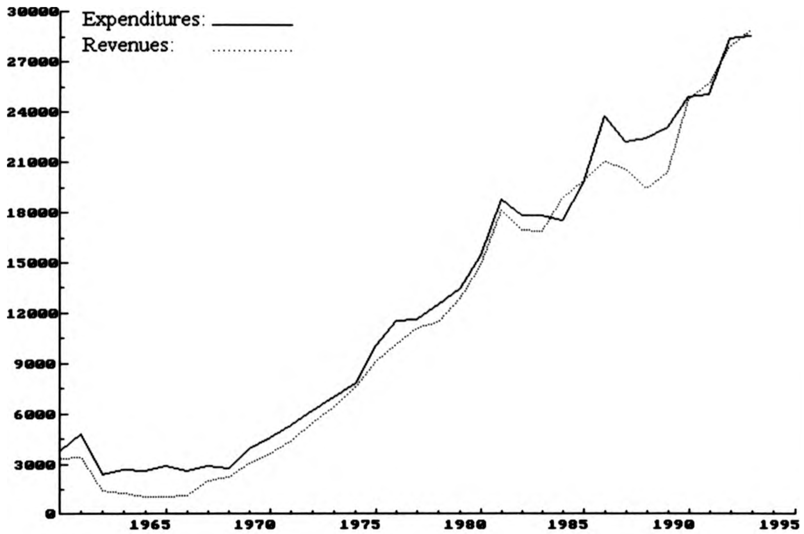


Source: Bank of Indonesia, *Report for the Financial Year*, various issues.

In addition, the decline in the ratio of current expenditure to total public expenditure, experienced in the early years of Soeharto's government, continued throughout the oil boom period, from 62% in 1973 to 51% in 1981. This reflects the increasing concern of policy makers to investing in physical infrastructures, education, agricultural development and capital intensive industry. Notably, this did not result in fiscal imbalances due to the high compensating revenues and to the above mentioned balanced budget rule. The following graph illustrates how real government expenditures and revenues moved closely together throughout the oil boom.

[20] Figures are proportionately adjusted for solar year.

Graph 1.4.3. Real Government Expenditures and Revenues 1960-93. (Billion Rupiahs at 1985 Prices)[21]



Source: Bank of Indonesia, *Report for the Financial Year*, various issues.

Despite its size, however, the government sector grew less rapidly after the Pertamina crisis, as can be seen in the table below.

Table 1.4.2. Government Expenditure Real Growth 1973-83. (Percentages)

1973	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**
12.7	11.6	29.1	14.9	0.9	7.4	7.4	15.0	21.6	-4.8	-0.2

Source: Bank of Indonesia, *Report for the Financial Year*, various issues.

Pertamina, a large oil state company, incurred in a serious debt crisis in 1975 following a series of scandals related to corruption episodes, an endemic plague of the Indonesian public sector. Pertamina defaulted its debt on the 20th of February 1975, the size of its debt being equal to about one third of GDP. Given the company's

[21] Figures are proportionately adjusted for solar year.

involvement in the international credit market, not only was the government forced to assume the responsibility of Pertamina's debt covering, but also state-owned enterprises were denied access to the international credit market. Nevertheless, as argued in Woo and Nasution (1989), this was a "blessing in disguise". The government adopted a more cautious external debt strategy, which prevented excessive borrowing and debt crises in subsequent periods. Moreover, the commitment to the balanced budget rule and to the rescue of Pertamina imposed a tighter discipline on the expenditure side, on monetary policy and on budget transparency[22].

As for foreign exchange policy measures, the shortage of international reserves[23], an acceleration of inflation, the poor infrastructure of the economy, coupled with uncertainty over future trends and increasing instability in the rest of the world were among the determinants of the 10% devaluation in 1971.

Following the oil boom of 1973 Indonesia appeared to suffer from the Dutch Disease syndrome. While the oil sector was booming the performance of the non-oil-non-gas sector did not match the rapid growth of the whole economy (see next subsection). Moreover, the quadrupling of the price of oil, the subsequent rise in government revenues, combined with an accommodating monetary policy led to increasing inflationary pressures (see table 1.4.3. and graph below).

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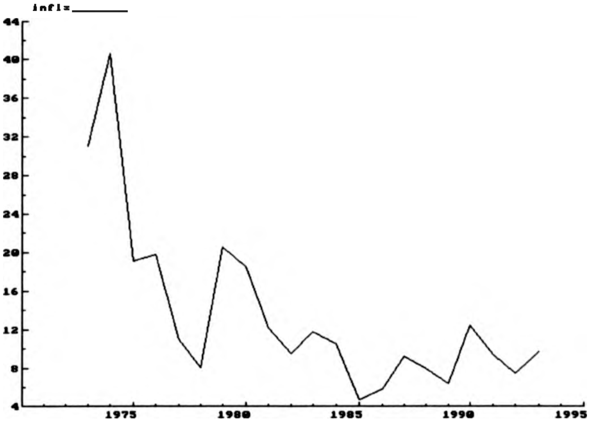
[22] Pertamina's operations were recorded off-budget.

[23] Net official foreign exchange reserves, defined as official short-term assets less official short-term liabilities, had been negative since 1963 through 1971.

Graph 1.4.4. Inflation 1972-1993. (Percentages)



Source: IMF, *International Financial Statistics*, various issues.

Concurrent causes of the resurgence of double digit inflation (31% in 1973 and 40.6% in 1974) are a rice price crisis in 1972[24] and rising international inflation. Given a fixed nominal exchange rate, this caused a real exchange appreciation. The government became increasingly concerned about the loss of competitiveness of the non-oil-non-gas sector caused by an excessive reliance on the oil sector. Despite a healthy balance of payments and adequate international reserves the rupiah was 'surprisingly' devalued in 1978 by almost 50% to help restructure the economy. Following this devaluation, manufactured exports rose sharply and international competitiveness was restored, even in the presence of inflation[25]. Part of the success of

[24] Rice prices doubled within 5 months in 1972.

[25] Warr (1992), however, argues that the impact of the 1978 devaluation on relative prices was smaller than the adverse effect of the oil boom on them in the preceding years. The devaluation was intended to offset, at least partly, the decline in relative prices brought on by the oil boom, but was subsequently slowly dissipated.

this devaluation episode was also due to the government's cautious management, as it coupled the devaluation with prudent fiscal and monetary behaviour in the years immediately preceding the devaluation.

Table 1.4.3 shows the persistence of chronic inflation and the spectacular growth of the Indonesian economy, which averaged 7.7% during the oil boom. It also illustrates how the easy monetary policy of the early 1970's was interrupted by the Pertamina crisis in 1975. Money growth slowed down from 40.5% in 1974 to 24.3% in 1978, the 40% devaluation year.

Table 1.4.3. Inflation, Money Growth (M1) and Real Growth 1973-81. (Percentages)

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Inflation	31.0	40.6	19.1	19.8	11.0	8.1	20.6	18.5	12.2
Money	42.4	40.5	33.0	28.8	25.3	24.3	35.8	48.3	29.2
Growth	11.4	6.8	5.6	6.5	8.8	8.4	5.8	8.5	7.2

Source: IMF, *International Financial Statistics*, various issues.

1.4.1. Structural Change.

Following the 1973 oil boom the Indonesian economy experienced rapid growth and a series of structural changes. The direction of growth of the sectors' contribution to GDP formation became an important issue for policy makers. From a long term perspective, the expansion of the oil sector at the expenses of a shrinking non-oil sector was not deemed desirable, since it would weaken the economy and lead to increased dependence on oil-price fluctuations. This issue is related to the Dutch Disease effect of a booming sector.

The composite non-tradable biased structural adjustment of the economy is termed Dutch Disease[26]. Dutch Disease need not be necessarily brought on by a commodity boom. Capital inflows, and in particular aid, may also induce a real appreciation in the exchange rate. As they add to the recipient country's spending capacity, spending and resource movement effects may happen. Therefore, pressure on the non-tradable sector to expand at the expenses of the tradable sector may emerge.

Table 1.4.1.1 and graph 1.4.1.1 illustrate the pattern of structural changes in the Indonesian economy. During oil boom era the agricultural share in GDP declined particularly quickly, despite rapid growth of agricultural output and intensive public investment in agriculture, and this trend continued through the following years, albeit at a slower pace. The increasing weight of the oil industry, the decline of the relative price of agricultural output, the slowdown of the land expansion frontier and of its cropping intensity may help explain this decline. Martin and Warr (1993) emphasise supply side factors such as capital accumulation and rapid technological change. The highly successful 'green revolution' backed by Soeharto's New Order government[27] since 1966 promoted agricultural modernisation and increased yields and production. By stimulating technological change and capital accumulation, this resulted in pulling out labour from the agricultural sector and pushing it into other economic sectors. As a result, the decline in the agricultural sector compared to other sectors is the consequence of Indonesia's overall economic development.

[26] There is an extensive literature on Dutch Disease. Among the most authoritative studies we should mention Corden (1984), Corden and Neary (1982), Neary and Van Wijnbergen (1986) and Van Wijnbergen (1984 and 1986a).

[27] Soheharto is keen on reminding his peasant origin (Hill, 1996, pp.130-131).

The contribution of service sector to GDP fluctuated during the oil boom era, and this is probably a reflection of the absolute and relative importance of the oil sector. However, its share is high and seems to follow a growing trend in the period following the oil boom.

The relative importance of the industrial sector (which includes mining, manufacturing, constructions and other industrial activities, both in the tradable and in the non-tradable sectors) exhibit a mixed trend, being strongly influenced by the weight of the mining sector and thus by oil price fluctuations. Therefore, it is useful to consider the behaviour of the manufacturing sector as more indicative of the industrial development of the Indonesian non-oil economy. This sector experienced a steady growth in its contribution GDP formation. However, figures on the manufacturing sector are not informative as for the size and trends of the tradable and the non-tradable sectors, since both are included in it[28].

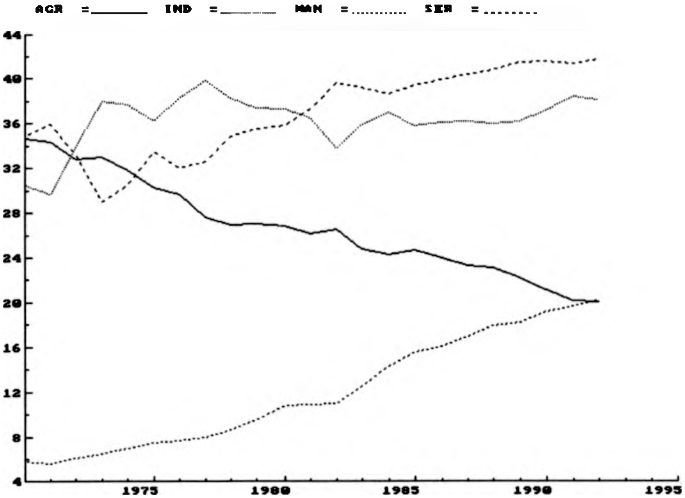
Table 1.4.1.1. Sectoral Growth. Growth Rates of Agricultural, Industrial, Manufacturing and Services Shares on GDP 1971-83. (Percentages)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Agriculture	-0.9	-4.6	0.6	-3.6	-4.7	-2.0	-7.1	-2.5	0.7	-1.1	-2.6	1.5	-6.4
Industry	-2.6	14.1	12.1	-0.8	-4.0	5.8	3.9	-4.0	-2.1	-0.3	-2.1	-7.4	6.2
Manufactures	-3.4	8.9	6.5	7.7	5.7	2.7	5.3	7.5	10.5	13.7	0.9	0.9	14.5
Services	3.2	-7.5	-12.6	4.8	9.9	-4.2	1.9	6.7	2.0	1.1	3.9	7.2	-2.0

Source: World Bank, *World Tables*, various issues.

[28] Complete time series data on the size and growth of the tradable and non-tradable sectors in Indonesia are not available.

Graph 1.4.1.1. Structural Change. AGR: Agriculture Value Added to GDP; IND: Industry Value Added to GDP; MAN : Manufactures Value Added to GDP; SER: Services Value Added to GDP 1970-92. (Percentages)



Source: World Bank, *World Tables*, various issues.

In fact, the manufactures sector expansion was not accompanied by a matching rapid growth in manufactures exports. As mentioned above, the overvaluation of the real exchange rate damaged the competitiveness of Indonesian exports (see graph 1.4.1.2). Figures in table 1.4.1.2 indicate the persistent low proportion in manufactures export in total exports and a decline in the non-oil-non-gas exports ratio[29].

Table 1.4.1.2. Composition of Exports. Manufactures Exports, Non-Oil-Non-Gas Exports (NONG) and Oil-Gas Exports Ratios to Total Exports 1971-83. (Percentages)

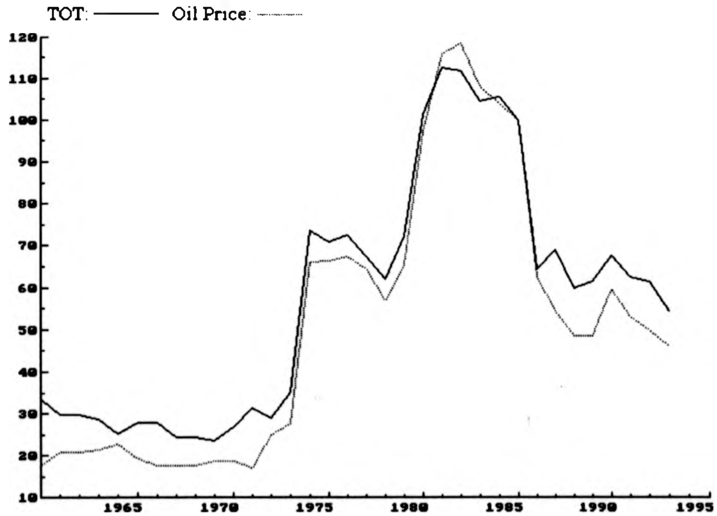
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Manufactures	1.8	2.1	2.2	1.0	1.2	1.4	1.7	1.9	3.1	2.4	3.3	3.9	7.7
NONG	60.2	48.2	50.0	29.9	25.2	29.3	32.0	31.2	34.5	28.0	20.3	17.8	23.8
Oil-Gas	39.8	51.8	50.0	70.1	74.8	70.7	68.0	68.8	65.5	72.0	79.7	82.2	76.2

Source: World Bank, *World Tables*, various issues.

[29] Non-oil exports include manufactures exports.

Graph 1.4.1.2 illustrates the behaviour of the terms of trade and of the real oil price (unit value of oil exports deflated by import unit value price). The three marked jumps in Indonesian competitiveness in 1973, 1979 and 1984 are clearly associated with the oil price shocks. Given the large share of oil exports in total Indonesian exports during the oil boom era it is not surprising that the real oil price and the terms of trade moved so closely together. After the sharp decline in the oil price of 1982-84 the terms of trade reflect rising manufactures exports so that the correlation with the oil price is less tight.

Graph 1.4.1.2. Terms of Trade (TOT) and Real Oil Price 1960-93. (Index Numbers 1985=100)



Sources: IMF, *International Financial* Statistics, various issues and World Bank, *World Tables*, various issues.

Academics generally agree that Indonesia suffered from an oil induced Dutch Disease; however, there is not consensus on its interpretation. In their analysis of Indonesia, Woo and Nasution (1989) emphasise the oil induced nature of the Dutch

Disease. The oil sector is an enclave high capital intensive export sector with very limited linkages with the rest of the economy. Its growth was coupled with a nominal exchange rate fixed at 415 rupiahs per dollar and with inflationary resurgence. This caused a real exchange appreciation and thus loss of competitiveness, as illustrated in graph 1.4.1.2. As a result, the reallocation of resources, especially labour, among the economy penalised the tradable sector, particularly the labour intensive agricultural export sector. In contrast, non-tradable industries, benefited from the squeeze of the tradable sector. An indicator of the poor tradable performance was the deteriorating performance of non-oil exports relative to Malaysia and Thailand. During the period 1973-78 annual growth rates were respectively 32% and 20%, compared to the Indonesian rate of 16%. The immediate acceleration in growth of non-oil exports after the 1978 devaluation is finally deployed as a proof of the Dutch Disease.

The focus on employment and resource shifting is made clear in Van Wijnbergen (1984). He develops a Swan-Salter type model to show that the oil bonanza benefited neither the tradable sector (i.e. Dutch Disease occurred) nor employment in the whole economy in countries such as Indonesia, United Kingdom, Egypt and Latin American oil-exporting countries. Excess demand for non-tradables resulted in real appreciation and in a subsequent draining out of resources from the tradable sector into the non-tradable one.

Usui (1996) also agrees on the timing of the 1978 devaluation. In his simulation exercise he shows how instrumental the devaluation has been in increasing manufacturing production, via a reversal of real exchange rate (RER) behaviour. He argues that without this devaluation the manufacturing sector would have seriously suffered from an overvalued RER. The government responded to the oil boom with a devaluation and budget surplus accumulation. These macroeconomic policy measures are deemed appropriate to contain and eventually avoid the Dutch Disease.

A critical voice comes from Warr (1986), who not only finds little evidence for the Dutch Disease syndrome in Indonesia, but also argues that the Dutch Disease was benign, a mild disease with some positive side effects. He emphasises the growth in size of the government sector and a monetary expansion at a greater rate than the real GDP growth. Coupled with the fixed exchange rate, this led to inflation and consequently to a decline in the tradable/non-tradable ratio. In the absence of the oil boom, massive balance of payments deficits and increasing foreign debt would have occurred. As a consequence, a devaluation should have been inevitable as early as in 1975. In fact, the oil boom enabled the authorities to defer devaluation and to absorb petroleum revenues. Unlike other oil-exporting countries, Indonesia did not borrow heavily and avoided the worst problems of LCDs debt crisis in the early 1980's. An explanation for this appears to be a more prudent attitude to borrowing of the government sector induced by the Pertamina Crisis in 1975. The unsuspected benefit of the imprudent borrowing and financial adventurous behaviour of Pertamina was to restrain borrowing abroad in the following years. In addition, Warr argues that manufacturing output continued to grow albeit at a slower pace, probably induced by the oil price shock. He thus admits that the expansion of the manufacturing sector was not dramatic, especially in comparison to other Asian countries. Moreover, the expansion of the government sector fell mainly on public investment, rather than on public consumption. Sensible public investment did not result in the waste of oil revenues.

An interesting sectoral analysis is presented in Farmandesh (1991). In his study he compares the experience of Algeria, Ecuador, Indonesia, Nigeria and Venezuela following the oil boom. He shows that in all cases it was the agriculture sector which suffered most, while both the non-tradable and the manufacturing sector expanded.

Pinto (1987) develops an interesting comparison with the Nigerian experience. The two countries were both heavily dependent on agriculture and primary sectors during the oil boom. He argues that Indonesia was more successful than Nigeria in avoiding serious economic disruption in the agricultural sector. Moreover, Indonesian exchange rate policy, market oriented strategy and conservative fiscal policy have successfully helped the country in the post-oil- boom adjustment period when compared with Nigeria[30].

Other comparative analysis are offered in Gelb (1986)[31] and Sherr (1989). Gelb stresses Indonesian success in strengthening non-oil sectors and in expanding national control over the economy when compared to most oil-exporting countries. Sherr compares agriculture performance in Indonesia, Mexico and Nigeria and shows vulnerability of this sector to a Dutch Disease type of effect[32].

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[30] For additional insights to policy responses to the oil price shocks and to debt management in Indonesia and Nigeria see Nyatepe-Coo (1993).

[31] Another study by Gelb (1985) develops a multisector computable general equilibrium model to assess the oil windfalls consequences for and Indonesia-like economy. Comparative statics simulations show that consumers will gain from the oil boom. Distributional effects and domestic oil price policy are also analysed.

[32] It is worth mentioning the Computable General Equilibrium (CGE) analysis by Benjamin et al. (1989) for the case of Cameroon. This alternative methodology is extremely powerful for the study of the sectoral impact of external (or even internal) shocks. In this paper, simulation of a CGE model demonstrates once again how the agricultural sector is the most likely to be hurt from an oil boom, whereas some of the manufacturing sector would benefit.

1.5. Adjusting to External Shocks: 1982-1989.

The fourth devaluation in March 1983 followed the world recession of the early 1980's, which caused a deterioration of the trade balance, due to rising oil export values, but declining non-oil exports, partly because of the drop in world demand and partly because of loss of Indonesian competitiveness (see graph 1.4.1.2). International reserves fell and the government was left with no choice, but for a new devaluation of over 30%. In 1983 the devaluation was accompanied by a series of important policy measures, such as a banking sector deregulation package, a tightening of fiscal policies and a wide ranging tax reform. Starting from March 1984, successive five years economic plans[33], Repelita 3 and 4, were inaugurated with the government's commitment to adjustment[34] and macroeconomic reforms. Essentially, the government adopted austere macroeconomic policies in order to achieve financial stability and stimulate the restructuring of the economy to reduce the dependency on oil revenues.

The banking system experienced a radical process of deregulation. This consisted of the following main elements: the removal of nearly all interest rate ceilings on state-owned banks' deposits and loans (banks owned by the state controlled over 80% of banks assets); the gradual reduction of state banks access to cheap funds from the central bank (which accounted for a large proportion of their funding); the dismantling of the pervasive control system on lending operations (which prior to the reform applied to all banks). In October 1988, the financial liberalisation process was

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[33] Five years economic plans, named Repelita, were first introduced in 1968.

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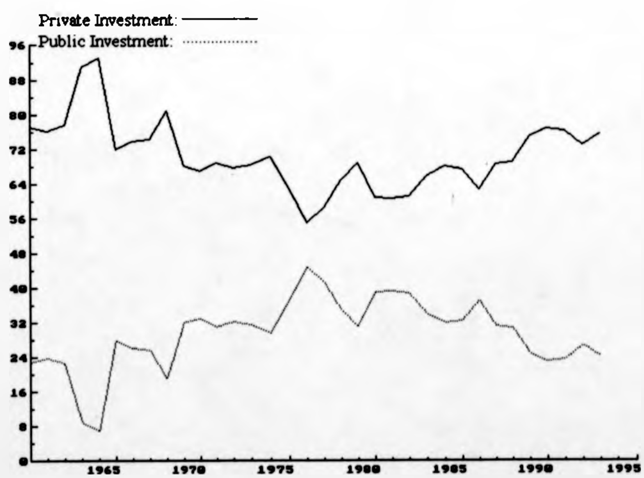
[34] Notably, the government underwent this adjustment program voluntarily.

further enhanced by the removal of institutional and bureaucratic obstacles to competition in the banking industry, which had been previously closed to new entrant banks. Procedures for branch openings and foreign exchange and joint ventures licensing were simplified. As a result, competition among banks became tighter and fund mobilisation larger.

As for fiscal policy, budget retrenchment meant strict controls over government expenditure principally through a rescheduling, and deferring, of large capital and import intensive public investment projects and a curtailing of non-concessional import-related credits. Graph 1.5.1 illustrates the gradual decline in the weight of government investment on total investment since 1982 as opposed to its rising trend during the oil boom.

Graph 1.5.1. Composition of Investment 1960-93. (Percentages)



Sources: Bank of Indonesia, *Report for the Financial Year*, various issues and IMF, and *International Financial statistics*, various issues.

The tax system underwent a radical transformation aimed at reducing oil-revenues dependence and income tax evasion. In particular, the value added tax system replaced sales taxes, company and personal income tax rates were unified into three marginal rates, and land and building property taxes simplified. The results were successful: simplification made the tax system more enforceable and efficient and most importantly it became less reliant on oil tax revenues. Table 1.5.1 shows the steady increase in non-oil tax collection at the expenses of reduced weight of oil revenues. It also illustrates, however, that reliance on aid started to rise again, after the low aid ratios of the oil boom years (see also table 1.4.1). Despite its efforts, government finances still depend strongly on external sources (see also graph 1.4.1).

Table 1.5.1. Composition of Total Government Revenues: Oil Revenues, Aid Inflows and Non-Oil Tax Revenues (NOTR) Ratios to Total Government Revenues 1982-89. (Percentages)

	1982	1983	1984	1985	1986	1987	1988	1989
Oil	56.9	52.0	53.8	48.8	28.9	37.3	28.9	29.5
Aid	13.5	21.2	17.9	15.6	26.3	22.8	30.3	24.7
NOTR	29.6	26.8	28.3	35.6	44.8	39.9	40.8	45.8

Source: Bank of Indonesia, *Report for the Financial Year*, various issues.

The Government managed to reduce the external imbalance, although the debt service was still rising, due to the upcoming maturity of existing debt. It should be noted that the adoption of such sound policies and of prudent borrowing strategies allowed Indonesia to receive strong financial support from official agencies on concessional terms. Moreover, foreign reserves and commercial bank credit lines were still widely available. These factors contributed Indonesia not being ranked within the group of highly indebted country with credit access problems.

The managed float foreign exchange regime was further liberalised, as exporters were no longer required to sell their foreign exchange export proceeds to the banks and the banks in turn to resell these to the central bank. The tight control over the fiscal budget contributed to the success of the 1983 devaluation. As can be seen in table 1.5.2 GDP growth rates and the weight of the manufacturing sector increased rapidly after 1986, reverting the negative trend of the preceding two years (see also graphs 1.1.1 and 1.4.1.1).

Table 1.5.2. Real GDP Growth and Composition of Exports. Manufactures Exports, Non-Oil-Non-Gas Exports (NONG) and Oil-Gas Exports Ratios to Total Exports 1982-89. (Percentages)

	1982	1983	1984	1985	1986	1987	1988	1989
Growth	-0.3	8.8	7.0	2.5	5.9	4.9	5.8	7.5
Manufactures	3.9	7.7	11.0	13.4	19.6	24.8	29.6	32.1
NONG	17.8	23.8	28.3	33.9	45.3	50.1	60.3	60.1
Oil-Gas	82.2	76.2	71.7	66.1	54.7	49.9	39.7	39.9

Sources: World Bank, *World Tables*, various issues and IMF, *International Financial Statistics*, various issues.

Chronic inflation of the early 1980's was brought under control by 1985 as a result of a temporary slowdown in economic growth and of decelerating money expansion, as illustrated in the table below.

Table 1.5.3. Inflation and Money Growth (M1) 1982-89. (Percentages)

	1982	1983	1984	1985	1986	1987	1988	1989
Inflation	9.5	11.8	10.5	4.7	5.8	9.2	8.0	6.4
Money	10.0	6.4	13.3	17.9	14.9	9.2	13.5	39.5

Source: IMF, *International Financial Statistics*, various issues.

The 1986 devaluation of almost 30% was due to negative external shocks, i.e. world demand falling and the sharp decline of oil prices between 1983 and 1986 (third oil shock), and also to unsatisfactory performance in competitiveness. As in the 1983 devaluation episode, short run balance of payment concerns explain the devaluation more than in the 1978's case. Warr (1989) shows that short-run balance of payments concerns played an important role in explaining both the 1983 and the 1986 devaluations He argues, in the context of a Swan-Salter model, that a devaluation is necessary whenever the tradable/non-tradable price ratio reaches an unacceptable level, given the key role that this price ratio has in influencing the balance of payments. This hypothesis appears to be confirmed by the marked decline that the calculated tradable/non-tradable price ratio in the Indonesian case exhibited in the years immediately preceding the devaluation episodes.

After 1986, in promoting non-oil export, foreign exchange policy has been focused on the current account. Since then, a broader nominal exchange peg, including the dollar, the yen and the Deutsche Mark, has been actively applied. The Government adopted the target of maintaining a constant real exchange rate[35], as it became increasingly aware of the destabilising effects on business confidence of too many large devaluations[36].

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[35] Ahmed (1993) argues in support of this targeting strategy: the 1986 devaluation helped the realignment of the real exchange rate to its equilibrium rate. A study on the behaviour of fundamentals affecting this equilibrium rate advocated by Ahmed will be presented in the chapter on the Real Exchange Rate (chapter 5).

[36] The following table reports the Rupiah/Dollar nominal exchange rates from 1960 to 1995.

1960	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**	**1967**	**1968**	**1969**	**1970**	**1971**
.045	.045	.045	.045	.045	.045	66.9	153.7	300.1	326	362.8	391.9
1972	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**
415	415	415	415	415	415	442.1	623.1	627	631.7	661.4	909.3
1984	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
1026	1111	1287	1644	1686	1770	1843	1950	2030	2087	2161	2249

Source: World Bank, *World Tables*, various issues.

1.6. Recent Developments: 1990 to the Present[37].

The comprehensive structural adjustment reforms of the 1980's enabled the Indonesian economy to successfully respond to the series of negative external shocks, namely oil shocks and world recession. Since the late 1980's Indonesia has experienced steady growth at more than 6% per annum, as shown in the following table.

Table 1.6.1. Real Growth 1990-96. (Percentages)

	1990	1991	1992	1993	1994	1995	1996
Growth	7.2	7.1	6.4	7.3	7.5	8.2	7.8

Source: For figures from 1990 to 1993: IMF, *International Financial Statistics*, various issues; for figures from 1994 to 1996: Bank of Indonesia, Financial Data, available on the Bank's web site.

The record on growth since 1993 is in line with the target set off in the sixth Five Year Development Plan, Repelita VI, which projects an average growth rate of 7.1% per annum for the period 1993/94 to 1998/99[38]. Growth has been mainly fuelled by the expansion of the manufacturing sector which grew at an average annual growth rate of 10.9% between 1985 and 1995 and is expected to grow at 11.5% per annum in both 1996 and 1997.

During the 1990's the government has continued to implement the prudent fiscal policy of the earlier decades. The development strategy has been designed to raise the competitiveness of Indonesia through trade and investment deregulation while

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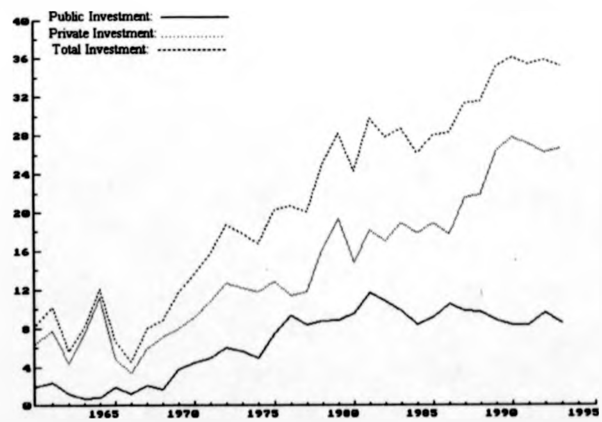
[37] Information on developments in the Indonesian economy in the last years, 1995-97, has been mainly drawn from documents available on the Internet web sites of Bank of Indonesia, Biro Pusat Statistik and Bappenas (National Planning Board).

[38] The average projected growth rate for Repelita VI has been revised upwards in August 1995 from 6.2% to 7.1% per annum.

maintaining macroeconomic stability. The investment boom of the past few years signals the rising confidence in the business community, both domestic and foreign, in the economic prospects of Indonesia. In particular, investment has grown at an average annual rate of more than 8% between 1990 and 1995 and its gross GDP share has risen from 28% in 1990 to 32% in 1996 (see also graph below). Most of this dynamism is attributable to private investment, whose share in GDP accounted for more than 22% in the past few years. In addition, foreign investment has been encouraged for the development of infrastructures for public utilities through a major deregulation in 1994, which allows foreign investors to form joint ventures in Indonesia and fully own the capital invested in Indonesia.

Graph 1.6.1. Public, Private and Total Investment Ratios to GDP 1960-93. (Percentages)



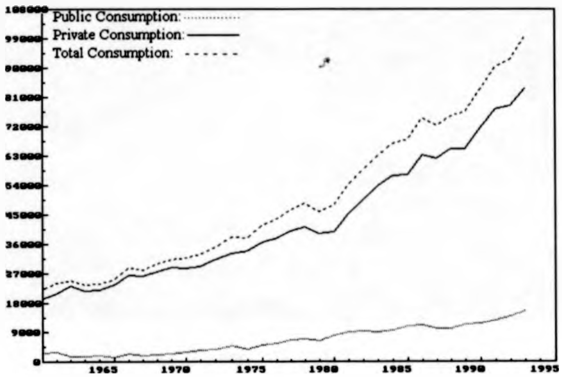
Sources: Bank of Indonesia, *Report for the Financial Year*, various issues and IMF, *International Financial Statistics*, various issues.

In 1991, for the first time since 1969, more than half of government total revenues (51.1%) came from domestic non-oil tax collection. This ratio rose to 55.3% in fiscal year 1992/93, reached 76% in 1996/97 and is projected to peak 87% by the end of Repelita VI (1999). The steady decline in the dependence from external budget financing (see graph 1.4.1) is the result of the government efforts to boost domestic revenues from the non-oil/gas sector. Despite the large direct tax cuts introduced with the 1995 tax reforms, which lowered tax rates on corporate and personal income, revenues were increased primarily by intensifying tax collection and broadening the tax base. On the expenditure side, the control on the budget resulted in an average annual growth of government expenditure of 3.6% over the period 1990-95, almost half than the corresponding 6.5% average growth rate of private consumption. Most importantly, the government ran rising fiscal surpluses: their ratio to GDP rose from 0.3% in 1994 to 1.3% in 1996. Finally, the privatisation program, which includes the partial sale of shares in telecommunications and mining companies, has been implemented not only to improve efficiency but also in order to obtain resources to prepay high interest external debt. This strategy in reducing the debt burden will be further pursued by the government in the future.

Significant steps towards trade liberalisation have taken place: import tariffs are being gradually reduced and unified and some non-tariff barriers removed. In addition, the government officially committed to widening deregulation, purporting free international trade and undertaking a major liberalisation of foreign investment regulations in 1994, when President Soeharto took over the position of chairman of APEC (Asia Pacific Economic Cooperation).

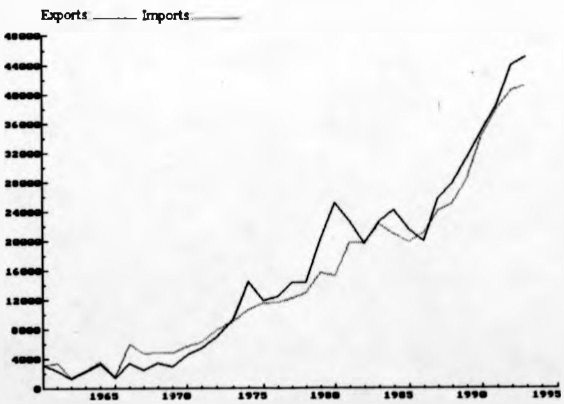
In the 1990's, nevertheless, some macroeconomic imbalances have emerged on the demand side and on monetary developments. The expansion of the private sector resulted in demand pressures leading to increased demand for imports. This can be seen in graphs 1.6.2 and 1.6.3.

Graph 1.6.2. Real Public, Private and Total Consumption 1960-93. (Billion Rupiahs at 1985 Prices)



Sources: Bank of Indonesia, *Report for the Financial Year*, various issues and IMF, *International Financial Statistics*, various issues.

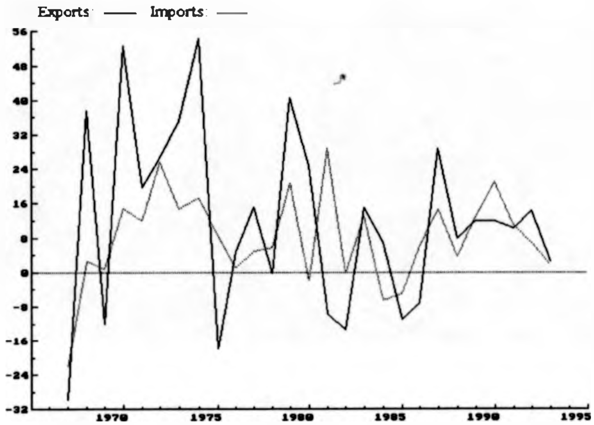
Graph 1.6.3. Real Exports and Imports 1960-93. (Billion Rupiahs at 1985 Prices)



Source: IMF, *International Financial Statistics*, various issues.

In addition, the early 1990's world recession, the slowdown of non-oil exports and the resurgence of inflation, described in the next paragraph, resulted in slow growth in exports in the early 1990's, as illustrated in the following graph.

Graph 1.6.4. Export and Import Growth 1967-93. (Percentages)



Source: IMF, *International Financial Statistics*, various issues.

In September 1997, the government announced a series of measures to boost exports including deregulation, reduction of import tariffs and direct help to exporters and their supporting industries. Moreover, increased sales tax on a number of luxury goods will be raised.

As for monetary policy, the monetary authorities have faced the dilemma of controlling inflation on the one hand and capital inflows (and outflows) on the other hand. Tight monetary policy would help curbing overheating and inflation. However, the induced interest rates rise would have a twofold impact: the possibility of capital inflows which need to be sterilised and the disincentive effect on investment. The open capital account and the fluctuations in international capital market of recent years have resulted in the difficulty for the monetary authorities to control money growth. In practice, the dilemma for the Indonesian government has been to reduce domestic interest rates low enough to stimulate investment, but not too low to induce capital outflow. Therefore, in order to reduce domestic interest rates[39], monetary policy has been relatively easy in terms of liquidity expansion. As a result inflation has been close to almost 10% per annum in 1991, 1993 and 1994. Table 1.6.2 illustrates trends in inflation and money growth from 1990 to 1997.

Table 1.6.2. Inflation and Money Growth (M1) 1990-97. (Percentages)

	1990	1991	1992	1993	1994	1995	1996	1997
Inflation	7.8	9.4	7.5	9.2	9.2	8.6	6.5	4.1[a]
Money	18.4	10.6	9.3	27.9	23.3	16.1	21.7	8.1[b]

Source: For figures for 1990 to 1993: IMF, *International Financial Statistics*, various issues; for figures from 1994 to 1997: Bank of Indonesia, Financial Data, available on the Bank's web site.
a: January to end August. b: January to end July.

McLeod (1997) argues that the government's limited ability to control money growth may be ascribed to the targeting of broad money growth instead of base money. The government announced in December 1995 the extension of direct central bank controls to many financial operations in order to control the growth of monetary aggregates. McLeod warns about the danger of re-introducing controls and regulations in the banking system, which would threaten the liberalisation achieved during the past decade.

[39] S. Sabirin (1993) suggests the financial liberalisation of the domestic sector, in 1982 and 1988, may have played a role in pushing interest rates up. Tighter competition among banks increased fund mobilisation at higher interest rates.

In the last few years, the government targeted inflation between a range of 5% to 10%. The past two years show a marked decline in inflation, thanks to a tightening of monetary policy, including an increase in the interest rate on the Central Bank's securities, and the above mentioned fiscal cautious management, which entails the possibility of rescheduling of government projects should budget imbalances occur in the future.

Despite the deceleration of inflation in the last three years, inflation is still higher than in most of the country's trading partners' and competitors (see table below). This places pressure on the exchange rate and on the competitiveness of the country.

Table 1.6.3. Inflation in Selected Countries 1990-96. (Percentages)

	USA	Japan	Hong Kong	Malaysia	Philippines	Singapore	Thailand	Mexico
1990	5.4	3.1	9.7	2.6	14.1	3.4	5.9	26.7
1991	4.2	3.3	6.9	4.4	18.7	3.4	5.7	22.7
1992	3.0	1.7	9.6	4.8	8.9	2.3	4.1	15.5
1993	3.0	1.3	8.7	3.5	7.6	2.2	3.6	8.7
1994	2.6	.7	8.6	3.7	9.1	3.1	5.3	7.0
1995	2.8	-.1	9.0	3.4	8.1	1.7	5.8	n.a.
1996	2.9	.1	6.0	3.5	8.4	1.4	5.8	n.a.

Sources: For figures from 1990 to 1994: IMF, *International Financial Statistics*, various issues; for figures from 1995 to 1996: Bank of Indonesia, Financial Data, available on the Bank's web site.

In actual facts, the rupiah has steadily depreciated against the dollar since 1990, from 1843 in 1990 to 2680 in 1997, and the intervention band has been widened eight times since 1992. Moreover, recent development in international capital markets placed further pressure on the rupiah. Following the strengthening of the dollar over the past months against the major currencies in the world, such as the yen and most European currencies, South-East Asian currencies, including the rupiah, the Thai baht and the

Malaysian ringgit, experienced turmoil and dramatic depreciation. In an attempt to reduce speculation against the rupiah and to maintain Indonesian competitiveness in international markets, the government has decided to float the rupiah in August 1997.

1.7. Prospects for the Medium Run.

The development strategy of the government for the medium run is focused on the following key elements: reducing regional differences through decentralisation of development planning at a regional level; increasing the role for the private sector through further deregulation; continuing the globalisation policies of the 1990's to boost foreign investment further; improving health and education and investing in human capital; and following a sustainable resource management, which protects the environment.

As mentioned above, growth is projected at an average 7.1% per annum by the end of Repelita VI (1999). Main sources of growth are expected to be high domestic demand on the expenditure side, while on the production side the main contribution will come from the manufacturing and infrastructure related sectors, notably telecommunications and power generation on the production side.

Foreign direct investment is projected to continue the rising trend of the past few years; consequently, capital inflows should remain high and mainly destined to finance activities in the private sector.

As world economic growth recovers, Indonesian non-oil exports are expected to increase, in response also to persistent government efforts towards trade liberalisation, restored competitiveness and expanded domestic capacity.

The early stages of a floating exchange rate system are generally characterised by substantial fluctuations and speculation. After the floating of the rupiah in August 1997, a challenge for the Indonesian government is represented by dealing with the impact of the new regime on the rupiah through sound macroeconomic policies. As already mentioned, the government has recently announced (September 1997) a series of measures, ranging from gradual reduction of interest rates and cautious loosening of liquidity to prudent fiscal policy management, in order to provide reduce uncertainty, boost confidence in the business community and support Indonesian competitiveness in international markets.

Finally, Indonesia's creditworthiness is expected to improve as a result of high growth and of declining debt burden, given the government's commitment to prepay high interest external debt with the proceeds from the privatisation program.

In sum, Indonesian prospects for the medium to long run are ones of growth and development, provided stable macroeconomic foundations ensure increases in efficiency and productivity. We conclude this overview of the Indonesian economy with the following statements made by Mr. Kartasasmita, the Bappenas' chairman, on "the 'vision for the 21st century":

"Indonesia has come a long way over the past 25 years, and is now recognised as one of the East Asian "miracle" economies. However, we are still a low income developing country with half of our work force employed in traditional agriculture, so we still have a long way to go.

By the end of the second decade of the 21st century, we intend to become a middle income industrial nation, with one-third of our GDP coming from manufacturing and less than 10% from farming. Almost all of our young people will enjoy a senior secondary school education, and one-quarter of them will be able to move on to higher education. We aim to raise the average Indonesian income by 4 times, to approximately US$3,000 (in today's dollars).

With a population approaching 260 million, our economy will be one of the largest in the world. Continuation of the rapid economic growth which we have experienced over the last decade will also create the resources needed to eliminate absolute poverty within ten years. We are committed to attaining these fundamental milestones in our national development, and we will institute policies that promote grass roots participation in order to ensure that the economic gains are equitably distributed."[40]

[40] Excerpt from Ginandjar Kartasasmita, Chairman of Bappenas, (1997), *Indonesian Planning for Development*, paper downloaded from the Bappenas web site.

Appendix 1. Main Indonesian Data.

Table A1.1. Real Growth 1961-96, Inflation 1961-97 and Money Growth (M1) 1973-97. (Percentages)

	Growth	Inflation	Money		Growth	Inflation	Money
1961	5.1	95.2		**1980**	8.5	18.5	48.3
1962	2.5	155.9		**1981**	7.2	12.2	29.2
1963	-2.4	128.8		**1982**	-0.3	9.5	10.0
1964	4.9	135.3		**1983**	8.8	11.8	6.4
1965	0.0	594.5		**1984**	7.0	10.5	13.3
1966	2.3	635.4		**1985**	2.5	4.7	17.9
1967	2.3	112.2		**1986**	5.9	5.8	14.9
1968	11.1	84.8		**1987**	4.9	9.2	9.2
1969	6.0	17.4		**1988**	5.8	8.0	13.5
1970	7.3	12.3		**1989**	7.5	6.4	39.5
1971	6.6	4.4		**1990**	7.2	7.8	18.4
1972	10.7	6.4		**1991**	7.1	9.4	10.6
1973	11.4	31.0	42.4	**1992**	6.4	7.5	9.3
1974	6.8	40.6	40.5	**1993**	7.3	9.2	27.9
1975	5.6	19.1	33.0	**1994**	7.5	9.2	23.3
1976	6.5	19.8	28.8	**1995**	8.2	8.6	16.1
1977	8.8	11.0	25.3	**1996**	7.8	6.5	21.7
1978	8.4	8.1	24.3	**1997**		4.1[a]	8.1[b]
1979	5.8	20.6	35.8				

Source: IMF, *International Financial Statistics*, various issues; for figures from 1994 to 1997: Bank of Indonesia, Financial Data, available on the Bank's web site.
a: January to end August. b: January to end July.

Table A1.2. Composition of Total Government Revenues: Oil Revenues, Aid Inflows and Non-Oil Tax Revenues (NOTR) Ratios to Total Government Revenues 1973-1989[41]. (Percentages)

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Oil	29.4	49.0	45.7	43.9	45.2	43.6	52.7	59.9	61.7
Aid	17.4	11.7	18.0	21.2	17.9	19.5	17.1	12.7	12.2
NOTR	53.2	39.3	36.3	34.9	36.9	36.9	30.2	27.4	26.1

	1982	1983	1984	1985	1986	1987	1988	1989
Oil	56.9	52.0	53.8	48.8	28.9	37.3	28.9	29.5
Aid	13.5	21.2	17.9	15.6	26.3	22.8	30.3	24.7
NOTR	29.6	26.8	28.3	35.6	44.8	39.9	40.8	45.8

Source: Bank of Indonesia, *Report for the Financial Year*, various issues.

[41] Figures refer to fiscal year beginning 1st April.

CHAPTER 2

AID AND ITS MACROECONOMIC IMPACT.

2.1. Introduction.

Over the past decades a number of studies have been focused on the macroeconomic impact of aid. Not only the concept of aid itself has evolved, but also the identification of the macroeconomic relationships between aid and other economic variables has grown in many directions. Aid effectiveness can be assessed in relationship to a whole range of targets for the recipients' economy. Traditionally, the most important indicators of the impact of aid are: the level and/or the growth rate of national income, its distribution, some measure of poverty alleviation.

It is worth noting that the ways in which aid effectiveness has been studied have not only been an evaluation of the macroeconomic impact of aid inflows from abroad, but also an evaluation of the microeconomic consequences of development projects.

Up to the early 1970's the major concern was the impact of aid on growth. Thereafter, the savings debate flourished. An important turning point is represented by the seminal work of Heller (1975) which introduced the fiscal response approach. From the late 1970's up to the current days various approaches have been developed: aid and trade (Michaely, 1981; Van Wijnbergen, 1986b; Morrissey, 1991; Lahiri and Raimondos, 1994), aid and allocation (Maizels and Nissanke, 1984; Gulhati and Nallari, 1988; McGillivray, 1989), aid and counterparts funds (Roemer, 1989; Bruton and Hill, 1990; Owens, 1991), aid tying (Levy, 1987; Jepma, 1991; Morrissey and White, 1993 and 1994), aid and the real exchange rate (Edwards, 1988a and 1989; Wood, 1988; White, 1990; White and Wignaraja, 1991 and 1992), aid and fiscal response (Mosley et al., 1987; Gang and Khan, 1991), among the most relevant ones. It is on the last two approaches that we will concentrate our attention.

This chapter is organised as follows. Section 2.2. presents an overview on aid related definition and measurement issues. Section 2.3. describes recent trends in aid. Section 2.4. offers a critical survey on issues related to the macroeconomic effectiveness of aid. Section 2.5 concludes and points out new research approaches.

2.2. Definition of Aid.

2.2.1. Some Preliminary Considerations.

The notion of aid represents one of those powerful concepts that stimulate an interdisciplinary approach and raise a spectrum of questions at different levels of speculation, ranging from purely practical problems to highly abstract and philosophical issues.

At its very heart, aid can be thought of as being the response to the needs of somebody[1]. Moral, socio-political, theoretical and economic issues arise from this tentative definition.[2]

[1] An attempt to define aid in the broadest sense implies the need for identifying the very nature of aid. Once there is a consensus on it, there can be a relatively solid point of reference, bearing in mind, though, that there is no absolute concept. What we think is the core of aid is the following reasoning: somebody is in need, we might give a hand.

The motives for aid lead us to a "moral case for aid" (see Riddell, 1987, for an interesting exposition of these issues). Moral judgements and value rankings provide different frameworks for qualifying the motives for giving aid. On one extreme we find pure altruism, on the opposite, mere self-interest[3]. Political and ideological perspectives also play a role in assessing the moral case for aid. Critics from the left argue that the purpose of aid is a capitalists' attempt to extend their power and install a neo-colonialist international order. They also emphasise the negative impact of aid on the poor and on the environment. Writers from the right see aid as an instrument for extending and centralising the power of the state and even for offering political support from the donor countries. Aid is thus an obstacle to the efficacy of the free market.

The political feasibility and sustainability of aid is relevant in both donor and recipient countries. A donor country plagued by high unemployment rates and social instability may face strong internal opposition to giving aid to other countries. A recipient country ruled by incompetent, corrupt and extremely weak governments may have credibility problems and be subject to a number of conditions for receiving aid. Moreover, a donor country may be politically motivated to give aid for strategic purposes. The US huge aid flows to Israel are an example. A socio-political dimension of the aid issue arises also when analysing the consequences of aid in the receiving country. Who gains and who loses - and how we evaluates those gains and losses -,the international role of the receiver, the long run prospects, the poverty and equality issues are among the questions to be addressed in this context.

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[2] These broad categories of issues do not stand independently of each other as they overlap and interrelate.

[3] Self-interest motivated aid is nothing but a version of a "do ut des" ("I give to be given") action.

All of these considerations bring us back to a more theoretical ground. In order to address the ex ante, interim and ex post aid case we need a framework and some guidelines to tell us from where to start, what to look at and what to look for. The theoretical debate on aid has been quite lively and has not yet reached conclusive answers. One of the most relevant questions concerns the effectiveness of aid. When talking about developing countries as receivers, the most comprehensive point of reference for the assessment of aid effectiveness is economic development. As pointed out by Meier (1989) it "involves more than economic growth. Development is taken to mean growth plus change", covering both quantitative and qualitative aspects of receivers' economies and societies. However, traditionally the focus has been on increasing growth.

The economic content of the aid debate can be thus hardly disconnected to the previous range of issues. To some extent, there is paradoxically no room for pure economics of aid.

2.2.2. An Economic Approach to Aid.

A quite broad and generally acceptable definition of aid is "a transfer of resources on concessional terms - on terms, that is, more generous or 'softer' than loans obtainable in the world's capital market" (Cassen, 1986 and 1994)[4]. Aid can be classified in terms of its nature, such as more or less conditional (that is of a more or

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[4] For issues related to aid measurement problems refer to Riddell (1987).

less grant-like nature), or in terms of its source, bilateral or multilateral, official or private.

The main official source for aid statistics, OECD publications, define the total flow of resources from donors to recipients as the sum of official development agencies, comprehensive also of grants and technical cooperation, (ODA), plus other official non concessional flows (OOF), plus private sector flows. ODA flows must pursue a developmental objective (military assistance and private investments are thus excluded). The terms and conditions of the financial package have to be concessional, i.e. softer than the ones offered on the commercial and financial markets. They must be provided by governmental agencies to governments of the developing countries.

Concessionality is measured by the grant equivalent of aid flows, which is the amount of the 'grant-like' nature incorporated in the flows. The actual determination of grant equivalents depends on the financial terms of the loan (disaggregation by nature).

Another important characterisation of aid is the imposition of 'ties' and policy conditions to the recipient government[5]. Typically, aid can be tied to: i) a particular end-use (project tying); ii) the purchase of goods and services from the donor (procurement tying) or another country (partial tying); iii) the implementation of a specified package of reforms (conditional aid).

As for the sources of aid, the usual classification is: i) bilateral aid, if the transaction actors are just the donor government and the recipient government; ii) multilateral aid, if international organisations whose members are governments and multilateral development banks act as donors; iii) private flows, if aid comes from non-

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[5] A clear exposition of the issue of aid tying is in Jepma (1991).

governmental organisations and has the developmental and concessional nature mentioned above.

Finally, aid can be classified in relationship with its practical nature, so that we may have, for instance, project aid, commodity aid (most notably food aid), technical assistance.

The distinction between types of aid is relevant to our topic. As a matter of fact, different sorts of aid and of the conditions under which aid is given may well have different impacts on growth. For instance, food relief programmes have a temporary effect, in that they are meant to ease emergency situations.

The classification of aid is particularly important when it comes to the problems of fungibility of aid disbursement and of the possible crowding out/in effect. An exogenous inflow of resources will directly finance some development programme, but it may also influence indirectly the economy via a reallocation of the government's spending plans and a change in the domestic system of relative prices. In other words, some types of aid inflows from abroad may 'crowd out' private investment and thus erode the beneficial effects of a development project.

2.3. Recent Trends in Aid Flows.

The flow of resources to developing countries has risen over the past thirty years from 4.6 US billion dollars in 1960 to 75.2 US$ billions in 1993[6]. Figures for

[6] Current prices.

net official flows from 1960 to 1993 are presented in table 2.3.1. alongside their percentage composition. It can be noticed that bilateral aid has consistently represented the greatest proportion of total net resources although its relative weight has been decreasing from a high 95% in 1960 to the 61.2% figure of 1993. The second important component is multilateral aid which has dramatically increased its relative weight from a modest 4% in 1960 to 31.2% in 1993. Peaks in multilateral aid giving were experienced during the 1980's, at the expenses of bilateral aid. As for the last component, official private grants, which do not include private foreign investments, their share on total flows has been relatively stable, ranging between 9.2% in 1970 and 6.2% in 1985.

Table 2.3.1. Total Net Official Flows[a] to All Developing Countries. (Billion US$).

	Bilateral Aid	% of Total	Multilateral Aid	% of Total	Private Grants	% of Total	Total
1960	4.4	95.6	0.3	4.4	n.a.	n.a.	4.6
1965	6.0	88.8	0.9	11.2	n.a.	n.a.	6.8
1970	7.1	72.4	1.8	18.4	0.9	9.2	9.8
1975	11.9	60.7	6.4	32.6	1.3	6.7	19.6
1980	21.7	59.1	12.6	34.3	2.4	6.6	36.7
1985	28.1	59.8	16.0	34.0	2.9	6.2	47.0
1990	46.0	61.5	23.7	31.7	5.1	6.8	74.8
1991	46.7	62.3	22.9	30.5	5.4	7.2	75.0
1992	49.4	64.6	21.1	27.6	6.0	7.8	76.5
1993	46.0	61.2	23.5	31.2	5.7	7.6	75.2

Source: OECD, *DAC Development Cooperation Annual Review*, various issues.
a: Include ODA and Other Official Development Flows.

Recent trends in the regional and income distribution of ODA flows are reported in table 2.3.2. for the early 1990's. Over the period 1990-1994, Asia and Sub-Saharan Africa stand out as the major recipient of ODA. They both constantly received around one third of total ODA to all developing countries. North Africa and the Middle East, on the contrary, have experienced a steady decline in the absolute and relative amount of ODA obtained. The 1990 figure of 13.4 billion US $ fell to 8.3 billion US $ in 1994, alongside an even more marked decline in their share on total ODA (from 23.5% in 1990 to 14.2% in 1994). America, Europe and Oceania's receipts never exceeded 10.4 billion US $ (1993 figure) and their ratio has ranged between 14.3% in 1990 and the 1993 peak of 20%, without dramatic or clear trends. The figures for income group distribution between 1991 and 1994 are relatively stable in both absolute and relative terms. As expected the biggest share of ODA goes to Low Income Countries.

Table 2.3.2 Total Net Receipts of ODA by Region and Income Group 1990-94. (Billion US $)

	Billions US Dollars					% of Total ODA				
Region Countries	**1990**	**1991**	**1992**	**1993**	**1994**	**1990**	**1991**	**1992**	**1993**	**1994**
Asia	18.1	20.3	19.7	17.6	20.9	31.7	34.0	34.4	33.7	35.9
Sub-Saharan Africa	17.4	17.7	19.1	17.4	18.9	30.5	29.6	33.3	33.3	32.5
North Africa and Middle East	13.4	12.1	9.1	6.8	8.3	23.5	20.3	15.9	13.0	14.2
America	5.3	6.0	5.6	5.6	6.1	9.3	10.0	9.8	10.7	10.5
Europe and Oceania	2.8	3.6	3.8	4.8	4.0	5.0	6.1	6.6	9.3	6.9
Total	57.0	59.7	57.3	52.2	58.2	100	100	100	100	100
LICs[a]		33.9	33.6	29.2	32.2		56.9	58.6	55.9	55.3
of which LLDCs[a]		16.0	16.6	15.1	16.2		26.8	29.0	28.9	27.8
LMICs[a]		13.7	13.6	14.0	15.0		22.9	23.7	26.8	25.7
UMICs[a]		2.3	1.8	2.4	2.3		3.8	3.1	4.6	3.9

Source: OECD, *DAC Development Cooperation Annual Review*, various issues.
a: LICs: Low Income Countries; LLDCs: Least Less Developed Countries; LMICs: Lower Middle Income Countries; UMICs: Upper Middle Income Countries.

Table 2.3.3. offers additional information on the regional distribution and the annual real change of net ODA receipts over the past decade and provides figures for the 1994 regional shares of population on total less developed countries population. It is worth noting the high proportion of ODA given to Sub-Saharan Africa relative to its population share (12%). The same can be said of North Africa and the Middle East. Latin America exhibit a stable trend: its share of total ODA stayed at a constant 11%, which is also comparable to its population share (10.6% in 1994). The overall real growth of ODA of .5% between 1984 and 1994 masks opposite regional trends. Most notably, real ODA, to Southern Europe grew at a yearly 10.9%, due to rising aid flows to the war devastated Balkan area. On the other extreme, ODA receipts for North Africa and the Middle East steadily declined at an annual average rate of 4.2% between 1984 and 1994, as shown in the final column.

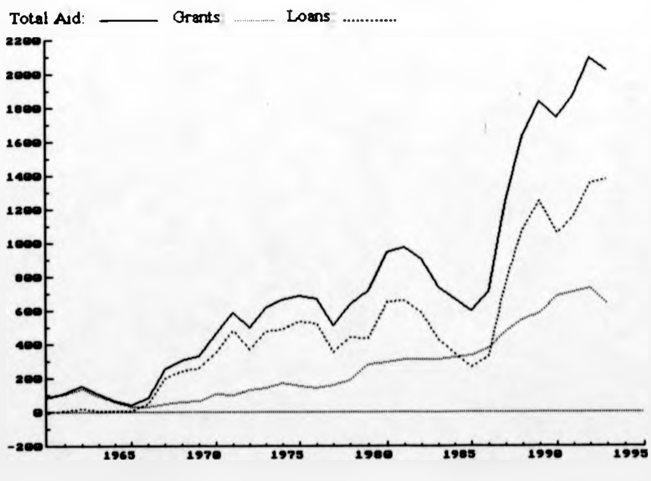
Table 2.3.3. Total Net Receipts of ODA, Share in Total Population and ODA Annual Real Change by Region 1983-94 (Selected Years. Percentages).

	% of Total ODA			Share in Total Population (%)	ODA Receipts Annual Real % Change
	1983-84	**1988-89**	**1993-94**	**1994**	**1984-94**
Sub-Saharan Africa	30.8	39.4	36.6	12.0	2.1
Asia	29.5	32.7	30.2	69.5	1.1
Oceania	3.4	3.3	2.8	0.1	-0.6
North Africa and Middle East	23.5	12.4	14.0	5.7	-4.2
Latin America	11.0	11.2	11.0	10.6	0.1
Southern Europe	1.8	1.1	5.3	2.1	10.9
Total	100	100	100	100	0.5

Source: OECD, *DAC Development Cooperation Annual Review*, 1996.

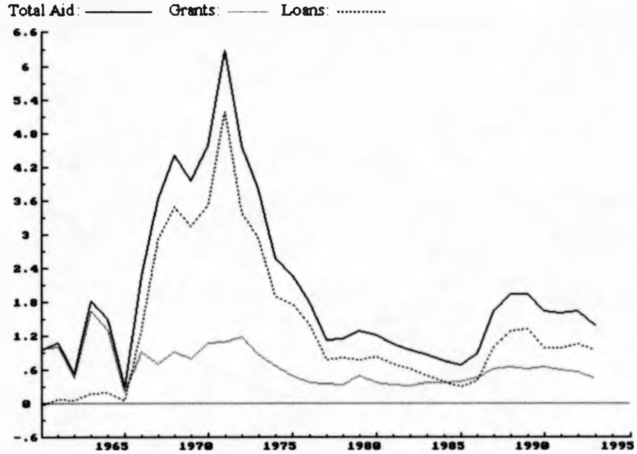
As for Indonesia, graph 2.3.1 and 2.3.2 illustrate the trends in aid inflows for the 1960-93 period. Total aid inflows are here disaggregated by nature into loans and grants and are shown in current dollar values and as percentage of GDP. Prior to 1965, flows were very low, as mentioned in the overview of the Indonesian economy (in particular, see section 1.3). A sudden increase followed the stabilisation period of the New Order government to help reconstruct the economy. Looking at aid ratios to GDP, a peak of over 6% was reached in 1971. During the oil boom the relative weight of aid steadily declined only to reverse the trend in the mid-1980's. Aid inflows increased sharply both in absolute and relative terms between 1985 and 1989. Since then, flows have been fluctuating but still large. Loans have constantly outweighed grants, except in the 1984-86. Although the relative weight of grants on total aid inflows has been rising over the whole period, during the past decade, loans have increased more rapidly than grants.

Graph 2.3.1. Total Aid, Grants and Loans to Indonesia 1960-93. (Million US$)



Source: OECD, *Geographical Distribution of Financial Flows to Developing Countries*, various issues.

Graph 2.3.2. Indonesia: Total Aid, Grants and Loans Ratios to GDP 1960-93. (Percentages)



Source: IMF, *International Financial* Statistics, various issues and OECD, *Geographical Distribution of Financial Flows to Developing Countries*, various issues.

2.4. The Assessment of the Macroeconomic Effectiveness of Aid.

The evaluation of the effectiveness of aid is a rather complex issue. It requires adequate theoretical support and conclusive evidence from empirical research. As for now, both the theory and the empirical research are unable to give an unambiguous answer to the problem of the impact of aid.

Despite the fact that aid is commonly well understood to be a transfer of resources from donor to recipient countries whose economies are, generally speaking, underdeveloped, there is not yet a clear idea of what is the role of aid for the recipients' economies. The basic question "Does Aid Work?" has been central in almost all of the recent empirical literature. Although this question seems simple, it needs to be qualified according to what might be the objective of aid policies. Aid effectiveness can be assessed in relationship to a whole range of targets for the recipients' economies.

Traditionally, the most important indicators of the impact of aid are: the level and/or the growth rate of national income[7], its distribution, some measure of poverty alleviation, the terms of trade. The ways in which aid effectiveness has been studied have essentially been either an evaluation of the micro-economic consequences of development projects or an analysis of the macro-economic impact of aid inflows from abroad. An interesting perspective on the so-called 'micro-macro paradox' is presented in Mosley (1986 and 1987), the paradox being the co-existence of positive evaluations from the microeconomic level analyses and of ambiguous answers from the macroeconomic level evidence.

This section focuses on the macroeconomic analysis of aid effectiveness. Some of the limitations of both the theory and the empirical research will be highlighted that may have hampered ability to assess aid effectiveness[8].

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[7] As pointed out in Cassen (1994), another classification of growth is also the distinction between 'intensive growth' (increase in per capita income or output) and 'extensive growth' (absolute rise of national income or output).

[8] An excellent survey on the macroeconomic effectiveness of aid is presented in White (1990 and 1992a).

2.4.1. The Theoretical Framework.

The basic theoretical framework for most of the empirical studies on aid and growth has been the Harrod-Domar growth model in its simplest form (see Lewis, 1955; Rostow, 1960; Rosenstein-Rodan, 1961) or in its developments, known as 'two-gap' models (Chenery and Bruno, 1962; Chenery and Strout, 1966, a commonly used version). A bottleneck approach characterises the whole class of the models mentioned. In particular, in the Harrod-Domar formulation capital shortage is the only constraint on growth, while the simplest version of the two-gap model identifies foreign exchange shortage as a further constraint on growth in addition to capital shortage.

The Harrod-Domar[9] condition for equilibrium growth is derived by the Keynesian savings-investment equilibrium condition when put in a dynamic context. Savings are assumed to be a constant proportion s of real income Y, so that $S = s * Y$. The investment function is derived by assuming a constant desired capital/output ratio k. Entrepreneurs will increase investment to meet anticipated increases in demand if they expect output to grow, that is $I = k * \Delta Y$. Equilibrium in the goods market requires that desired savings equal desired investments at each moment in time and that capital is fully utilised. The equilibrium condition is thus obtained by imposing $I = S$ and in its simplest form is given by:

$$\Delta Y/Y = s / k,$$

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[9] It is common practice to refer to the Harrod-Domar model, even though, as it is fairly well understood, the model proposed by Harrod is slightly different from the one suggested by Domar. Both yield the same equilibrium growth condition, although they differ in the interpretation of the dynamics between the variables involved.

where $\Delta Y/Y$ is the rate of growth of national income, k is the incremental capital output ratio (ICOR) and s is the saving ratio. An important implication is that capital shortage is the main constraint on growth: growth can be raised if the saving rate - and thus the investment rate - is increased, or, in other words, if the capital constraint is eased.

Two-gap models include an additional constraint on growth, which stems from the foreign exchange equilibrium condition. Accordingly, two constraints on growth are identified:

1) the saving gap (S-I), where S is the domestic savings and I the domestic investment;

2) the foreign exchange gap (X-M), where X is the export earnings and M the import requirements.

Various combinations of the gaps and of their relative size may arise. According to whether the growth constraint is caused by a limited absorptive capacity or by a prescribed growth target, the requirement of foreign capital to fill the gaps and ease the bottlenecks will be determined by whichever of the two gaps is dominant. Foreign borrowing is thus not only intended to ease the savings-investment gap, that is to provide additional capital where it is scarce in order to promote growth, but also serves to ease foreign exchange constraint. This arises when earning from exports are not sufficient to finance imports from abroad and may constitute an obstacle to faster growth if no substitution between domestic and foreign resources exists.

A further development of the two-gap models has been recently proposed by L.Taylor (1990) and Bacha (1990). Here, an additional constraint on growth is identified in the government finance gap, namely (T-G), where T is total government revenues and G total government expenditure, hence the denomination 'three-gap' model. These models strictly relate to the structuralist tradition, which is particularly concerned with the institutional structure of developing countries economies.

The class of Harrod-Domar growth models offers in essence a Keynesian explanation of the growth mechanism. It has been extensively used as a basis for the empirical research on the impact of aid on growth. Given the condition for equilibrium growth - which is explicit in the Harrod-Domar model and is implicit in the two- and three-gaps models - the role of aid is that of an exogenous impulse to capital accumulation leading to higher and self-sustained growth. Its impact is therefore interpreted and measured in terms of its multiplier effect and in relationship with either the ICOR or the saving rate.

Serious limitations, however, undermine the appealing characteristics of clarity and structural simplicity of these models. They are simplistic: the underlying assumptions of a fixed coefficient production function (i.e. no substitution in production) and of a fixed saving rate are too rigid, hence highly unrealistic. Moreover, the lack of generality of this class of models becomes apparent when considering that they are basically one-sector growth models. No account is taken of the labour force or of relative price dynamics, to mention just two of the factors that affect growth besides capital accumulation. As a result, the growth mechanism is not really explained[10] and the ways in which aid may interact with savings, investment and growth not clearly identified.

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[10] Too rigid a priori assumptions 'explain' only tautologically what is claimed to be explained as the outcome of a model.

2.4.2. The Savings Debate.

In the early 1970's, the empirical research on the relationship between aid and growth analysed the macroeconomic impact of aid in terms of the Harrod-Domar model. In this theoretical framework, savings is a crucial determinant of growth in that it acts as the most important channel through which growth can be affected. Hence, if aid affects savings this will automatically influence growth. This is the reason why this relationship between aid and savings has represented the main concern in the empirical aid growth debate of the early 1970's. While in the 1960's almost every researcher had assumed a direct proportionality between aid and savings[11] - and thus growth -, in the early 1970's even the effectiveness of aid on savings has been questioned.

A sizeable empirical research has been devoted to contributions on the 'savings debate'[12]. Please (1967) argued that governments will tend to consume rather than invest additional tax revenues, thus reducing public savings. Griffin and Enos (1970) developed the most radical position in the debate by arguing that aid displaces savings. In the simple context of an intertemporal budget constraint on consumption, they claimed that an anticipated aid inflow will be allocated between consumption and savings - except for extreme values of 0 and 1 of the savings rate - in such a way that the total resources for capital accumulation will increase at the expense of domestic

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[11] Their basic and rather naive assumption "was that each dollar of foreign resources would result in an increase of one dollar in imports and investments" (Papanek, 1972).

[12] Selected references for the aid growth and the savings debate are: Bhagwati and Grinols (1975, 1976 and 1979), Griffin (1970 and 1971), Griffin and Enos (1970), Eshag (1971), Over (1975), Papanek (1972 and 1973), Pezmaglu (1972), Please (1967), Voivodas (1973), Wasow (1979) and Weisskopf (1972).

savings, which, in turn, will be partly used to finance current consumption. As a result, by inducing lower savings, an aid inflow will decrease growth.

The lack of a firm theoretical basis casts doubts not only on Griffin and Enos's results, but also on the validity of the subsequent works from authors who offered empirical evidence to support this rather pessimistic interpretation of the impact of aid[13].

The economic-theory-free way in which these researches have been carried out is actually more disconcerting than their actual findings. A behavioural relationship is not identified by the sole evidence of a cross country association of high foreign inflows with low savings devoid of any explanation in terms of a specified savings function. It only provides a measure of a negative correlation between aid and savings - and thus growth - and does not demonstrate causality. Savings are affected by many other factors besides aid, such as the social, political and economic structure of the recipient countries, their demographic characteristics and some exogenous climatic and environmental variables, in addition to conventional economic theory type factors (e.g. level and/or distribution of income, government behaviour, interest rate, etc.).

Moreover, from a statistical and econometric point of view, the methodology used has been quite unsatisfactory. Definition and measurement of the variables do seem often questionable. Cross country comparisons have been constantly preferred to time series analyses, despite the fact that the individual characteristics of the recipient countries may differ considerably. Finally, extensive testing procedures have rarely

[13] Papanek (1972) names these critics " 'revisionist' in the true sense of the term", a qualification which we find quite appropriate.

been applied, especially with regard to dynamics and functional form. However, the positive contribution of this literature in challenging the simplistic view of the impact of aid on growth through savings should be acknowledged.

It is not surprising, thus, in the light of these considerations, that no definitive conclusion has been reached. The results of the empirical econometric estimations of the impact of foreign inflows on savings vary considerably in the works of the authors from the radical position. In most cases the estimated relationship between foreign inflows and savings turns out to be negative, but this result does not seem very reliable for the reasons mentioned above.

From a theoretical point of view, the issue of the impact of aid on savings is still open and further research should attempt to go beyond this simple single equation model. Important economic channels exist through which aid can affect savings and growth, such as the interest rate, income distribution, government behaviour and terms of trade. These mechanism need to be explicitly modelled in order to capture the static and/or dynamic simultaneity that actually exists among the determinants of growth and growth itself[14]. For illustrative purposes, Appendix 1 presents an empirical example of the relationship between aid and savings for the case of Indonesia.

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[14] See also Bowles (1987) and Newlyn (1991).

2.5. Recent Developments.

As a result of the failure of the savings debate in reaching some conclusive outcome, the empirical research of the 1970's mainly centred the attention on the microeconomic effect of aid (for reference of the literature on project evaluation see Cassen (1986), in particular USAID and World Bank reports). The poor performance of high aid receiving countries such as Sub-Saharan Africa was the major point of reference the savings debate literature. The Harrod-Domar and the related dual gap model proved their inadequacy to explain what was going on during that time.

The relationship between aid and growth and the Harrod-Domar paradigm remained relatively neglected until the beginning of the 1980's, when the series of external shocks that the world's economy was experiencing (i.e. a sharp fall in the price of primary goods exported from less developed countries, such as the second oil-price shock, recession and high lending cost in most developed countries and debt crises) revived interest on the macroeconomic impact of aid.

The direction towards which the research has gone thereafter are many and interesting. As White (1994a) remarks: "A more fruitful approach is to examine the channels through which aid is intended to increase growth...", rather than trying to concentrate on deciding whether aid has increased growth or not.

In fact, recent works on aid and growth by Mosley et al. (1987) and Boone (1994) have focused on the channels through which aid should impact the receiver's economy, such as investment and consumption[15]. In addition, a few studies have modelled aid effectiveness on growth in relation to political regimes (Boone, 1996; Isham, Kaufmann and Pritchett, 1996) and government policies (Burnside and Dollar, 1997) and provide evidence of a positive link between civil liberties, good policy environment and the benefits of aid programmes.

As mentioned in the introduction, other fields of investigation have also been exploited, such as aid and trade, aid and the real exchange rate, aid and government behaviour, aid tying, aid allocation, aid and counterparts funds.

Also, CGE modelling techniques are now being used to perform comparative statics exercises in the presence of aid (see for instance Radelet, 1991, for an application to the Gambian economy and Weisman ,1990, for a case study on Papua New Guinea).

The next chapters will analyse two different channels through which aid may impact the receiver's economy. The first one concerns the role of fiscal behaviour in the presence of aid and the interactions between the public sector and the main macroeconomic variables. We then focus on the link between aid and the real exchange rate in the broader theoretical framework of real exchange rate determination.

[15] Mosley et al and Boone find some evidence of aid impact on growth. Moreover, Boone concludes that virtually all aid goes into consumption.

CHAPTER 3

A DYNAMIC MODEL OF FISCAL BEHAVIOUR FOR INDONESIA.

3.1. Introduction.

This chapter is concerned with the impact of aid on the behaviour of the public sector and with the feedback effects on the economy as a whole. We present a model of fiscal response to foreign aid in Indonesia. A number of studies have developed the seminal contribution by Heller (1975) of modelling government behaviour in order to capture one of the channels through which aid could displace savings and hence negatively influence growth. Heller imposes an optimising framework on the simple Harrod-Domar set-up, which had until then been used to analyse the macroeconomic impact of aid, in order to model the impact of aid on taxation and government expenditure (and thus on public savings). The theoretical result of such models is twofold: on the revenue side, aid may reduce the government's taxation efforts, while on the expenditure side, not all the aid inflow will be allocated to government investment, that is aid is fungible and is deflected away from investment and into consumption[1].

Many empirical studies have adopted the core of Heller's approach (see among others Gang and Khan, 1991; Khan and Hoshino, 1992; McGillivray and

[1] The underlying value judgement is that increasing consumption is a 'bad'. This issue is however open to debate. For instance, food relief programmes increase consumption of food but also save lives.

Papadopoulos, 1991). Mosley et al. (1987) incorporated the core of Heller's approach in a wider model which includes also a production and an investment function, so that they do not actually estimate a Heller type model. However, the empirical evidence based on the fiscal response approach is mixed.

This research aims at assessing the impact foreign aid has had on the fiscal budget and other real variables in the Indonesian economy. Following White (1993), we insert the Government sector into a simple demand determined macroeconomic model. The inclusion of dynamic linkages and of static macroeconomic feedback effects in a fiscal response model highlights the complexity of aid's impact.

We find that on impact aid has a weak negative effect. In the long run, once the intra- and intertemporal linkages have started multiplier processes, foreign inflows appear to influence the economy. In particular, grants, multilateral and bilateral aid negatively affect all fiscal variable as well as income and consumption. However, they reduce public consumption more than investment, thus exhibiting a pro-investment bias. On the contrary, loans encourage tax collection, public and private investment and consumption so that the whole economy benefits.

We also find, not surprisingly, that permanent increases in aid greatly amplify the effects of a temporary shock, namely beneficial effects from loans and negative effects from grants, bilateral and multilateral aid. These results are in contrast with the widespread negative assessment of aid's impact on public budget and on the recipient economy.

The contribution of this paper to the literature is threefold, respectively from a modelling, an empirical and a methodological perspective. From the modelling point of view, three aspects have been introduced: a) interaction between the objective variables in the utility function; b) static feedback effects, via a Keynesian like multiplier; c) dynamic effects, mainly through the investment function. From the empirical perspective, a time series approach has been adopted and the impacts of temporary and permanent increases in foreign inflows have been simulated. From the methodological point of view, the problems related to the choice of the dataset and to the empirical estimation techniques employed have been emphasised.

The chapter is organised in three sections. The first section presents a critical review of the literature on fiscal response. The second part describes the model and its implications. The third section discusses the empirical implementation of the model and the related data and estimation technique issues. It also presents results from a simulation exercise. A conclusion highlights the main lessons from this particular study and proposes directions for further research.

3.2. Overview of the Literature.

In this section we present a critical review of the fiscal response literature. We first discuss briefly its origin and motivation and explain its core features and motivation. Three major contributions, namely Mosley at al.(1987), Gang and Khan (1991) and White (1993), are then described. An assessment on the state of the art concludes.

3.2.1. Origins and 'Raison d'être' of the Fiscal Response Literature.

In the early 1970's, the empirical research on the relationship between aid and growth analysed the macroeconomic impact of aid within an Harrod-Domar theoretical framework, as pointed out in chapter 2. Since savings are a crucial determinant of growth, if aid affects savings this will then automatically influence growth[2]. The 'Please effect' (Please, 1967) indicated that governments would tend to consume rather than invest additional tax revenues, thus reducing public savings. Critics of aid, most notably Griffin and Enos (1970), argued that aid would displace savings and hence the most important channel through which growth can be affected. The savings debate which followed, however, did not reach neither theoretical nor empirical consensus in support of the claim of aid ineffectiveness.

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[2] This is the reason why the aid-savings relationship has represented the main concern in the early 1970's. While in the 1960's a direct proportionality between aid and savings - and thus growth had been generally assumed, in the early 1970's even the effectiveness of aid on savings has been questioned.

A more recent literature has developed the seminal contribution by Heller (1975) of modelling the effect of aid on fiscal behaviour and hence on the public component of a country's savings. The central assumption in his model is that the recipient government maximises a utility function subject to its finance constraints. The arguments of the utility function, which is of a linear quadratic form, consist of a set of 'intermediate targets' in terms of government investment, both 'developmental' and 'non-developmental' recurrent government expenditure, public borrowing and tax revenues. Two separate budget constraints are imposed in order to rule out the financing of recurrent expenditure by means of borrowing. The effect of aid on public savings and thus on a determinant of growth can be assessed, given the underlying Harrod-Domar framework. Heller's results show that aid stimulates public investment but facilitates a reduction in public borrowing and tax revenues. Moreover, although both grants and loans stimulate investment, grants show a higher pro-consumption bias, while loans exhibit a higher pro-investment bias[3].

The debate on the ambiguous aid-savings relationship pointed out the need for investigating, more closely, the behavioural links between aid and other macroeconomic variables rather then simply exploring national accounts identities.

The fiscal response literature focuses on the impact of aid on government behaviour. The main issue is that of aggregate fungibility, i.e. the extent to which an aid inflow may displace or crowd in taxes and/or government expenditure. In other words, the question is whether aid is used to fully fund expenditure increases or, alternatively, partly used to decrease taxes and borrowing. As public savings is a key variable to the

[3] Heller's results confirm the Please effect only for grants.

whole analysis, this literature can be viewed as a natural development of the savings debate.

As it has been mentioned above, fiscal response models have been developed on the idea that the government maximises a utility function in various choice variables subject to its finance constraint. The following discussion of three major contributions will exemplify this approach.

3.2.2. Mosley et al.'s Model.

Mosley (1987) and Mosley et al. (1987) adopted the core of Heller's model of government behaviour and extend it to include a production and an investment function. They then apply the model in a cross country empirical investigation in order to explore the impact that fiscal response to aid has on the economy (and on its growth rate). Their results do not allow for establishing a statistically significant and unambiguous relationship between aid and economic growth and between aid and savings.

The starting point is the assumption that the recipient government tries to minimise a loss function subject to its finance constraints. The arguments of the loss function consist of a set of 'intermediate targets' in terms of government investment (I_g), both 'developmental' (or socio-economic) and 'non-developmental' (or civil) recurrent government expenditure (respectively G_d and G_{nd}), public borrowing (B) and tax revenues (T). There are two budget constraints: the first one posits that recurrent government expenditure derives from taxes and aid inflows (A); the second one states that government investment must be financed by taxes, aid inflows plus public borrowing. An unspecified aggregate production function (Y), whose arguments are private capital, public capital and the labour force (L), is also introduced in the model. Finally, private investment (I_p) is assumed to be determined by lagged investment, aid, business profits (π) and the domestic bank credit expansion (ΔCR), according to the function:

$$I_p = \gamma + \alpha_1 A + \alpha_2 I_{p,t-1} + \alpha_3 \pi + \alpha_4 \Delta CR \tag{3.1}$$

The government will optimise its loss function facing the two budget constraints and the linkage between aid and private investment. Aid inflows represents the control variable used in order to achieve the targets. From the first order conditions Mosley et al. derive the reduced form expressions for G_n, G_{nd} and I_g. By substituting these in the total differential of Y they finally get the reduced form solution of the relationship between aid and growth:

$$\Delta Y = \beta_0 + \beta_1 A + \beta_2 I_{p,t-1} + \beta_3 \Delta CR + \beta_4 T + \beta_5 Y_{t-1} + \beta_6 \Delta L \tag{3.2}$$

where the β_i's are combinations of the parameters of the model. The impact of aid on the instantaneous rate of change of income is then obtained by simply taking the derivative of equation (3.2) with respect to aid. Actually, as pointed out by White (1992a), the model is incorrectly solved and an endogenous variable, namely tax revenues, is left in the reduced form expression for growth[4].

[4] The correct and far more complicated solution is given in White (1992b) as:

$$\frac{\partial \Delta Y}{\partial A} = \delta_1 \alpha_{15} + \frac{\delta_2}{\Gamma} \left\{ (1-\alpha_{14}) + \frac{\alpha_1 \alpha_7 \alpha_{15}}{\alpha_5} - \varepsilon \frac{\left[\alpha_{14} + \frac{\alpha_5 \mu}{\alpha_{13}} \cdot \varepsilon (1+\alpha_{14}) \right]}{\tau} \right\},$$

where Y is income, A the aid inflow, $\varepsilon = 1 - \alpha_{13}$, $\mu = (1/\alpha_3 + 1/\alpha_4)$, $\tau = [\alpha_{13} + (\mu/\alpha_{13})(\alpha_2 + \varepsilon^2 \alpha_5)]$, $\Gamma = [1 + \alpha_1/\alpha_5 - \varepsilon^2 \alpha_5 \mu/(\tau \alpha_{13})]$, and the parameters are as defined in Mosley et al.

The main purpose of their model of fiscal behaviour is to investigate the problem of the fungibility of aid disbursements. An exogenous inflow of resources will directly finance some development programme, but it may also indirectly influence the economy via a reallocation of the government's spending plans and a change in the domestic system of relative prices. In other words, aid inflows from abroad may 'crowd out' private investment and thus erode the beneficial effects of a development project.

Mosley et al. applied the model in a cross-section analysis of government behaviour for a large number of developing countries. Their pessimistic results have been subject to some criticism (Newlyn, 1990) based on the unsatisfactory theoretical foundations and on the limited correspondence between the theoretical solution and the econometric specification.

The equation they actually estimate is an expanded version of the traditional specification of the Harrod-Domar growth model, in which changes in output are dependent on aid inflows, savings (S), private foreign investments (I_f) plus the additional variables of changes in the literacy rate (ΔLit) and in export values (ΔX). Their econometric specification for equation (3.2) is:

$$\Delta Y = \gamma_0 + \gamma_1 A + \gamma_2 S + \gamma_3 I_f + \gamma_4 \Delta X + \gamma_5 \Delta Lit \tag{3.3}$$

where ΔY is the growth rate of GDP and A, S, I_f are measured as a proportion of GDP. Their claim is that this expanded equation may well be interpreted as a long-run form of the solution equation of their model, given the nature of their cross-section data

This answer is far less manageable than the incorrect one given by Mosley et al.; moreover, it is more difficult to interpret in terms of the individual coefficients.

aggregated over ten-year periods. However, there are three weaknesses undermining (3.3):

1) First, and most important, the 'misuse' of I_p. Although the model includes an equation for the determination of private investment (eq.(3.2)), the arguments consist of a number of exogenous variables that do not appear anywhere else in the model. Moreover, private investment is not directly present in the estimated equation (3.3), its role being split between savings and private inflows from abroad. In other words, the accounting relationship

$$I_p = S + I_f \qquad (3.4)$$

replaces the behavioural relationship defined by equation (3.2). What is more serious, it represents a surreptitious introduction of savings. This seems quite arbitrary, as long as savings behaviour is not modelled and as long as it constrains the impact of private capital flows exclusively on private investment.

2) The introduction of ΔX and ΔLit. The use of a literacy variable is not a plausible proxy for labour force, since in this single equation model literacy rate is exogenously treated and the impact of aid on growth induced by its effect on literacy is not explained. Furthermore, if in the regression on growth the rates of growth of literacy and of export values are used, as Mosley et al. do, the resulting equation (3.3) is not consistent with the solution expression for the model (3.2). In the latter all the variables would be divided by the GDP, while in the first the changes of literacy and of export values would be divided by the respective current values. Similarly, the justification for the introduction of the change in export values as a proxy for the

constraint of world demand is equally not convincing, since no mention of world demand nor of such a constraint is included in the model.

3) The overdeterminacy of the model. The model is overdetermined and some of the structural parameters have to be taken exogenously. The detailed theoretical explanation of the structural parameters of the model is not matched by an equivalently clear actual derivation from the estimated reduced form coefficients. Potential problems of ambiguous determination of the responsiveness of private investment to aid disbursement and of the return on private and government investment lie in the unsatisfactory specification of the investment function - which does not include the interest rate - and in the lack of specification of the aggregate production function. In fact, their source for the marginal productivities of private (δ_p) and public capital (δ_g) is a painstaking statistical elaboration. They obtained an average of δ_p and δ_g by taking the ratio of the average 1970-80 increase in constant prices GDP to the average 1970-80 increase in constant prices total domestic investment. Given that the model is overdetermined and that the differential nature of marginal productivities is not matched by the calculated discrete incremental output-capital ratio, it does not seem likely that this estimate may coincide with the average of the corresponding parameters obtained by working out the coefficients estimated econometrically.

As a result, the correspondence between the theoretical solution of the model (eq. (3.2)) and the econometric specification used (eq. (3.3)) is not straightforward.

In addition to the above shortcomings, the theoretical foundation of the model is unsatisfactory. Treating national income and exports as exogenous and not modelling savings behaviour obscures the partial equilibrium analysis on which the model is based. No attempt is made to analyse static feedback effects based on usual Keynesian-like multipliers.

Finally, the lack of dynamic analysis is a serious limitation for the interpretation of the results. They turn out to be only impact multipliers and not long-run. Dynamic factors are likely to be very important and the inclusion of lagged variables is a sensible way to overcome potential simultaneity problems due to dynamic feedback effects. This issue is not exploited in the model. To be precise, Mosley et al. impose a lag structure of the benefits from aid inflow across time on the variables A and I_f. However, this lag structure is rather arbitrary in that it is derived from World Bank estimates of the distribution of project benefits across time. On the contrary, lag structures should be obtained by the likely data generation process[5] and not by treating them as being exogenously determined. Although the idea of introducing a dynamic structure is innovative, the procedure used by Mosley et al. is questionable: more than modelling the dynamics of aid, it forces aid to conform to an a priori fixed dynamic process.

Despite the limitations, the pathbreaking contribution by Mosley et al. represents an appealing attempt to understand the effectiveness of aid on less developed economies. Their model allows for a variety of behaviours in the allocation of aid inflows, for interactions between the private and public sector and for trade-offs

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[5] Time series data should provide the necessary information on dynamics and thus on lag structure.

between productive and non-productive expenditures. Most importantly, it has revived the debate on the issue of aid effectiveness and on the related policy issues[6].

3.2.3. Gang and Khan Model.

Gang and Khan (1991) developed a modified version of Heller's model which attempts to overcome some of the econometric and data inadequacies of earlier works. Their results appear to back the revenue side results obtained by Heller of a negative relationship between taxes and government investment in the presence of aid. However, on the expenditure side their findings contrast with those of Heller and Please. Grants, loans and multilateral aid are found to have no statistically significant impact on government consumption and to be entirely used to finance development projects. Only bilateral aid shows a significant and negative relationship with government consumption in deflecting resources away from consumption and to investment.

The government's utility function is assumed to be linear quadratic in the deviations from the target levels of the choice variables and is in fact the same function used by Heller. The five choice variables are defined as above (except for a minor change of notation regarding G_d and G_{nd} which are denoted here G_s and G_c respectively) and an asterisk indicates a target variable in the following expression:

[6] It should be noted that our concern is with fiscal response rather than on the aid and growth issue.

$$U = \alpha_0 + \alpha_1(I_g - I_g^*) - \frac{\alpha_2}{2}(I_g - I_g^*)^2 + \alpha_3(G_{nd} - G_{nd}^*) - \frac{\alpha_4}{2}(G_{nd} - G_{nd}^*)^2 +$$
$$\alpha_5(G_d - G_d^*) - \frac{\alpha_6}{2}(G_d - G_d^*)^2 - \alpha_7(T - T^*) - \frac{\alpha_8}{2}(T - T^*)^2 - \alpha_9(B - B^*) - \frac{\alpha_{10}}{2}(B - B^*)^2 \qquad (3.5)$$

where α_i's ≥ 0 and starred variables represent target levels.

This utility function is then maximised subject to the following composite budget constraint:

$$\begin{aligned} I_g &= B + (1-\rho_1)T + (1-\rho_2)A_g + (1-\rho_3)A_l \\ G_{nd} + G_d &= \rho_1 T + \rho_2 A_g + \rho_3 A_l \end{aligned} \qquad (3.6)$$

where $1 \geq \rho_i$'s ≥ 0 for i=1,2,3 and A_g and A_l denote foreign grants and foreign loans, respectively. Two separate budget constraint are imposed so that recurrent expenditure is not financed out of domestic borrowing[7]. This structure also allows for aid fungibility, as it has been defined above (paragraph 3.2.1).

Gang and Khan claim their approach is superior to previous studies in the empirical implementation. Their use of a consistent time-series dataset for India in a three-stages least square system estimation and the treatment of target variables represents an improvement. An innovative property of the linear quadratic (LQ) objective function is its asymmetry: undershooting and overshooting are not equally desirable. However, there are many problems with their approach, as pointed out by Binh and McGillivray (1993) and White (1994a,d).

Firstly, the utility function is not maximised to α_0 when the target values of the choice variables are met. This is due to the LQ functional form for U, and the same

[7] It is worth reminding that a dual budget constraint is imposed in most empirical fiscal response studies, such as in Heller, Mosley et al., Khan and Hoshino, McGillivray and Papadopoulos.

criticism can be made of Heller's original formulation. A quadratic functional form would then account for this problem, although, as Gang (1993) replied, the asymmetry property of the LQ form would be lost. It should be noted, however, that even losing asymmetry a quadratic objective function would still be compatible with the notion that deviations from targets are undesirable.

Secondly, although the rational behind the imposition of two separate budget constraint is in general correct, their joint use amounts to predetermining the outcome of the model. Since the ρ_i's are given, and represent the proportions to which the revenue variables are allocated within the budget, the allocation itself is predetermined and bound to yield fungibility. Utility would be maximised if the ρ_i's reflected the values necessary to allocate spending optimally. However, the ρ_i's are parameters and not variables to be determined by the model solution. Budget allocation is thus not the outcome of the government's optimising behaviour, which is in fact over-restricted. White (1993) shows that a single budget constraint of the form

$$I_g + G_{nd} + G_d = B + T + A_g + A_l \tag{3.7}$$

imposed on a quadratic utility function will also produce the result of fungibility. Though solving the shortcomings determined by the presence of two separate budget constraints (that is utility is not maximised since government behaviour is over-restricted and determined by the two budget constraints), this alternative formulation treats different types of aid in the same analytical way. The issue of recurrent expenditure financing is left over, given some conflicting evidence. It should also be noted that the substitutability of foreign capital between recurrent expenditure and government investment should not be imposed a priori. The budget constraint is essentially an accounting consistency condition and not a behavioural statement. Therefore, claiming that a single budget constraint assumes 100% fungibility of aid is not more valid than supporting a dual budget constraint.

Thirdly, the analysis is further complicated by the treatment of the target variables which results in the presence of too many exogenously assumed parameters. The determination of the target variables is rather weak and does not fully exploit the interactions between the macroeconomic variables. Heller, Mosley et al. and Khan and Hoshino defined target values as linear combinations of a series of instrumental variables, given some underlying economic rational. Gang and Khan approximate them by fitting the actual values on instrumental variables independently of the equation system. They then use these fitted values as targets. McGillivray and Papadopoulos also use a similar method for their analysis of the Greece case. The problem is that the closer the fit the more meaningless the target values become. If, on the other hand, the R^2 is not very high there is no reason to consider the resulting target values as sensible approximations of the true unknown targets. The definition of the targets is once more driving and strongly influencing the final quantitative outcome of the model. Moreover, there is no guarantee that estimated targets will meet the budget constraint.

Finally, in presenting their results Gang and Kahn neither discuss the parameters of reduced form equation nor explore the implicit dynamics implied by lagged government consumption. In fact, they base their conclusions on the significance of the ρ_i's[8] and therefore their interpretation of the results is misleading.

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[8] When grants and loans are used, they find only ρ_1 is significant and positive, while in the bilateral versus multilateral aid case both ρ_1 and ρ_2 are found to be significant, the latter being negative.

White (1994d) derives the actual reduced form coefficients and reverses Gang and Khan findings of the impact of aid on government investment.

The same criticism applies to Khan and Hoshino[9] and McGillivray and Papadopoulos[10] findings. Khan and Hoshino claim that grants stimulate public investment and consumption and reduce taxation efforts, while loans stimulate taxes and investment and pull resources out of the consumption budget. A closer inspection of their results reveals that while the conclusions of the positive impact on public investment holds, there is no statistical evidence of a direct impact on government consumption and taxation. McGillivray and Papadopoulos argue that both grants and loans have no significant impact on taxes and that grants deflect resources away from consumption and to investment, while loans do not have any significant impact on the budget. Once again, if we look at the estimated structural equation parameters their results must be reinterpreted and reveal that aid has no impact on the budget, except for a negative effect of grants on government consumption.

The study by Gang and Khan presents some weakness, but on the other hand highlights important issues to be addressed if the fiscal response literature is to give sensible answers.

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[9] They estimate a fiscal response model using pooled time series-cross section data from five South and Southeast Asian countries.

[10] They estimate a fiscal response model on a time series basis for the case of Greece.

3.2.4. White's Contribution.

White's contribution to the literature on aid effectiveness and on the fiscal response in particular has been rich. We have summarised some of his critical reviews in the previous paragraphs. The need for dynamic linkages and for static multiplier effects have been strongly emphasised in his simulation exercise published in 1993.

The starting point is a simplified quadratic utility function in the usual arguments:

$$U = -\frac{\alpha_1}{2}(G - G^*)^2 - \frac{\alpha_2}{2}(T - T^*)^2 \tag{3.8}$$

which is maximised subject to the simple budget constraint:

$$G = T + A \tag{3.9}$$

Target values are determined as linear combination of instrumental variables. In particular, G^* is defined as a fraction of lagged government expenditure and T^* as a fraction of current income:

$$G^* = \alpha_3 G_{t-1} \tag{3.10}$$

$$T^* = \alpha_4 Y \tag{3.11}$$

The model is closed by the introduction of an equation for private investment (I_p) and two standard macroeconomic relationships:

$$C = \gamma_1 + \gamma_2(Y - T) \tag{3.12}$$

$$I = I_p = \alpha_5 + \alpha_6 A \tag{3.13}$$

$$Y = C + I + G \tag{3.14}$$

The model solution yields a reduced form equation for income which allows for multiplier and dynamic effects. A temporary and a permanent aid shock are then simulated. The results show that an aid inflow will only partly fund an increase in government expenditure and will also offset tax collection. Fungibility of aid is thus obtained as a result of the model and not because two separate budget constraints have been imposed.

Once again, there are some problems with this approach. Firstly, as White (1994a) himself has pointed out, an aid receiving economy cannot be closed. Therefore, equation (3.14) is incorrectly specified. However, the correction he suggests is not satisfactory. In order to explain this point we need to open a brief parenthesis on accounting identities involving aid and the balance of payments. Given the balance of payments accounting identity:

$$(X - M) + NTR + NFP = -(LTL^c + LTL^n + STL + OKI + \Delta R + EO) \tag{3.15}$$

where NTR denotes net current transfer, NFP net factor payment, LTL^c long term concessional loans, LTL^n long term non-concessional loans, STL short term loans, OKI net other capital inflows, ΔR net changes in reserves and EO net errors and omissions and given:

$$NTR = OT + PCT \tag{3.16}$$

where OT are official transfers conventionally on the current accounts (or grants) and PCT are private current transfer on the capital account, and defining aid as:

$$AID = OT + LTL^c \tag{3.17}$$

it is easy to rewrite AID as:

$$AID = M - X - PCT - NFP - LTL^n - STL - OKI - \Delta R - EO = OT + LTL^c \tag{3.18}$$

In practice, however, aggregation and consistency problems may arise as well as difficulties in identifying unambiguously the actual figures for the accounting identities.

White (1994a) discusses this 'accounting framework' at length[11]. Still, the income identity he proposes is:

$$Y = C + I + G - A = C + I + G + (X - M) \qquad (3.19)$$

In this formulation aid is identified with the balance of trade. The implied concept of aid is therefore unsatisfactory in that it encompasses many spurious components.

Secondly, the target value for tax revenues are indeed a function of the endogenous level of actual taxes (this is easily seen by solving Y for C and then substituting Y into the expression for T^*, see also appendix 2). White substitutes the value for the target value of T only after having obtained the first order conditions from the Lagrangean. This underestimates the derivatives of the Lagrangean with respect to the tax variable. In fact, other studies include current period income among the determinants of one or more targets (see for example Heller, Mosley et al. and Gang and Khan). The simultaneity problem implicit in those studies is made explicit in White with the inclusion of the income identity. Appendix 2 presents a stylised dynamic fiscal response model with endogenous income. The static and dynamic solutions of the model are discussed. It is shown that in this model the impact of aid is smaller than in White's model. Even if the multiplier is larger, the inclusion of current income in target formation will result in lower effects of an aid inflow.

[11] It should be noted that this 'accounting approach' is typically ignored in empirical work. An interesting and lucid means of addressing these concerns is offered by Bacha's approach.

Finally, the treatment of the dynamics is not really satisfactory. Dynamics is not really intrinsic, but rather ad hoc and stems only from the exogenously specified G_{t-1}. An alternative formulation which would allow for endogenously determined dynamics could be the introduction of lagged income or even of an the accelerator mechanism in the investment function[12].

To sum up, the critical discussion of the existing literature presented here has highlighted two main issues: i) some models have incorrect derivations of the reduced form (Mosley et al), whereas others present inconsistencies and/or misspecifications (e.g. Gang and Khan); ii) all models have incomplete macroeconomic frameworks, which in itself is not a fault, so long as the model is consistent about what is endogenous and what exogenous.

[12] Greene and Villanueva (1991) offer support for the idea of an accelerator mechanism for investments in developing countries.

3.3. A Dynamic Fiscal Response Model for Indonesia.

3.3.1. Main Features of the Model.

We present a model of fiscal response to aid inflows. We formally model the policy maker's decision process as to the level of taxation and the alternative uses of public resources and exogenous capital inflows.

The main characteristics of the model can be summarised as follows: the government maximises a quadratic objective function defined in three intermediate targets (government consumption, G_c, government investment, I_g, and tax revenue, T), and in their interactions, facing a single budget constraint. A series of economic relationships within an accounting framework determines the targets and closes the system. From the fundamental macroeconomic identity the static feedback effect (a keynesian-like multiplier) can be derived. There exist also dynamic linkages originating from the inclusion of lagged income in the private investment function and of lagged government consumption in target determination.

Finances obtained both internally, via taxation (T) and borrowing (B), and externally, via foreign assistance, may be used for investment purposes (I_g), with a high commitment to development targets, or for current expenditure (G_c), mainly devoted to the maintenance of the state organisation itself and the provision of social assistance. This functional distinction of expenditure categories reflects the way the Indonesian public budget is structured. The presence of aid inflows may discourage and even displace taxation efforts. In this case, the original purpose of aid of financing I_g would be partly or completely offset. Similarly, policy makers may divert aid monies received to finance investment projects from their intended use to the funding of more consumption oriented expenditure.

The diversion of aid from its intended purpose, or fungibility, may therefore occur on both the revenue side and the expenditure side: in the first case, aid is diverted to finance a reduction in tax efforts, while in the second one aid is used to fund government consumption. The political short term advantages are among the plausible determinants of this kind of public behaviour. The potential for economic damages lie in the use of aid in less long term productive activities. It should be noted, however, the fungibility might be a blessing if the intended purpose of aid is not appropriate to the country's needs (e.g. steel mills with negative externalities).

The structure of the model thus allows for the case of fungibility and implies that fungibility itself does not necessarily displace taxation efforts. On the expenditure side, the effect of aid on public investment, in particular, is linked to the response of private investment to the same aid inflow, given the interactions between private and public investment. Finally, the comparison between the short term and the long term effect highlights the importance of including intra- and inter-temporal effects. It is our contention that the focus on these linkages is relatively more important than the issue of fungibility itself once a less partial approach has been chosen.

3.3.2. The Model.

3.3.2.1. The Government Sector.

The objective function of the government that reflects the above mentioned interacting choices for any period t can in general be presented as

$$U = F(I_g, G_c, T, B, A) \tag{3.20}$$

where I_g, G_c, T and B are the expenditure and revenue variables described above and A represents foreign aid inflows. These can take the form of loans or grants and are received by the government from all sources. Aid inflows are assumed to be exogenous to the policy makers, i.e. the amount of aid donors will allocate to the country does not depend on and is not influenced by the policy maker and by the country's economic performance. All the other variables are determined endogenously by the public sector. Since during the last decades the Government has pursued a balanced budgeting approach resulting in no internal borrowing[13], B is dropped from the arguments. The objective function is thus simplified as

$$U = F(I_g, G_c, T, A) \tag{3.21}$$

The functional form chosen is a quadratic one. Deviations from target values for each variable are the arguments of the function. Although undershooting and overshooting are equally treated, they still are undesirable. As mentioned in the previous section, a linear quadratic function (such as the one used by Gang and Khan and also present in Heller) would allow asymmetric treatment of deviations form

[13] Balanced budgeting is a constitutional rule in Indonesia. Deficit financing is allowed only in the presence of compensating realised aid levels (see also chapter 1).

targets. However, as pointed out by Binh and McGillivray (1993), a linear quadratic functional (LQ) form for U would not achieve a maximum of zero when targets are met, a desirable property which is instead present in the chosen quadratic functional form for U. Further research is needed for providing an asymmetric objective function which is optimised when targets are met. The state of the art imposes a choice between the asymmetric property of the LQ and the full optimisation property of the quadratic form. We have chosen the second one and write it as

$$\begin{aligned} U = & -\frac{\alpha_1}{2}(I_g - I_g^*)^2 - \frac{\alpha_2}{2}(G_c - G_c^*)^2 - \frac{\alpha_3}{2}(T - T^*)^2 \\ & -\alpha_4(I_g - I_g^*)(G_c - G_c^*) - \alpha_5(I_g - I_g^*)(T - T^*) - \alpha_6(G_c - G_c^*)(T - T^*) \end{aligned} \quad (3.22)$$

where I_g, G_c and T are the expenditure and revenue variables described above, the '*' denotes target variables and α_i's> 0 . The α_i's represent the relative weights given to the various terms of the utility function and without loss of generality may be normalised so that their sum is unity. When all targets are met, an unconstrained maximum of zero is reached[14]; otherwise, deviating from the planned levels of revenues and expenditures is undesirable[15].

Similar formulations have been used in the fiscal response literature. The formulation adopted here differs slightly from earlier specifications in that it represent a more general case[16]. As for the first three terms, the disutility consequences of

[14] A positive maximum cannot be achieved when one or more target deviations are negative because of the quadratic terms and of concavity conditions.

[15] Asymmetry in this kind of quadratic function could be introduced by imposing different values on the α_is, depending on whether the attached deviation is positive or negative. It is, however, apparent how this is a surreptitious solution to the asymmetry problem.

[16] A constant term is usually included, say α_0, which is here dropped without loss of generality. It mainly represents a shift factor.

deviations (either positive or negative) are assumed to become increasingly serious, as implied by the squared terms. In an attempt to take into account the interdependency between the variables, the last three terms have been added. These reflect the disutility consequences of the interactions between the three deviation. Disutility from deviations is amplified when these have the same sign. On the other hand, interaction between opposite deviations, positive and negative, may partly compensate the disutility coming from the first three terms. The compensation would be only partial because of concavity conditions, necessary for defining a well behaved objective functions, as will be shown in the following paragraphs. Given unconstrained finances, the government's utility will be ameliorated by partly offsetting the undershooting of one or two targets with the overshooting of the remaining target/targets. For example, disutility arising from a too low level of government investment may be partly compensated by a sufficiently high level of tax revenues. The imposition of a budget constraint (and concavity conditions) will ensure that economically plausible fiscal behaviour is pursued. Quadratic forms which exclude the interactive terms, i.e. the government is only concerned with the deviations and is not affected by partial compensatory effects from other targets, are simply special case of (3.22), where $\alpha_{4,5,6} = 0$.

First order partial derivatives of U are given by

$$\begin{aligned} \frac{\partial U}{\partial I_g} &= -\alpha_1(I_g - I_g^*) - \alpha_4(G_c - G_c^*) - \alpha_5(T - T^*) \\ \frac{\partial U}{\partial G_c} &= -\alpha_2(G_c - G_c^*) - \alpha_4(I_g - I_g^*) - \alpha_6(T - T^*) \\ \frac{\partial U}{\partial T} &= -\alpha_3(T - T^*) - \alpha_4(I_g - I_g^*) - \alpha_6(G_c - G_c^*) \end{aligned} \tag{3.23}$$

It can be easily shown that utility unambiguously decreases if the government undershoots or overshoots either all its targets simultaneously or only one target at a time, the other two being just met. Apart from these extreme cases, the interaction terms may partly compensate utility losses stemming from undershooting (overshooting). If, for instance, the government undershoots (overshoots) one target, it may be possible to partly offset the utility loss by overshooting (undershooting) the other one, given the third is met.

The Hessian, H, is:

$$H = -\begin{bmatrix} \alpha_1 & \alpha_4 & \alpha_5 \\ \alpha_4 & \alpha_2 & \alpha_6 \\ \alpha_5 & \alpha_6 & \alpha_3 \end{bmatrix} \tag{3.24}$$

The utility function will be concave, ensuring that the second order conditions for a maximum will be satisfied[17], if

$$\begin{gathered} \alpha_1\alpha_2 > \alpha_4^2 \\ -\alpha_1\alpha_2\alpha_3 - 2\alpha_4\alpha_5\alpha_6 + \alpha_1\alpha_6^2 + \alpha_2\alpha_5^2 + \alpha_3\alpha_4^2 < 0 \end{gathered} \tag{3.25}$$

These conditions imply that the combined weights attached to deviations have to be larger than those attached to the interaction terms (i.e. $\alpha_{1,2,3}$ are of higher order than $\alpha_{4,5,6}$). The government will give more weight to meeting a target rather than to the corresponding interaction effects. In fact, if it was to give no weight to the target deviations (i.e. $\alpha_{1,2,3} = 0$), or the same weight to all α_i's, second order conditions would not be met. On the contrary, $\alpha_{4,5,6} = 0$ is consistent with a well behaved utility function. In other words, concavity conditions will ensure that preferences will be concave,

[17]For strict concavity to hold, the Hessian must be negative definite. In our case, this requires that the three principal minors (i.e. the determinants of the sub-matrixes obtained by taking only the first n_i rows and n_i columns, where i=1,2,3) must alternate in sign starting from the negative sign. Note that the first minor is given by $-\alpha_1 < 0$, while the second and the third are shown in order in (3.25).

consistent and transitive. Moreover, $\alpha_1\alpha_2>\alpha^2_4$ can still be met if $\alpha_1>\alpha_4$ and $\alpha_2<\alpha_4$ (and viceversa). In this case, α_5 must be greater than α_6 (or if $\alpha_1<\alpha_4$ and $\alpha_2>\alpha_4$, $\alpha_5<\alpha_6$), that is, if the government attaches a higher weight to meeting I_g^* relative to meeting G_c^*, then, given α_3, then interaction between I_g^* and G_c^* has to be preferred to interaction between G_c^* and T^*. As a rule of thumb, the sum of $\alpha_{1,2,3}$ must be greater than one half to ensure concavity[18].

The allocation of public financing is subject to the country's economic and institutional ties. The policy makers' maximisation process is therefore subject to the following budget constraint:

$$I_g + G_c = T + A_g + A_l \qquad (3.26)$$

The assumption underlying the budget constraint is that government spending in investment and current expenditure must be financed by tax revenues and grants (A_g) and loans (A_l) inflows. We have chosen a single budget constraint rather than a dual one (in the Heller's tradition) in order not to predetermine the allocation of government resources and thus overdetermine the system (see also paragraph 3.2.3, on the discussion of Gang and Khan model's shortcomings)[19]. In any case, the budget constraint imposes an a posteriori consistency condition and is not a behavioural relationship. The test of whether aid leaks to recurrent expenditure rather than is on

[18] If for instance $\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=\alpha_6=1/6$, their sum being equal to unity, it is easy to show condition (3.25) is not met. If $\alpha_1=\alpha_2=\alpha_3=2/9$, so that their sum is greater than 1/2, and $\alpha_4=\alpha_5=\alpha_6=1/9$, so that the sum of the α_i's$=1$, then condition (3.25) is met:

$$\alpha_1\alpha_2 = 4/81 > \alpha_4^2 = 1/81$$

$$-\alpha_1\alpha_2\alpha_3 - 2\alpha_4\alpha_5\alpha_6 + \alpha_1\alpha_6^2 + \alpha_2\alpha_5^2 + \alpha_3\alpha_4^2 = -4/729 < 0$$

[19] As noted in paragraph 3.2.3 a single budget constraint implies that different kinds of aid are analytically equivalent. This can be the case if aid was fully fungible. One rather different argument for including a dual budget constraint is that this can pick up conditionality: if donors impose some restrictions on the use of revenues, the 'conditions' affect fungibility.

public investment should be based upon the model's solution and not on the budget constraint. As shown in White (1993), a single budget constraint is also consistent with the possibility of fungibility. An aid inflow may not fully fund capital expenditure, but may instead be used to partly fund increases in G_c at the expense of reducing T.

Moreover, the rationale for the imposition of a dual budget constraint, that is the controversial issue of recurrent expenditure financing out of domestic borrowing, is not relevant in the case of Indonesia. Although in theory government deficit financing is possible, the pursuit of roughly balanced budgets and of no internal borrowing has been an established practice in fiscal policy since 1965. Aid inflows have thus resulted in financing the gap between tax revenues and government expenditures[20].

The imposition of the budget constraint results in further interactions between fiscal variables in addition to those implied by the last three terms in the utility function. As a result, interaction between T, I_g and G_c is picked up in the model via the utility function and the accounting relationship, i.e. the budget constraint. These two channels are different in nature and complement each other, so that the final effect of the budget constraint will depend on the utility function interaction terms, as will be shown in the following.

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[20] An alternative way of imposing a budget constraint which includes internal borrowing and allows for the issue of recurrent expenditure financing could be the imposition of a single budget constraint coupled with some complementary slackness condition on I_g and B, e.g. I_g>=B or I_g>=B+A. If I_g=B or I_g=B+A, there would be full fungibility. If I_g>B or I_g>B+A, then public investment would be financed out by B and/or A and some fungibility could arise.

Finally, maximising the quadratic utility function subject to this budget constraint is consistent with the occurrence of aggregate fungibility[21], i.e. of government diverting aid revenues from the purposes they were primarily destined - typically from developmental investments to recurrent expenditures.

The desired levels of government investment and consumption and of tax revenues, respectively I_g^*, G_c^* and T^*, are defined as:

$$I_g^* = \alpha_7 I_p \qquad (3.27)$$

$$G_c^* = \alpha_8 G_{c,t-1} \qquad (3.28)$$

$$T^* = \alpha_9 OIL_{t-1} + \alpha_{10} A_g + \alpha_{11} A_l \qquad (3.29)$$

where I_p denotes private investment, Y is income, OIL is Oil Revenues, A_g and A_l are as defined above, and the subscript (t-1) lags the variables. In an ideal world we would be able to have full information on these target levels. Unfortunately, this is not the case and we have to approximate the desired levels of government policy variables. Here, we assume that the policy makers set their targets according to the above relationships between observable macroeconomic variables[22]. I_g^*, G_c^* and T^* are thus defined as linear combinations of instrumental variables I_p, previous period government consumption, lagged OIL revenues and aid inflows. This is a simplified version of both Heller and Mosley et al. targets specification and reflects a similar economic rationale, described as follows.

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[21] However, it does not shed light on categorical fungibility, an issue which is not on our agenda. Categorical fungibility occurs when aid funds which are destined to a certain economic sector are diverted to an other one, so that, for instance, flows destined to agriculture end up financing education. See, for example, Pack and Pack (1990 and 1993).

[22] See paragraph 3.2.3 for a critical discussion of the alternative method of estimating targets independently of the equation system.

The planned level for public investment is related to private investment decisions. Higher private investment would trigger higher demand for infrastructures and hence lead to higher public investment. In the context of a Harrod-Domar growth mechanism public investment serves to complement private investment in order to reach a desired growth rate. The target for government current expenditure is simply set to reflect the routine needs of the public sector assuming adaptive expectations and stable growth, that is next year G_c will be a proportion of last year's level of government consumption. The desired level of tax revenues is set as a proportion of previous period oil revenues as a determinant of T^*[23]. It also depends on current aid inflows[24]. Indonesia is an oil exporting country and oil related tax revenues represent a large proportion of tax revenues, although in recent years a major tax reform has been introduced that attempts to raise proportionately higher non-oil taxes. Pack and Pack (1990) argue that there is a strong sentiment against aid among Indonesian officials. This could be reflected in a positive relationship between aid and taxation efforts, in order to reduce aid reliance, i.e. α_{10} and/or $\alpha_{11} > 0$.

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[23] T^* depends on lagged oil revenues given the high oil price volatility. This is justified by an underlying adaptive expectation assumption for oil revenues. Incidentally, preliminary estimations confirm the significance of OIL_{t-1} against the insignificance of current oil revenues.

[24] A better specification would define the aid variable as aid commitment. Data limitations prevent us to use aid commitments so that aid disbursements are employed instead. In an adaptive expectation framework, this implies the assumption that last year's commitments are equal to current year disbursements. The issue of aid commitments versus aid disbursements is not addressed here, although it deserves further investigation, despite data constraints.

3.3.2.2. Other Relevant Economic Relationships.

The structure of the model thus far is clearly identified in the tradition of the fiscal response literature modelling. Here, however, we add three economic relationships in order to close the system (see White, 1993, who is one of the early proponents of such practice, as already mentioned) and to provide dynamic linkages. The static economy-wide effects and the dynamic impact of aid inflows can be assessed once the relevant multipliers are derived.

The first relationship is the following private investment function:

$$\begin{aligned} I_p = \beta_0 + \beta_1 Y_{t-1} + \beta_{2,1,1} A_g + \beta_{2,1,2} A_{g,t-1} + \beta_{2,2,1} A_l + \beta_{2,2,2} A_{l,t-1} \\ + \beta_{3,1} OF + \beta_{3,2} OF_{t-1} + \beta_4 DomCred \end{aligned} \tag{3.30}$$

where A_g and A_l represent grants and loans respectively, OF are other official financial flows from abroad[25] and DomCred is the level of domestic credit available in the economy. In essence, this specification assumes that private investment decisions depend both on real lagged GDP and financial foreign (A_g, A_l, OF) and domestic (DomCred) variables. In particular, β_0 is an exogenous investment component[26]. β_1 links I_p with previous period level of economic activity, which again reflects an underlying Harrod-Domar growth framework[27]. The $\beta_{2,i,j}$'s coefficients are of particular

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[25] Other official financial flows, as defined in OECD statistics, are non concessional capital flows both from official and private sources other than grants and loans.

[26] We may think of β_0 as capturing all the other investment determinants which are exogenous to our model. For instance, it may embody the relationship between investment and interest rate as well as a purely autonomous component of investment decisions. Here we are not modelling monetary issues and assume constant price levels. A possible extension of the model could take into account the monetary sector and the dynamics of prices.

[27] An accelerator mechanism could replace lagged income. However, preliminary estimates for the case of Indonesia show how the accelerator mechanism does not fit the Indonesian case well.

importance. Negative (positive) values imply that aid inflows stimulate (displace) private investment. Since I_p is among the determinants of the target level of public investment I_g, aid will also affect I_g and the level of income. The $\beta_{2,i,i}$'s are therefore a key measure in the assessment of aid's impact. The rationale for including aid among the determinants of private investment is that entrepreneurs perceive them as additional financial resources. It should be noted that this is a simplification as aid is normally given to governments and not directly to the private sector. Therefore, the relationship between private investment and aid depends on the government's response to aid, on the consequences on the credit market and on how the government will pass aid inflows to the private sector. In equation (3.30), the $\beta_{2,i,i}$'s thus incorporate the anticipated indirect effect of aid on I_p through the public sector. Further research should develop a more sophisticated specification requiring a simultaneous modelling of private and public responses to aid inflows[28].

We then assume a standard keynesian consumption function C:

$$C = \gamma_0 + \gamma_1 (Y - T) \qquad (3.31)$$

where γ_0 is the subsistence level of consumption and γ_1 is the marginal propensity to consume out of disposable income (Y-T)[29].

[28] The problem of the relationship between private and public investment in the presence of aid inflows is further complicated by issues related to credit markets and credit rationing. The simple inclusion of current public investment in (3.30), for instance, which would endogenise private investment, or the insertion of lagged public investment in (3.30), which would imply that I^*_g is a function of $I_{g,t-1}$, would not account for these issues.

[29] The estimation of this specification for consumption suffered from autocorrelations problems. We therefore added lagged consumption among the regressors. This does not pose any particular problem of theoretical justification. The above specification may be viewed as the long run specification for private consumption.

We assume that income is demand determined[30], so that the following applies:

$$Y = Min(Y^s, Y^d) \quad (3.32)$$

Finally, the following accounting identity ensures system consistency:

$$Y = C + I_p + I_g + G_c + X - M \quad (3.33)$$

where X and M are respectively exports and imports of goods and services and all the other variables are as defined earlier. Once we take into account the accounting relationship between aid and the balance of payment, discussed in greater detail in White (1994a,c), we can rewrite the national accounts identity as:

$$Y = C + I_p + I_g + G_c - A_g - A_l - OF - OBP \quad (3.34)$$

where all the variables are as defined above and OBP is an aggregate of other components of the capital account not included elsewhere[31] plus private current transfers and net factor payments, the last two coming from the current account. An alternative disaggregation for aid would distinguish between bilateral and multilateral flows.

A superficial inspection of this accounting identity would suggest a negative impact of aid on income. Solving for the level of income we get:

$$Y = \frac{1}{1-\gamma_1}(\gamma_0 - \gamma_1 T + I_p + I_g + G_c - A_g - A_l - OF - OBP) \quad (3.35)$$

In fact, the national account identity is only a consistency condition and once the behavioural implications of the model are included ∂Y/∂A appears to be given not simply by $-1/(1-\gamma_1)$. We will see later how the impact of aid is more complex[32].

[30] This implies that we are not modelling the supply side.

[31] These are essentially short term capital, changes in reserves and errors and omissions.

[32] This impact is even more complex when current income is included in target specification (see appendix 2).

3.3.2.3. The Solution of the Model.

The reduced form equations which must hold under maximisation are obtained by maximising the following Lagrangean:

$$\begin{aligned}\max L = -\frac{\alpha_1}{2}(I_g - I_g^*)^2 - \frac{\alpha_2}{2}(G_c - G_c^*)^2 - \frac{\alpha_3}{2}(T - T^*)^2 \\ -\alpha_4(I_g - I_g^*)(G_c - G_c^*) - \alpha_5(I_g - I_g^*)(T - T^*) - \alpha_6(G_c - G_c^*)(T - T^*) \\ +\lambda(I_g + G_c - T - A_g - A_l)\end{aligned} \tag{3.36}$$

The first order conditions are:

$$\begin{aligned}\frac{\partial L}{\partial I_g} &= -\alpha_1(I_g - I_g^*) - \alpha_4(G_c - G_c^*) - \alpha_5(T - T^*) + \lambda = 0 \\ \frac{\partial L}{\partial G_c} &= -\alpha_2(G_c - G_c^*) - \alpha_4(I_g - I_g^*) - \alpha_6(T - T^*) + \lambda = 0 \\ \frac{\partial L}{\partial T} &= -\alpha_3(T - T^*) - \alpha_4(I_g - I_g^*) - \alpha_6(G_c - G_c^*) - \lambda = 0 \\ \frac{\partial L}{\partial \lambda} &= I_g + G_c - T - A_g - A_l = 0\end{aligned} \tag{3.37}$$

It can be shown that the structural equations for I_g, G_c and T are given by the following equations:

$$\begin{aligned}I_g &= \delta_1 I_g^* + \delta_2(A_g + A_l + T^* - G_c^*) \\ G_c &= \delta_3 G_c^* + \delta_4(A_g + A_l + T^* - I_g^*) \\ T &= \delta_5 T^* - \delta_6(A_g + A_l - I_g^* - G_c^*)\end{aligned} \tag{3.38}$$

where

$$\delta_1 = \frac{(\alpha_1+\alpha_5)(\alpha_2-\alpha_4+\alpha_6-\alpha_5)-(\alpha_4-\alpha_1)(\alpha_3+\alpha_4+\alpha_5+\alpha_6)}{D}$$
$$\delta_2 = \frac{(\alpha_3+\alpha_5)(\alpha_2-\alpha_4)-(\alpha_4+\alpha_6)(\alpha_6-\alpha_5)}{D}$$
$$\delta_3 = \frac{(\alpha_2-\alpha_4)(\alpha_1+\alpha_3+2\alpha_5)-(\alpha_4+\alpha_6)(\alpha_4-\alpha_1+\alpha_6-\alpha_5)}{D}$$
$$\delta_4 = \frac{(\alpha_1+\alpha_5)(\alpha_6-\alpha_5)-(\alpha_3+\alpha_5)(\alpha_4-\alpha_1)}{D} \tag{3.39}$$
$$\delta_5 = \frac{(\alpha_3+\alpha_5)(\alpha_2-\alpha_4)-(\alpha_4-\alpha_1)(\alpha_3+\alpha_6)-(\alpha_6-\alpha_5)^2}{D}$$
$$\delta_6 = \frac{(\alpha_1+\alpha_5)(\alpha_2-\alpha_4)-(\alpha_4+\alpha_6)(\alpha_4-\alpha_1)}{D}$$
where
$$D=\alpha_1\alpha_2-\alpha_4^2+(\alpha_2-\alpha_4)(\alpha_3+2\alpha_5)+(\alpha_1-\alpha_4)(\alpha_3+2\alpha_6)-(\alpha_6-\alpha_5)^2$$

From the budget constraint, the following adding up restrictions apply[33]:

$$\begin{gathered}\delta_1+\delta_2=\delta_3+\delta_4=\delta_5+\delta_6=1\\ \delta_2+\delta_4+\delta_6=1\\ \delta_1+\delta_3+\delta_5=2\end{gathered} \tag{3.40}$$

Substituting out the target variables in the structural equations we obtain the following semi-structural set of equations:

$$I_g=\delta_1\alpha_7 I_p-\delta_2\alpha_8 G_{c,t-1}+\delta_2(1+\alpha_{10})A_g+\delta_2(1+\alpha_{11})A_l+\delta_2\alpha_9 OIL_{t-1} \tag{3.41}$$

$$G_c=-\delta_4\alpha_7 I_p+\delta_3\alpha_8 G_{c,t-1}+\delta_4(1+\alpha_{10})A_g+\delta_4(1+\alpha_{11})A_l+\delta_4\alpha_9 OIL_{t-1} \tag{3.42}$$

$$T=\delta_6\alpha_7 I_p+\delta_6\alpha_8 G_{c,t-1}+(\delta_5\alpha_{10}-\delta_6)A_g+(\delta_5\alpha_{11}-\delta_6)A_l+\delta_5\alpha_9 OIL_{t-1} \tag{3.43}$$

The sign of the δ_i's is not known a priori, as they depend on the relative preferences within the utility function[34]. If α_1 and α_2 are both larger than α_4 the δ_i's will be positive, except for the cases when α_5 is sufficiently greater than α_6 (so that

[33] The derivation of conditions (3.40) from the budget constraint is not straightforward. However, it is easy to show that $\delta_2+\delta_4+\delta_6=1$ by substituting out I_g, G_c and T in the budget constraint with the corresponding equations in (3.38). This gives $(\delta_2+\delta_4+\delta_6-1)$ as the coefficient attached to aid; therefore, a change in aid, other things given, will result in $\Delta A\,(\delta_2+\delta_4+\delta_6-1)=0$.

[34] D has to be positive for the Lagrangean to be concave and thus possess an optimum.

$\delta_4<0$) or α_6 is sufficiently greater than α_5 (so that $\delta_2<0$)[35]. A larger preference of the policy maker to interaction between I_g^* and T^* relative to interaction between G_c^* and T^*, i.e. $\alpha_5>\alpha_6$, may thus result in a negative coefficient for T^* and A in the structural equation for G_c^*. Similarly, $\alpha_5<\alpha_6$ results in a negative parameter for the revenue side targets in the structural equation for I_g^*. Moreover, as mentioned above in the discussion of the α_i's, for concavity to hold $\alpha_1>\alpha_4$ and $\alpha_2<\alpha_4$ requires $\alpha_5>\alpha_6$ (and similarly $\alpha_1<\alpha_4$ and $\alpha_2>\alpha_4$ requires $\alpha_5<\alpha_6$). In these cases the δ_i's will generally be positive except for possible values of 0 for δ_2 and δ_4. In sum, the sign and magnitude of δ_i's will be determined by the variety of feasible combination of relative preferences within the utility function. This shows that the interaction terms in the objective function do affect fiscal behaviour in a complex way, different in nature from the effect of the budget constraint[36].

3.3.2.4. Static and Dynamic Impact of Aid.

Aid will affect the economy and government behaviour aid via a static and a dynamic channel. These will be discussed in turn in the next sub-sections.

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[35] Note that δ_2 and δ_4 cannot simultaneously be negative.

[36] While in theory the interactive terms allow for a more general utility function and for a wider variety of preferences -and relative preferences-, in practice they are less relevant as the actual derivation of the α_i's is not possible. However, they may help explain differences in the signs of the estimated parameters. An example will clarify this point. Suppose $\alpha_{4,5,6}=0$, then $\delta_2=\alpha_2\alpha_3/(\alpha_1\alpha_2+\alpha_1\alpha_3+\alpha_2\alpha_3)$ and $\delta_4=\alpha_1\alpha_3/(\alpha_1\alpha_2+\alpha_1\alpha_3+\alpha_2\alpha_3)$ which are both positive. Therefore, $\Delta I_g/\Delta A$ and $\Delta G_c/\Delta A$ will be both positive or negative, depending on the sign and magnitude of α_{10}. If $\alpha_{4,5,6}\neq 0$, then δ_2 and δ_4 can exhibit opposite signs, as discussed above. In such a case, $\Delta I_g/\Delta A$ and $\Delta G_c/\Delta A$ will also be of opposite sign.

Static Effects.

The impact of aid on government behaviour depends on the sign and magnitude of α_{10} and α_{11}, on the response of private investment to aid ($\beta_{2,i,i}$'s), on the relationship between public and private investment (α_7), and on the relative preferences within the utility function (δ_i's). It can be decomposed into a direct and an indirect effect.

The direct impact of aid is given by the coefficients on A_g and A_l in the semi-structural equations (3.41), (3.42) and (3.43) and crucially depends on the way the target for taxation is set. A tendency to reduce aid reliance, as mentioned above and as suggested by Pack and Pack, may result in increasing rather than reducing taxation efforts, i.e. α_{10} and $\alpha_{11}>0$. Supposing δ_2 and $\delta_4>0$, the direct impact of aid on the expenditure side will be positive, thus reflecting increased fund availability.

The indirect effect is channelled through private investment responses. If this increases in response to higher aid and does not crowd out public investment, then the indirect impact on tax and on I_g will be unambiguously positive. The effect on G_c will depend on the sign of δ_4.

The response of current income to an increase in aid will also include a static feedback effect brought on by the multiplier. If we consider, for simplicity, an increase in grants only, then

$$\frac{\partial Y}{\partial A}=\frac{\beta_{2,1,1}}{1-\gamma_1}+\delta_6\alpha_7\beta_{2,1,1}+(\delta_5\alpha_{10}-\delta_6) \tag{3.44}$$

The first term captures the effect of a consumption increase (decrease) caused by the response of private investment to higher aid. If I_p increases, income will rise and consequently also consumption will rise. The higher the marginal propensity to consume (γ_1), the higher the effect of aid channelled by consumption. In addition to the indirect consumption effect, all the other terms reflect the direct and indirect effects which result from fiscal behaviour[37].

Dynamic Effects.

The static effects represent only the impact effect . In the year following an increase in aid, dynamic linkages will start to operate, not only because of the influence of lagged aid on private investment, but also, and more importantly, via the changes in previous period income and government consumption. An increase in Y and/or in G_c will start a multiplier process which will last beyond the year of the initial aid shock. If the increase in aid is temporary, the long run effect, i.e. the cumulated sum of all periods changes, will thus include two multiplier effects, namely income and government consumption multipliers, plus the initial impact effects.

For simplicity, let us assume a temporary increase in grants only. The long run effect[38] on fiscal behaviour, on income and on consumption will be given by:

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[37] To obtain the static effects we substite out I_p, i.e. equation (3.30), in equations (3.35) for the impact on current income (i.e. (3.44)) and in the semi-structural equations (3.41), (3.42) and (3.43) for the impact on fiscal variables. We then take the derivatives of the dependent variables with respect to aid. The static impact of aid on consumption is finally derived using equation (3.31) and the calculated $\partial Y/\partial A$ and $\partial T/\partial A$.

[38] The derivation of these impacts is rather complex and tedious and will not be replicated here. It involves an iterative series of substitutions. A shock in year 1 will affect I_p, I_g, G_c, T, Y and C. If the shock is temporary, in the next period we will still observe a direct effect on I_p, i.e. $\partial I_p/\partial A_{t-1}$, but also the indirect effects brought on by lagged Y and G_c on private investment and on fiscal variables, that is $\partial I_p/\partial Y_{t-1}$, $\partial I_g/\partial G_{c,t-1}$, $\partial G_c/\partial G_{c,t-1}$, $\partial T/\partial G_{c,t-1}$, plus the indirect effect on I_g, G_c and T brought on by current I_p, i.e. $\partial I_g/\partial I_p$, $\partial G_c/\partial I_p$ and $\partial T/\partial I_p$. As a result, current income will also be affected and will influence the economy in the subsequent period. In the third period, all the direct effects will have been absorbed, but lagged Y and G_c will still propagate the effects of aid also through I_p. At the end of each period we calculated the impact on income and on G_c and used them for obtaining the next period change in I_p and subsequently the effects on fiscal variables. The iteration has produced a simultaneous system of geometric progressions which has finally been solved to yield (3.45) to (3.49).

$$\sum_{i=0}^{\infty}\frac{\partial G_{c,t+i}}{\partial A_{g,0}}=\frac{1}{\Phi_g}\left[\eta_1-\frac{\delta_4\alpha_7\beta_1(\vartheta\Phi_g+\delta_6\alpha_8\eta_1)}{\Phi_y\Phi_g+\delta_3\delta_6\alpha_7\alpha_8\beta_1}\right] \tag{3.45}$$

$$\sum_{i=0}^{\infty}\frac{\partial I_{g,t+i}}{\partial A_{g,0}}=\eta_2-\eta_1\frac{\delta_2\alpha_8}{\Phi_g}+\frac{\alpha_7\beta_1(\delta_1+\delta_2\delta_4\alpha_8)(\vartheta\Phi_g+\delta_6\alpha_8\eta_1)}{\Phi_y\Phi_g+\delta_3\delta_6\alpha_7\alpha_8\beta_1} \tag{3.46}$$

$$\sum_{i=0}^{\infty}\frac{\partial T_{t+i}}{\partial A_{g,0}}=\eta_3+\eta_1\frac{\delta_6\alpha_8}{\Phi_g}+\frac{\alpha_7\beta_1(\delta_6-\delta_4\delta_6\alpha_8)(\vartheta\Phi_g+\delta_6\alpha_8\eta_1)}{\Phi_y\Phi_g+\delta_3\delta_6\alpha_7\alpha_8\beta_1} \tag{3.47}$$

$$\sum_{i=0}^{\infty}\frac{\partial Y_{t+i}}{\partial A_{g,0}}=\frac{\vartheta\Phi_g+\delta_6\alpha_8\eta_1}{\Phi_y\Phi_g+\delta_3\delta_6\alpha_7\alpha_8\beta_1} \tag{3.48}$$

$$\sum_{i=0}^{\infty}\frac{\partial C_{t+i}}{\partial A_{g,0}}=\frac{\gamma_1(\beta_{2,1,1}+\beta_{2,1,2})}{1-\gamma_1} \tag{3.49}$$

where

$$\begin{aligned}
\eta_1 &= \delta_4(1+\alpha_{10})-\delta_4\alpha_7(\beta_{2,1,1}+\beta_{2,1,2})\\
\eta_2 &= \delta_2(1+\alpha_{10})+\delta_1\alpha_7(\beta_{2,1,1}+\beta_{2,1,2})\\
\eta_3 &= (\delta_5\alpha_{10}-\delta_6)+\delta_6\alpha_7(\beta_{2,1,1}+\beta_{2,1,2})\\
\vartheta &= (\delta_5\alpha_{10}-\delta_6)+\left(\frac{1}{1-\gamma_1}+\delta_6\alpha_7\right)(\beta_{2,1,1}+\beta_{2,1,2})\\
\Phi_g &= 1-\delta_3\alpha_8\\
\Phi_y &= 1-\beta_1\left(\frac{1}{1-\gamma_1}+\delta_6\alpha_7\right)
\end{aligned} \tag{3.50}$$

η_1, η_2, η_3 and ϑ represent the impact effect of aid on G_c, I_g, T and Y, respectively, after the first two periods following an aid shock. They embody the direct dynamic effect of aid on private investment in addition to the direct and indirect impact effects, but exclude all other dynamic linkages. $1/\Phi_g$ and $1/\Phi_y$ are the dynamic multipliers of lagged government consumption and income respectively[39].

[39] Similar results are obtained if we consider an increase in loans only. If we consider increases in both grants and loans the dynamic effect will be given by the sum of the two sets of effects.

There are three components of the long run effect: first, the static direct and indirect impact of aid (intratemporal effect); second, the dynamic leakages related to lagged G_c and Y (intertemporal effects); and third, the combination of intra- and intertemporal effects caused by the consumption multiplier process working in combination with the dynamic linkages[40].

Incidentally, equations (3.45) to (3.49) are equivalent to the difference between the new equilibrium level that the economy would attain if the increase in grants was set to be permanent and the initial equilibrium.

The next section presents the results from the empirical implementation of the model for the case of Indonesia using time series econometric estimation. The static impact of aid and its initial dynamic effect will be presented and discussed. The full dynamics of the model will be described analysing graphic output of the simulated model.

3.4. Econometric Estimation.

3.4.1. Data and Estimation Problems.

We use a time-series data set which covers Indonesia over the period 1968-1993[41]. All data are given in billions of real rupiahs using the 1985 GDP deflator.

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[40] In the long run, the economy resettles to its initial equilibrium provided that: $\Phi_y \Phi_g + \delta_3 \delta_6 \alpha_7 \alpha_8 \beta_1 < 1$.

[41] The period 1960 to 1967 has been deliberately excluded so that results would not be influenced by those years of economic and political turmoil (as it has been described in the first chapter).

Government data are drawn both from national official sources (mainly Bank of Indonesia, *Report for the Financial Year*, various issues) and from IMF, *Government Finance Statistics Yearbook* (various issues). In both cases, they have been adjusted for solar year, given that fiscal year begins on the 1st April[42]. Data on macroeconomic aggregates are taken from IMF, *International Financial Statistics* (various issues). Finally, aid dollar data are obtained from OECD, *Geographical Distribution of Financial Flows to Developing Countries* (various issues). They have been converted to rupiahs using the IMF published dollar exchange rate. Appendix 8 lists all the variables and the relevant sources.

We deem the use of data expressed in real terms consistent with the model and superior to the use of ratios to GDP, per capita figures and logarithmic transformations. Ratios to GDP surreptitiously introduce endogenous income. As a result, the econometric specification is inconsistent with the theoretical model. Per capita figures mask the addition of a new variable to the system, namely population. Assuming population is exogenous is unrealistic, although it could fit easily in the model. On the other hand, modelling population as being endogenously determined, for instance assuming population growth is affected by government spending in health care, and would need a rewriting of the model which would complicate it further. The use of logarithms implies that the whole model is not linear. The model would then need a careful reinterpretation.

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[42] The adjustment for solar year has been carried out on a constant flow assumption. While this is clearly a strong assumption, we do not have sufficient information for an alternative method of apportionment.

Most empirical studies on fiscal response (for instance Gang and Khan, 1991; Khan and Hoshino, 1992; McGillivray and Papadopoulos, 1991; and Pack and Pack, 1990) use budgetary statistics of the country governments. Aid data are generally taken either from the OECD statistics or from government sources.

Indonesian data presents some problems, even though government statistics provide detailed time-series across the whole period. Fiscal aggregates comprise budgetary accounts only and are divided into four main series: domestic and development - i.e. aid - revenues, and routine and development expenditures. They differ from the corresponding IMF government statistics, which instead include also extrabudgetary accounts. This is a relevant issue, given the size of Pertamina, the oil state company, and of its operations. Moreover, development revenues are not included in IMF government revenues. Routine and development expenditure correspond to IMF figures for budgetary current and capital expenditures respectively, apart from minor discrepancies. A second problem is that aid revenues from government sources are neither disaggregated into grants and loans nor into bilateral and multilateral flows. Most seriously, they are not comparable with aid data as provided from OECD sources. Given that the fiscal years begin 1st April, some differences in aid flows may be explained by the different time coverage: fiscal year for aid revenues and solar years for OECD aid data. Looking at the data discrepancies, however, this cannot fully account for such differences. From the government sources to which access to was available sufficient information was not obtainable on the composition of their aid revenues, so that a full explanation of such discrepancy was not possible.

According to budgetary data from national official sources (henceforth GOV dataset), the size of the government sector is underestimated, aid data of uncertain composition and unknown donor source are used, and the impact of different types of aid cannot be analysed. The only advantage is that the budget constraint is statistically met, given the balanced budget rule[43]. On the other hand, if IMF data on government behaviour and OECD aid data are employed (henceforth IMF-OECD dataset), the above mentioned problems are solved.

Using the second set of data, namely IMF-OECD dataset, the estimations have been replicated with the other set of data for comparison purposes (reported in appendixes 4, 5 and 6). Given the simultaneity that stems from private investment we estimated the system using instrumental variables. Moreover, given the budget constraint we only estimated two of the three equations, namely equations (3.41) and (3.43); the coefficients for the third one, equation (3.42) can be derived algebraically. The equations were estimated three times, allowing for distinction between grants and loans, bilateral versus multilateral aid, and total aid.

Simultaneous estimation methods could also be used. The empirical literature on fiscal response has in fact mostly employed system estimation methods, such as 2SLS or 3SLS. While on the one hand this last method would result in lower variance, it suffers most of the lack of degrees of freedom and propagates single equations problems to the whole system. Our dataset has not enough degrees of freedom to be confident with 3SLS results. We have replicated the estimations for both the IMF-OECD and the GOV datasets and results are reported in appendix 7. Further research may focus on the VAR approach, which would allow full incorporation of dynamic

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[43] It now becomes apparent how this rule should be interpreted with care, if not with suspicion.

aspects as well as a detailed analysis of reduced form equations. Once again data constraints could result in a serious lack of degrees of freedom.

3.4.2. Results and Interpretation.

The econometric estimates on a time series basis show that aid does have an effect on fiscal behaviour, but mainly through private investment and the dynamic linkages stemming from lagged government consumption and income[44]. Tables 3.4.2.1, 3.4.2.2 and 3.4.2.3 present the results for the three alternative models: Model I uses grants and loans, Model II bilateral and multilateral aid, and Model III total aid. Diagnostic test are reported in appendix 5. Tables 3.4.2.4, 3.4.2.5 and 3.4.2.6 report the calculated reduced form coefficients for each model expressed as percentage changes following a 1% shock in aid[45]. These tables show aid's effect on the budget, on GDP and on private consumption on impact and after the second period, when dynamic linkages have started to operate (i.e. short run and medium run effects). The full long run dynamics of the estimated model is presented in the next paragraph.

Grants and loans do not exhibit a significant direct impact on fiscal behaviour. However, the interaction between fiscal behaviour and private investment decisions channels an indirect effect. Reduced form coefficients show that grants tend to discourage taxation efforts and to deflect resources away from public investment and to

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[44] Instrumental Variables estimations were carried out with PcGive 8.0 while 3SLS estimations were implemented with PcFiml 8.0.

[45] The corresponding reduced form coefficients in levels are reported in Appendix 3.

government consumption. On the contrary, loans positively affect government revenues and investment, although in the short run the impact on taxation is negative. However, the correct interpretation of the results should be based on statistically significant parameters, as pointed out in paragraph 3.2.3. The tables show both sets of results to highlight how misleading it would be to rely on all parameters, significant and insignificant.

In fact, if we consider significant parameters only, there is no evidence of a short term impact either on fiscal behaviour or on income and consumption. Once dynamic linkages initiate a multiplier process, statistically significant effects emerge. At the end of the second period following the aid shock, a 1% increase in grants discourages taxation efforts and leads to a 4% drop in revenues. Similarly, on the expenditure side, investment and consumption will be curtailed, although investment will be reduced by less than consumption. Thus, grants seem to partly finance a tightening in fiscal policy aimed at reducing the size of government and exhibit a pro-investment bias. As for loans, the effect is reversed. A 1% rupiah increase in loans results in 1.7% increase in tax revenues leading to higher public investment and consumption. Even if public consumption grows more than investment, investment still increases more than proportionately with respect to the increase in loans. This implies that loans pro-consumption bias is not high enough to cause fungibility.

An explanation for the opposite effects of grants and loans may lie in the disincentive effect of receiving non-repayable grant money, which are used by policy makers to reduce the tax burden. Given the budget constraint, reduced finances result in reduced outlays and a general depressing effect on the whole economy. On the other hand, loans add interest payments and the final capital payback burden to the budget, so that they induce an intensification of tax collection efforts. Although increased revenues will finance public investment less than public consumption, the whole economy will benefit as a result of the multiplier process. As shown in table 3.4.2.4 to 3.4.2.6, the effect on income and private consumption are both negative in the grant case and positive in the loans case. The size of the coefficients in general is due to the small figures for aid as a proportion of GDP, which ranged from 1% to 6.2%. In particular, grants never exceeded 1% of GDP and loans ranged between 1% and 5.2%.

Interestingly, the use of the GOV dataset, yields different results. The impact of aid is direct and not channelled via private investment. Grants have a significant negative impact, while loans exhibit insignificant effects.

Model II and Model III perform less well than Model I. The impact effect of aid is only direct as coefficients for bilateral, multilateral and total aid in the private investment equation are insignificant. Moreover, there is no evidence of long run effects on the budget, on income and on private consumption from multilateral aid. In both models, bilateral and total aid negatively affect, on impact, only taxation, public consumption and income, while there is no statistical evidence for their effects on public investment and private consumption. However, at the end of the second period, not only T and G_c but also I_g will be curtailed as a consequence of an increase in bilateral or total aid. In both cases, there is a pro-investment bias, given that government investment will be reduced by .8% and .9%, respectively, against a fall in public consumption of 1.3% and 1.2%, respectively.

Once again results from the corresponding regressions using the GOV dataset differ. Government taxation efforts are significantly influenced by bilateral and multilateral aid. Bilateral aid has a direct and negative impact only. On the contrary, multilateral aid positively affects taxes, both directly and indirectly. Surprisingly, public investment does not interact with private investment decisions and the only aid effect comes from bilateral aid and is negative. When we turn to total aid results the only significant effect is the direct negative impact on taxation efforts.

As for general diagnostics, the three model perform well when estimated with the IMF-OECD dataset. The estimated equations (restricted reduced forms of the structural model) appear to parsimoniously encompass their respective unrestricted reduced forms. There is also no evidence of problems of autocorrelation and misspecification. On the contrary, for all the three models estimated with GOV dataset, diagnostic tests do not allow us to accept the null of the equations parsimoniously encompassing the unrestricted reduced forms. There are also problems of autocorrelation in both the private and the public investment equations when bilateral and multilateral aid are used.

The comparison with 3SLS results in all cases tend to confirm the corresponding results from IV estimations. However, these model perform badly in terms of some diagnostic tests. The most serious problem is the rejection in all cases of the null that the reduced model parsimoniously encompasses the system. There are problems of autocorrelation in most equations and of normality for public investment.

Finally, it is worth noting the robustness of the private consumption equation. The long run estimated marginal propensity to consume out of disposable income is 0.62 for the IMF-OECD dataset and 0.60 for the GOV dataset[46].

Table 3.4.2.1. Model I. Grants and Loans (IMF-OECD Dataset)

	Constant	I_p^{imf}	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A_g	A_l
T^{imf}	2661.0** (1239.7)	.37** (.07)	.46** (.19)	.65** (.28)	-3.04 (3.24)	-.75 (1.07)
I_g^{imf}	-932.6 (876.5)	.09* (.05)	.31** (.13)	.60** (.20)	-2.78 (2.29)	1.02 (.76)

Instruments used: $A_{g,t-1}$, $A_{l,t-1}$, OF_{t-1}, Y_{t-1}, Dcred.

	Constant	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A_g	A_l	$A_{g,t-1}$	$A_{l,t-1}$	OF_{t-1}	Y_{t-1}	Dcred
I_p^{imf}	-10098** (1793.6)	-.03 (.22)	-.50 (.41)	6.14 (3.72)	.30 (1.30)	-14.3** (5.68)	3.67** (1.48)	-.80** (.27)	.37** (.06)	.15** (.04)

Private Consumption Equation: Long Run

$$C = \underset{(2460)}{10990^{**}}\ \text{Constant} \quad \underset{(.05)}{+.62^{**}}\ Yd^{imf}$$

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses.

[46] Woo, Glassburner and Nasution (1994) obtain a 0.63 elasticity of the private consumption deflator with respect to the GDP deflator. This is loosely comparable with our estimated marginal propensities to consume, 0.62.

Table 3.4.2.2. Model II. Bilateral and Multilateral Aid (IMF-OECD Dataset)

	Constant	I_p^{imf}	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A_b	A_m
T^{imf}	2893.4**	.41**	.47**	.47*	-1.63**	3.47
	(1200.1)	(.07)	(.18)	(.26)	(.74)	(3.15)
I_g^{imf}	-634.2	.08	.34**	.49**	.26	.005
	(903.2)	(.05)	(.14)	(.20)	(.56)	(2.37)

Instruments used: $A_{b,t-1}$, $A_{m,t-1}$, OF_{t-1}, Y_{t-1}, Dcred.

	Constant	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A_b	A_m	$A_{b,t-1}$	$A_{m,t-1}$	OF_{t-1}	Y_{t-1}	Dcred
I_p^{imf}	-6858.3**	-.02	.23	-1.16	3.99	2.49	-9.78	-.52	.23**	.17**
	(1915.4)	(.25)	(.61)	(1.44)	(6.93)	(1.65)	(7.87)	(.32)	(.08)	(.05)

Private Consumption Equation: Long Run

$$C = \underset{(2581)}{11040^{*}}\ \text{Constant} \quad \underset{(.05)}{+.62^{**}}\ Yd^{imf}$$

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses.

Table 3.4.2.3. Model III. Total Aid (IMF-OECD Dataset)

	Constant	I_p^{imf}	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A
T^{imf}	2989.3**	.38**	.47**	.56**	-1.28*
	(1214.7)	(.07)	(.18)	(.26)	(.72)
I_g^{imf}	-719.5	.08	.34**	.50**	.28
	(881.5)	(.05)	(.13)	(.19)	(.53)

Instruments used: A_{t-1}, OF_{t-1}, Y_{t-1}, Dcred.

	Constant	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A	A_{t-1}	OF_{t-1}	Y_{t-1}	Dcred
I_p^{imf}	-8178.7**	-.04	-.33	.02	1.21	-.69**	.31**	.14**
	(1693.3)	(.25)	(.44)	(1.19)	(1.25)	(.30)	(.06)	(.05)

Private Consumption Equation: Long Run

$$C = \underset{(2449)}{10980^{**}}\ \text{Constant} \quad \underset{(.05)}{+.62^{**}}\ Yd^{imf}$$

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses.

Table 3.4.2.4. Model I. Grants and Loans (IMF-OECD Dataset).Estimated Impacts on the Budget, on GDP and on Consumption.

Percentage Changes Following a 1% Increase in Aid.

	All Parameters		Significant Parameters	
	1st period	2nd Period	1st Period	2nd Period
$\partial T / \partial A_g \cdot A_g / T$	-.7	-3.1	-	-4.7
$\partial I_g / \partial A_g \cdot A_g / I_g$	-5.0	-4.0	-	-2.9
$\partial G_c / \partial A_g \cdot A_g / G_c$	3.3	-.9	-	-5.4
$\partial T / \partial A_l \cdot A_l / T$	-.8	.3	-	1.7
$\partial I_g / \partial A_l \cdot A_l / I_g$	3.3	3.0	-	1.1
$\partial G_c / \partial A_l \cdot A_l / G_c$	-1.2	.5	-	1.8
$\partial Y / \partial A_g \cdot A_g / Y$	1.0	-4.5	-	-5.7
$\partial Y / \partial A_l \cdot A_l / Y$	-.04	1.5	-	1.7
$\partial C / \partial A_g \cdot A_g / C$	.4	-3.8	-	-4.7
$\partial C / \partial A_l \cdot A_l / C$	.02	1.2	-	1.2

Table 3.4.2.5. Model II. Bilateral and Multilateral Aid (IMF-OECD Dataset). Estimated Impacts on the Budget, on GDP and on Consumption.

Percentage Changes Following a 1% Increase in Aid.

	All Parameters		Significant Parameters	
	1st period	2nd Period	1st Period	2nd Period
$\partial T / \partial A_b \cdot A_b / T$	-2.5	-2.4	-1.9	-2.4
$\partial I_g / \partial A_b \cdot A_b / I_g$	.5	-1.0	-	-.9
$\partial G_c / \partial A_b \cdot A_b / G_c$	-2.1	-1.1	-1.0	-1.3
$\partial T / \partial A_m \cdot A_m / T$	3.6	3.3	-	-
$\partial I_g / \partial A_m \cdot A_m / I_g$	.7	5.4	-	-
$\partial G_c / \partial A_m \cdot A_m / G_c$	8.1	4.5	-	-
$\partial Y / \partial A_b \cdot A_b / Y$	-.5	.4	-.2	-.4
$\partial Y / \partial A_m \cdot A_m / Y$	1.5	-2.7	-	-
$\partial C / \partial A_b \cdot A_b / C$	-.1	.6	-	-.1
$\partial C / \partial A_m \cdot A_m / C$	.2	-3.2	-	-

Table 3.4.2.6. Model III. Total Aid (IMF-OECD Dataset). Estimated Impacts on the Budget, on GDP and on Consumption. Elasticities.

Percentage Changes Following a 1% Increase in Aid.

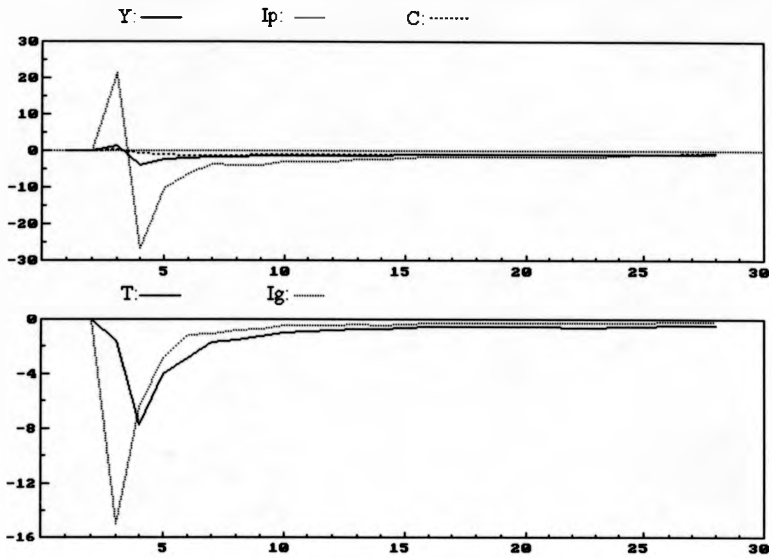
	All Parameters		Significant Parameters	
	1st period	2nd Period	1st Period	2nd Period
$\partial T / \partial A \cdot A / T$	-1.4	-1.4	-1.4	-1.8
$\partial I_g / \partial A \cdot A / I_g$	.8	.2	-	-.8
$\partial G_c / \partial A \cdot A / G_c$	-.9	-.5	-.4	-.7
$\partial Y / \partial A \cdot A / Y$	-.2	.1	-.2	-.6
$\partial C / \partial A \cdot A / C$	.02	.3	-	-.3

3.4.3. A Simulation Exercise.

The estimated parameters are also used to simulate the impact of grants and loans on fiscal and macroeconomic variables in order to explore the full long run dynamics of the estimated model. Graphs 3.2.3.1 to 3.4.3.6 show the simulated effects that temporary and permanent shocks in grants, loans and joint grants and loans have on all the endogenous variables of the system. We carried out simulations[47] using shocks of the size of the estimated standard errors from autoregressive regressions of grants and loans, namely 69.32 billion rupiahs for grants and 279.27 billion rupiahs for loans. Percentage changes are plotted against time.

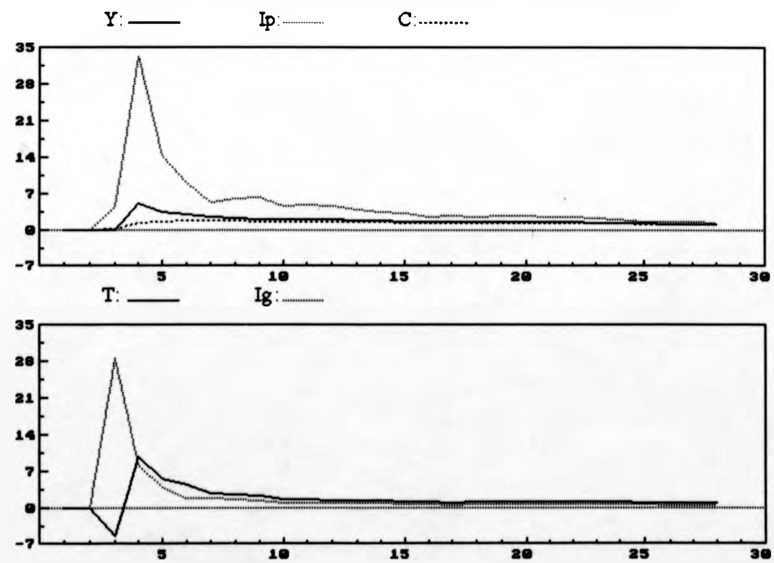
[47] Simulations have been carried out with TSP 4.3.

Graph 3.4.3.1. Effect of a Temporary Shock in Grants.



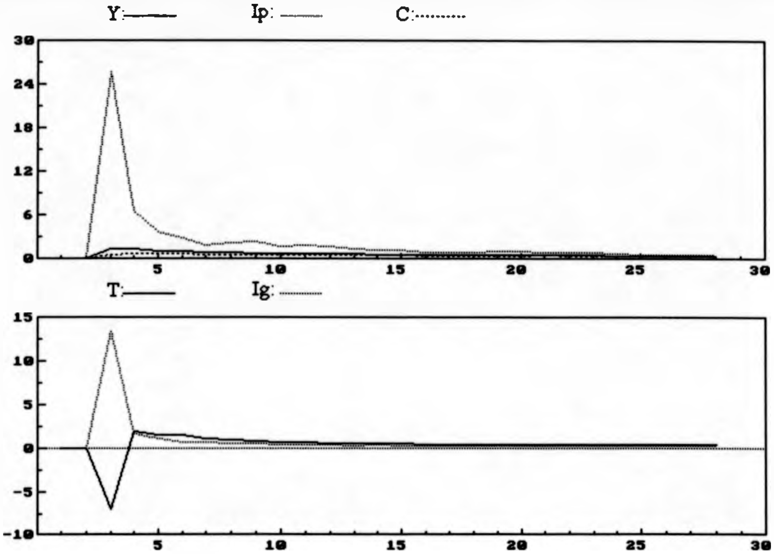
% Change on the vertical axis; time on the horizontal axis.

Graph 3.4.3.2. Effect of a Temporary Shock in Loans.



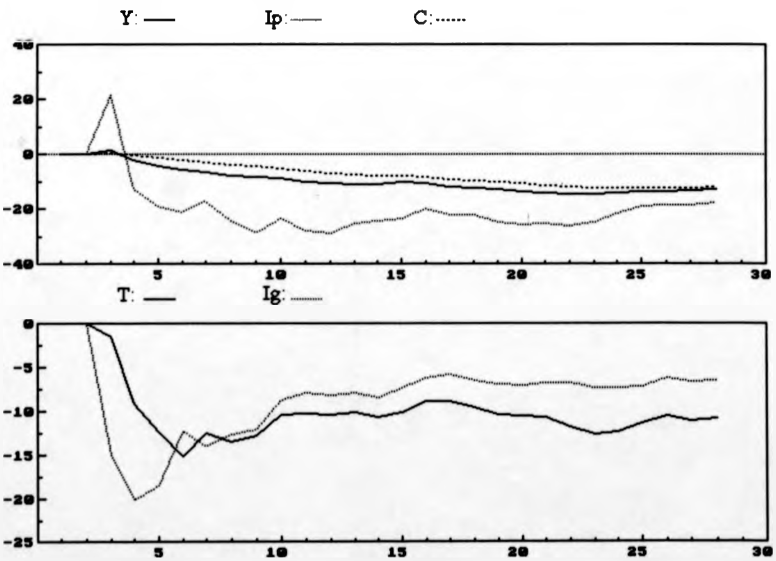
% Change on the vertical axis; time on the horizontal axis.

Graph 3.4.3.3. Effect of a Temporary Joint Shock in Grants and Loans.



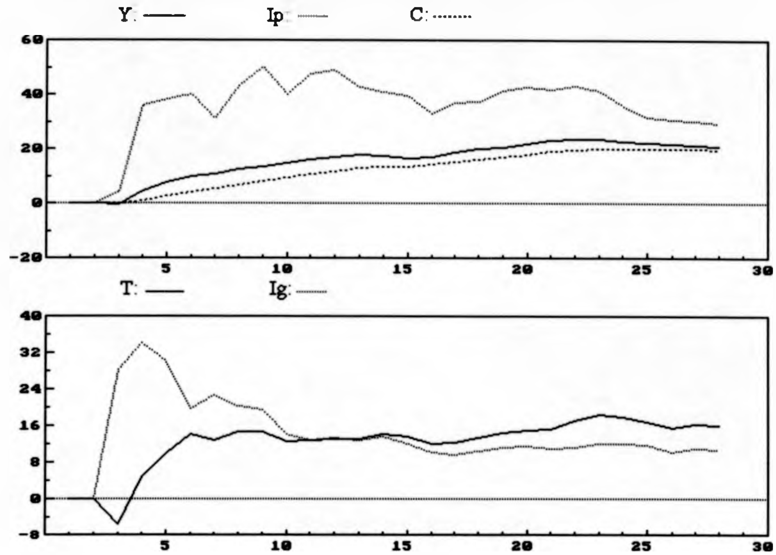
% Change on the vertical axis; time on the horizontal axis.

Graph 3.4.3.4. Effect of a Permanent Shock in Grants.



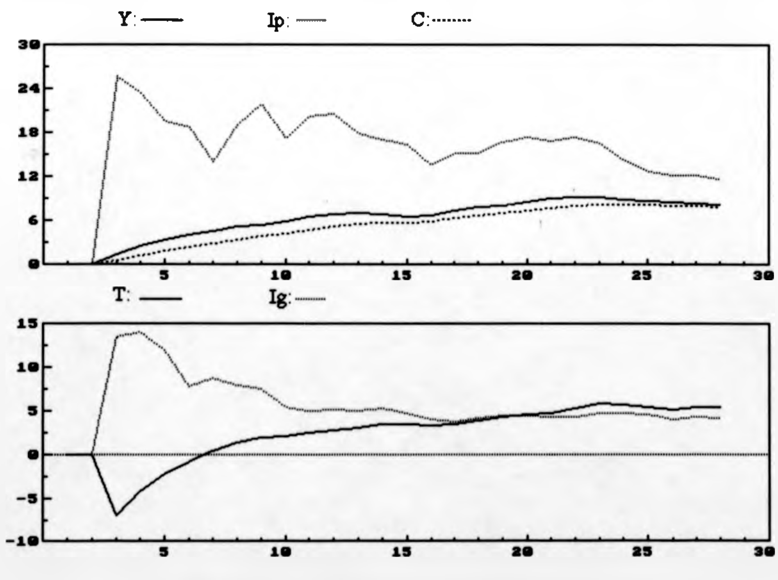
% Change on the vertical axis; time on the horizontal axis.

Graph 3.4.3.5. Effect of a Permanent Shock in Loans.



% Change on the vertical axis; time on the horizontal axis.

Graph 3.4.3.6. Effect of a Permanent Joint Shock in Grants and Loans.



% Change on the vertical axis; time on the horizontal axis.

Simulations confirm the preceding discussion of the results. We note briefly the overall negative impact of grant aid in contrast to the generally positive impact of loans. Their joint impact is also positive, except for a 2 periods adjustment in taxation efforts. What is striking is the size of the short period impact in all cases. This may be ascribed once again to the relative little weight of grants and loans to GDP. In fact, the temporary effects tend to stabilise to values not in excess of 2.5%. Not surprisingly, private and public investment are the most sensitive to such shocks, given the structure of the model. On the budget side, the policy maker in this simulated economy would reduce taxation efforts for about one year as a response to increased loans and joint loans and grants. Afterwards, tax revenues would rise again. The increase in public investment would therefore be at the expenses of taxation efforts only in the very short run. Grants alone would only harm the budget and the overall economy. Similar behaviour can be inferred when considering the reactions to permanent shocks. Not surprisingly, these cause a much higher impact on the economy, especially on investment decisions, both private and public.

3.4.5. A Comparative Perspective.

Our results on loans effectiveness are in line with Pack and Pack (1990) conclusions on aid effectiveness in Indonesia. They find that in Indonesia aid does not displace development expenditure nor lead to tax reduction. Moreover, they show there is no evidence of categorical fungibility since aid is not diverted from the use intended by the donors to other categories of spending. However, our findings of a negative effect, if any at all, of total aid, grants, bilateral and multilateral aid are in contrast with Pack and Pack conclusions.

The difference between their results and ours can be explained by the markedly different modelling approach used, and by the different dataset and sample period employed. Pack and Pack address the issue of categorical fungibility within a three equation model (plus a budget constraint) centred on the government sector only and closely related to the literature on public decision making. They use government aggregated aid revenues and disaggregate development expenditure into various categories over the period 1966-86. On the contrary, our approach focuses on the issue of aggregate fungibility and on the interactions of the public sector with the rest of the economy within an expanded fiscal response model. We use OECD disaggregated aid data and aggregated public investment over the period 1968-93.

Compared to results from other fiscal response empirical studies, our findings confirm them only in part. In particular, they are at variance with Heller and Pillai's (1982) results on the positive impact of loans on public investment and the negative effect of grants on taxation. Notably, our negative assessment on the effectiveness of total aid combined, bilateral and multilateral aid matches Mosley's et al. pessimism. Furthermore, the insignificant effect of grants and loans we have found is in line with the statistically insignificant reduced form coefficients obtained by Gang and Khan. However, our results strongly differ from theirs once dynamics are taken into account. Khan and Hoshino's reduced form coefficients are only significant and positive for the impact of aid on public investment. This compares with our loans result. Finally, McGillivray and Papadopoulos' reduced form coefficients show the only significant impact aid has is on government consumption and is negative. Once again, this confirms only partly with our results.

In sum, the empirical evidence from fiscal response literature is mixed. The fact that our results confirm, and contrast, partly and in different ways all the studies mentioned here demonstrates the complexity of the effectiveness debate, both from a theoretical and an empirical perspective.

3.5. Final Comments and Directions for Further Research.

The general lesson we draw from our analysis is threefold. On the aid issue, we conclude with a positive assessment of aid giving, provided it is given in loans. The burden of repayments stimulates a commitment to a fiscal behaviour such that perverse effects are prevented. Loans are found to encourage tax collection, public and private investment and consumption so that the whole economy benefits. On the contrary, total combined aid, grants, multilateral and bilateral aid negatively affect all fiscal variable as well as income and consumption. However, they reduce public consumption more than investment, thus exhibiting a pro-investment bias.

The second consideration is one of rethinking the modelling approach. The lack of consensus on aid effectiveness which emerges from the empirical studies is an indicator that the fiscal response modelling approach presents some weaknesses. Further research should include the monetary sector in the theoretical framework in order to take into account interest rates, inflation and monetary policy issues. Another important theoretical contribution would be the introduction of an asymmetric objective function for the government consistent with utility maximisation when targets are met. Further investigation is also needed to explain the nature of the budget constraint, that is whether it is linear or kinked, single or dual.

We have stressed the importance of static feedback effects and of dynamic linkages. It is our contention that their role is a crucial one in understanding aid effectiveness and must not be underestimated. A structuralist approach could focus on the three gap model (see for example White, 1994b), while more traditional views could analyse aid effectiveness in the endogenous growth theoretical framework. A dynamic Computable General Equilibrium (CGE) model would shed light on the intrasectoral interactions across time in the presence of aid. This approach, however, has prohibitive data and analytical costs[48].

Finally, the disaggregation of aid into grant and loan and into bilateral and multilateral aid has shown different impact of each aggregate, when compared to total combined official aid. It is thus important to take into account the forms and the nature in which aid is given. There is a variety of alternative aid disaggregations. One of the most significant ones refers to the distinction between tied versus untied aid and is related to the issue of the conditions attached to aid inflows the receiver has to fulfil. This has interesting policy and political implications[49].

The final consideration focuses on methodological aspects. The fact that our results change across the models and depending on the dataset used is likely to be an

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[48] For an example of static CGE modelling in the presence of aid see Benjamin et al. (1989), Radelet (1991) and Weisman (1990).

[49] There is a growing literature on aid tying. See for instance Jepma (1991) and Morrissey and White (1993 and 1994).

indicator that they are not too robust. The issue of the choice of data is shown to be a source of potential misinterpretation of results. At the same time, the estimation method is also important. The poor performance of our model when estimated simultaneously, with 3SLS estimation techniques, is probably due to the lack of degrees of freedom. What is cause for concern is the poor discussion of both issues in the existing literature. It is worth stressing how results heavily depend on the datasets used and on the estimation techniques employed. Moreover, results are comparable only if similar data conventions are adopted.

Appendix 2. A Dynamic Fiscal Response Model With Endogenous Income.

In paragraph 3.2.4., we discussed White's contribution and pointed out some shortcomings in his modelling approach. This appendix presents a slightly modified version of White's model (1993) and solves it statically and dynamically. The notation for the variables used is the same employed in paragraph 3.2.4.

White's model is incorrectly solved as endogenous income is not differentiated with respect to T and G in the derivation of first order conditions. Moreover, if the country receives aid, it is an open economy. If we assume, for simplicity, that all aid is capital in nature and that there are no other capital movements to and from the rest of the world, then we can rewrite the balance of payments as:

$$X - M = -A \tag{A2.1}$$

The starting point is a simplified quadratic utility function in the usual arguments:

$$U = -\frac{\alpha_1}{2}(G - G^*)^2 - \frac{\alpha_2}{2}(T - T^*)^2 \tag{A2.2}$$

which is maximised subject to the simple budget constraint:

$$G = T + A \tag{A2.3}$$

Target values are determined as linear combination of instrumental variables. In particular, G^* is defined as a fraction of lagged government expenditure and T^* as a fraction of current income:

$$G^* = \alpha_3 G_{t-1} \tag{A2.4}$$

$$T^* = \alpha_4 Y \tag{A2.5}$$

The model is closed by the introduction of an equation for private investment (I_p) and two standard macroeconomic relationships:

$$C = \gamma_0 + \gamma_1(Y - T) \qquad \text{(A2.6)}$$

$$I = I_p = \alpha_5 + \alpha_6 A \qquad \text{(A2.7)}$$

$$Y = C + I + G + (X - M) = C + I + G - A \qquad \text{(A2.8)}$$

Substituting the expression for consumption in the income identity we obtain:

$$Y = \frac{1}{1-\gamma_1}(\gamma_0 + I + G - \gamma_1 T - A) \qquad \text{(A2.9)}$$

Since T^* is a function of current income, the correct first order conditions include also derivatives of T^* with respect to Y, as shown in the following equations:

$$\begin{aligned}
\frac{\partial L}{\partial G} &= -\alpha_1(G - G^*) - \alpha_2(T - T^*)\cdot\frac{\partial T^*}{\partial Y}\cdot\frac{\partial Y}{\partial G} - \lambda = 0 \\
\frac{\partial L}{\partial T} &= -\alpha_2(T - T^*)\cdot\frac{\partial T^*}{\partial Y}\cdot\frac{\partial Y}{\partial T} + \lambda = 0 \\
\frac{\partial L}{\partial \lambda} &= T + A - G = 0
\end{aligned} \qquad \text{(A2.10)}$$

where L is the Lagrangean and λ is the constraint parameter.

It can be shown that the reduced form solutions for G, T and Y are given by the following equations:

$$G = \frac{\alpha_2\alpha_4(1-\alpha_4)(\gamma_0+\alpha_5) + \alpha_1\alpha_3(1-\gamma_1)G_{t-1} + \alpha_2(1-\alpha_4)[(1-\alpha_4)(1-\gamma_1)+\alpha_4\alpha_6]A}{(1-\gamma_1)[\alpha_1+\alpha_2(1-\alpha_4)^2]}$$

(A2.11)

$$T = \frac{\alpha_2\alpha_4(1-\alpha_4)(\gamma_0+\alpha_5) + \alpha_1\alpha_3(1-\gamma_1)G_{t-1} + [\alpha_2\alpha_4\alpha_6(1-\alpha_4) - \alpha_1(1-\gamma_1)]A}{(1-\gamma_1)[\alpha_1+\alpha_2(1-\alpha_4)^2]}$$

(A2.12)

$$Y = \frac{[\alpha_1 + \alpha_2(1-\alpha_4)](\gamma_0 + \alpha_5) + \alpha_1\alpha_3(1-\gamma_1)G_{t-1} + \{\alpha_6[\alpha_1 + \alpha_2(1-\alpha_4)] - \alpha_1(1-\gamma_1)\}A}{(1-\gamma_1)[\alpha_1 + \alpha_2(1-\alpha_4)^2]}$$

(A2.13)

Therefore, the static short run impact of an aid inflow embodies the consumption multiplier effect and is given by:

$$\frac{\partial G}{\partial A} = \frac{\alpha_2(1-\alpha_4)[(1-\alpha_4)(1-\gamma_1) + \alpha_4\alpha_6]}{(1-\gamma_1)[\alpha_1 + \alpha_2(1-\alpha_4)^2]} \quad \text{(A2.14)}$$

$$\frac{\partial T}{\partial A} = \frac{\alpha_2\alpha_4\alpha_6(1-\alpha_4) - \alpha_1(1-\gamma_1)}{(1-\gamma_1)[\alpha_1 + \alpha_2(1-\alpha_4)^2]} \quad \text{(A2.15)}$$

$$\frac{\partial Y}{\partial A} = \frac{\alpha_6[\alpha_1 + \alpha_2(1-\alpha_4)] - \alpha_1(1-\gamma_1)}{(1-\gamma_1)[\alpha_1 + \alpha_2(1-\alpha_4)^2]} \quad \text{(A2.16)}$$

Given that the denominator is positive, the sign of aid's impact crucially depends on the sign and magnitude of the investment response to an aid inflow, that is on α_6. In particular, given that α_4, the ratio of T^* to Y, is unlikely to be negative,

$$\frac{\partial G}{\partial A} > 0 \quad \textit{if} \quad \alpha_6 > 0 \quad \textit{or} \quad \alpha_6 < 0 \quad \textit{and} \quad (1-\alpha_4)(1-\gamma_1) > -\alpha_4\alpha_6$$
$$\frac{\partial G}{\partial A} < 0 \quad \textit{if} \quad \alpha_6 < 0 \quad \textit{and} \quad (1-\alpha_4)(1-\gamma_1) < -\alpha_4\alpha_6 \quad \text{(A2.17)}$$

$$\frac{\partial T}{\partial A} > 0 \quad \textit{if} \quad \alpha_6 > 0 \quad \textit{and} \quad \alpha_2\alpha_4\alpha_6(1-\alpha_4) > \alpha_1(1-\gamma_1)$$
$$\frac{\partial T}{\partial A} < 0 \quad \textit{if} \quad \alpha_6 < 0 \quad \textit{or} \quad \alpha_2\alpha_4\alpha_6(1-\alpha_4) < \alpha_1(1-\gamma_1) \quad \text{(A2.18)}$$

$$\frac{\partial Y}{\partial A} > 0 \quad \textit{if} \quad \alpha_6 > 0 \quad \textit{and} \quad \alpha_6[\alpha_1 + \alpha_2(1-\alpha_4)] > \alpha_1(1-\gamma_1)$$
$$\frac{\partial Y}{\partial A} < 0 \quad \textit{if} \quad \alpha_6 < 0 \quad \textit{or} \quad \alpha_6 > 0 \quad \textit{and} \quad \alpha_6[\alpha_1 + \alpha_2(1-\alpha_4)] < \alpha_1(1-\gamma_1) \quad \text{(A2.19)}$$

Aid will affect the economy dynamically via lagged G. If the shock is temporary, in the long run income will return to its initial equilibrium, but the cumulated sum of all the single periods effects will be given by:

$$\sum_0^{\infty}\frac{\partial Y_{t+i}}{\partial A_0}=\frac{\alpha_6[\alpha_1+\alpha_2(1-\alpha_4)]-\alpha_1(1-\gamma_1)}{\Phi}+\frac{\alpha_1\alpha_2\alpha_3(1-\alpha_4)[(1-\alpha_4)(1-\gamma_1)+\alpha_4\alpha_6]}{[\alpha_1+\alpha_2(1-\alpha_4)^2]-\alpha_1\alpha_3}$$

$$where \quad \Phi=(1-\gamma_1)[\alpha_1+\alpha_2(1-\alpha_4)^2] \qquad \text{(A2.20)}$$

which, incidentally, corresponds to the new equilibrium level at which income would settle if the aid shock was permanent. Note that the system will be stable provided that

$$(1-\gamma_1)[\alpha_1+\alpha_2(1-\alpha_4)^2]>0 \qquad \text{(A2.21)}$$

Although the multiplier, given by $1/\Phi$, is larger than the multiplier obtained by White, the final impact and dynamic effect of aid will in general be smaller. If aid encourages private investment, GDP will also rise and more taxes will be collected. As a result, the response of the government will be relatively smaller than the response in White's model: the inclusion of current income in taxes target formation implies a higher emphasis on the multiplier channel than on government intervention.

For illustrative purposes, White runs simulations for his model using the following set of parameters: $\alpha_1=\alpha_2=0.50$, $\alpha_3=1.03$, $\alpha_4=0.40$, $\alpha_5=0$ $\alpha_6=0.25$, $\gamma_0=20$ and $\gamma_1=0.70$. Using the same values for these parameters, we obtain: $\partial G_c/\partial A=0.41$, $\partial T/\partial A= -0.59$, $\partial Y/\partial A=0.24$ and a long run effect of 0.51 on income. These responses are much smaller than the ones derived using White's model, namely: $\partial G_c/\partial A=1.42$, $\partial T/\partial A=0.42$, $\partial Y/\partial A=4.58$ and a long run effect of 7.14 on income.

Appendix 3. Impact of Aid. Reduced Forms Coefficients in Levels.

Table A.3.1. Model I. Grants and Loans (IMF-OECD Dataset). Estimated Impacts on the Budget, on GDP and on Consumption.

	All Parameters		Significant Parameters	
	1st period	2nd Period	1st Period	2nd Period
$\partial T / \partial A_g$	-.77	-3.46	-	-5.29
$\partial I_g / \partial A_g$	-2.23	-1.79	-	-1.29
$\partial G_c / \partial A_g$	2.46	-.67	-	-4.00
$\partial T / \partial A_l$	-.64	.23	-	1.36
$\partial I_g / \partial A_l$	1.05	.96	-	.33
$\partial G_c / \partial A_l$	-.69	.27	-	1.03
$\partial Y / \partial A_g$	7.31	-33.97	-	-42.90
$\partial Y / \partial A_l$	-.24	9.65	-	11.02
$\partial C / \partial A_g$	1.94	-18.92	-	-23.32
$\partial C / \partial A_l$	.10	5.84	-	5.99

Table A.3.2. Model II. Bilateral and Multilateral Aid (IMF-OECD Dataset). Estimated Impacts on the Budget, on GDP and on Consumption.

	All Parameters		Significant Parameters	
	1st period	2nd Period	1st Period	2nd Period
$\partial T / \partial A_b$	-2.11	-2.03	-1.63	-2.08
$\partial I_g / \partial A_b$	.17	-.33	-	-.31
$\partial G_c / \partial A_b$	-1.28	-.70	-.63	-.77
$\partial T / \partial A_m$	5.11	4.79	-	-
$\partial I_g / \partial A_m$	.32	2.57	-	-
$\partial G_c / \partial A_m$	5.79	3.22	-	-
$\partial Y / \partial A_b$	-3.62	2.34	-1.63	-3.07
$\partial Y / \partial A_m$	10.29	-19.51	-	-
$\partial C / \partial A_b$	-.35	2.71	-	-.61
$\partial C / \partial A_m$	1.19	-15.1	-	-

Table A.3.3. Model III. Total Aid (IMF-OECD Dataset). Estimated Impacts on the Budget, on GDP and on Consumption.

	All Parameters		Significant Parameters	
	1st period	2nd Period	1st Period	2nd Period
$\partial T / \partial A$	-1.27	-1.26	-1.28	-1.59
$\partial I_g / \partial A$	.28	.07	-	-.14
$\partial G_c / \partial A$	-.55	-.33	-.28	-.45
$\partial Y / \partial A$	-1.24	.68	-1.28	-3.91
$\partial C / \partial A$	.01	1.21	-	-1.44

Appendix 4. GOV Dataset Instrumental Variables Estimates.

Table A.4.1. Model IV. Grants and Loans (GOV Dataset).

	Constant	I_p^{gov}	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A_g	A_l
T^{gov}	3996.3**	.31	.46**	.59	-6.46*	-.39
	(1562.5)	(.20)	(.21)	(.54)	(3.74)	(1.21)
I_g^{gov}	2453.4*	.11	.42**	.35	-5.68*	-.03
	(1197)	(.16)	(.16)	(.41)	(2.86)	(.93)

Instruments used: $A_{g,t-1}$, $A_{l,t-1}$, OF_{t-1}, Y_{t-1}, Dcred.

	Constant	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A_g	A_l	$A_{g,t-1}$	$A_{l,t-1}$	OF_{t-1}	Y_{t-1}	Dcred
I_p^{gov}	-12420**	-.52**	.83*	3.91	1.92	-15.8**	3.44**	-.85**	.32**	.03
	(1889.4)	(.21)	(.44)	(3.64)	(1.21)	(5.29)	(1.30)	(.26)	(.06)	(.04)

Private Consumption Equation: Long Run

$$C = \underset{(2196)}{11100^{**}}\ \text{Constant} \ \underset{(.04)}{+.60^{**}}\ Yd^{gov}$$

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses.

Table A.4.2. Model V. Bilateral and Multilateral Aid (GOV Dataset).

	Constant	I_p^{gov}	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A_b	A_m
T^{gov}	4212.2**	.45**	.46**	.16	-2.19**	6.50*
	(1455.2)	(.19)	(.20)	(.48)	(.90)	(3.55)
I_g^{gov}	2297.6*	.13	.40**	.21	-1.45**	4.08
	(1144.5)	(.15)	(.15)	(.38)	(.71)	(2.79)

Instruments used: $A_{b,t-1}$, $A_{m,t-1}$, OF_{t-1}, Y_{t-1}, Dcred.

	Constant	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A_b	A_m	$A_{b,t-1}$	$A_{m,t-1}$	OF_{t-1}	Y_{t-1}	Dcred
I_p^{gov}	-5449.2**	-.52**	1.70**	-1.18	11.4**	1.58*	-21.0**	-.19	.13**	.02
	(1770.5)	(.18)	(.37)	(.95)	(4.88)	(.86)	(5.30)	(.24)	(.05)	(.04)

Private Consumption Equation: Long Run

$$C = \underset{(2163)}{11080^{**}}\ \text{Constant} \ \underset{(.04)}{+.60^{**}}\ Yd^{gov}$$

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses.

Table A.4.3. Model VI. Total Aid (GOV Dataset).

	Constant	I_p^{gov}	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A^{gov}
T^{gov}	1907.3* (1047.5)	.20 (.26)	.70** (.16)	.72 (.71)	-.68* (.34)
I_g^{gov}	846.46 (860.8)	.001 (.21)	.58** (.13)	.45 (.58)	-.32 (.28)

Instruments used: A_{t-1}^{gov}, OF_{t-1}, Y_{t-1}, Dcred.

	Constant	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A^{gov}	A_{t-1}^{gov}	OF_{t-1}	Y_{t-1}	Dcred
I_p^{gov}	-7431.2** (1290.2)	-.80** (.20)	1.52** (.61)	-.23 (.44)	-.14 (.58)	-.52* (.27)	.22** (.07)	-.001 (.06)

Private Consumption Equation: Long Run

$$C = \underset{(2083)}{11050^{**}} \text{ Constant } \underset{(.04)}{+.60^{**}} Yd^{gov}$$

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses.

Appendix 5. Diagnostic Tests.

Table A.5.1. Model I. Grants and Loans (IMF-OECD Dataset). Diagnostic Tests.

T^{imf} RF R^2=.99; σ =1042.66; DW =1.73; IV $\chi^2(4)$=4.11 [.39]; IV β=0 $\chi^2(5)$=1463 [.00]
AR 2 $\chi^2(2)$=1.10 [.58]; ARCH 1 F(1,18)=.15 [.70]; N $\chi^2(2)$=3.67 [.16]; X_i^2 F(10,9)=.76[.66]

I_g^{imf} RF R^2=.99; σ =737.19; DW =2.29; IV $\chi^2(4)$=3.75 [.44]; IV β=0 $\chi^2(5)$=755.4 [.00]
AR 2 $\chi^2(2)$=.77 [.68]; ARCH 1 F(1,18)=.80 [.38]; N $\chi^2(2)$=3.72 [.15]; X_i^2 F(10,9)=3.3 [.05]

I_p^{imf} R^2=.99; F(9,16)=361.79 [.00]; σ =1088.28; DW =2.31; VIT: .110; JIT: 2.068
AR 2 F(2,14)=.44 [.65]; ARCH 1 F(1,14)=.30 [.59]; N $\chi^2(2)$=2.35 [.31]
RESET F(1,15)=1.36 [.26]

Probabilities in squared brackets.

Table A.5.2. Model II. Bilateral and Multilateral Aid (IMF-OECD Dataset). Diagnostic Tests.

T^{imf} RF R^2=.99; σ =1018.81; DW =1.62; IV $\chi^2(4)$=4.53 [.34]; IV β=0 $\chi^2(5)$=1536 [.00]
AR 2 $\chi^2(2)$=4.38 [.11]; ARCH 1 F(1,18)=.11 [.74]; N $\chi^2(2)$=.44 [.80]; X_i^2 F(10,9)=.94[.54]

I_g^{imf} RF R^2=.98; σ =766.75; DW =1.92; IV $\chi^2(4)$=4.21 [.38]; IV β=0 $\chi^2(5)$=696.6 [.00]
AR 2 $\chi^2(2)$=1.16 [.56]; ARCH 1 F(1,18)=1.27 [.27]; N $\chi^2(2)$=5.38 [.07]; X_i^2 F(10,9)=1.39[.32]

I_p^{imf} R^2=.99; F(9,16)=265.16 [.00]; σ =1270.07; DW =2.26; VIT: .260; JIT: 2.004
AR 2 F(2,14)=.22 [.80]; ARCH 1 F(1,14)=.03 [.85]; N $\chi^2(2)$=3.26 [.19]
RESET F(1,15)=2.44 [.14]

Probabilities in squared brackets.

Table A.5.3. Model III. Total Aid (IMF-OECD Dataset). Diagnostic Tests.

T^{imf} RF R^2=.99; σ =1029.63; DW =1.64; IV $\chi^2(3)$=3.48 [.33]; IV β=0 $\chi^2(4)$=1500 [.00]
AR 2 $\chi^2(2)$=1.79 [.41]; ARCH 1 F(1,19)=.35 [.56]; N $\chi^2(2)$=3.66 [.16]; X_i^2 F(8,12)=1.04[.46]

I_g^{imf} RF R^2=.98; σ =747.20; DW =1.92; IV $\chi^2(3)$=3.10 [.38]; IV β=0 $\chi^2(4)$=733.2 [.00]
AR 2 $\chi^2(2)$=1.23 [.54]; ARCH 1 F(1,19)=1.51 [.23]; N $\chi^2(2)$=5.3 [.07]; X_i^2 F(8,12)=2.40[.08]

I_p^{imf} R^2=.99; F(7,18)=337.68 [.00]; σ =1275.58; DW =2.26; VIT: .319; JIT: 1.653
AR 2 F(2,16)=.26 [.78]; ARCH 1 F(1,16)=.13 [.72]; N $\chi^2(2)$=1.09 [.58]
RESET F(1,17)=1.27 [.28]

Probabilities in squared brackets.

Table A.5.4. Model IV. Grants and Loans (GOV Dataset). Diagnostic Tests.

T^{gov} RF R^2=.99; σ =1185.73; DW =1.58; IV $\chi^2(4)$=10.3 [.04]; IV β=0 $\chi^2(5)$=977.6 [.00]
AR 2 $\chi^2(2)$=.61 [.74]; ARCH 1 F(1,18)=.33 [.57]; N $\chi^2(2)$=.39 [.82]; X_i^2 F(10,9)=1.06 [.47]

I_g^{gov} RF R^2=.98; σ =908.39; DW =1.36; IV $\chi^2(4)$=10.9 [.03]; IV β=0 $\chi^2(5)$=452.2 [.00]
AR 2 $\chi^2(2)$=1.80 [.41]; ARCH 1 F(1,18)=.19 [.66]; N $\chi^2(2)$=3.21 [.20]; X_i^2 F(10,9)=.71 [.70]

I_p^{gov} R^2=.99; F(9,16)=445.17 [.00]; σ =1011.88; DW =2.64; VIT: .113; JIT: 1.799
AR 2 F(2,14)=2.51 [.12]; ARCH 1 F(1,14)=.16 [.69]; N $\chi^2(2)$=.45 [.80]
RESET F(1,15)=.97 [.34]

Probabilities in squared brackets.

Table A.5.5. Model V. Bilateral and Multilateral Aid (GOV Dataset). Diagnostic Tests.

T^{gov} RF R^2=.99; σ =1134.69; DW =1.53; IV $\chi^2(4)$=8.76 [.07]; IV β=0 $\chi^2(5)$=1071.1[.00]
AR 2 $\chi^2(2)$=1.77 [.41]; ARCH 1 F(1,18)=.05 [.83]; N $\chi^2(2)$=.79 [.67]; X_i^2 F(10,9)=.48 [.87]

I_g^{gov} RF R^2=.98; σ =892; DW =1.10; IV $\chi^2(4)$=11.09 [.03]; IV β=0 $\chi^2(5)$=469.1 [.00]
AR 2 $\chi^2(2)$=7.64 [.02]; ARCH 1 F(1,18)=1.32 [.26]; N $\chi^2(2)$=3.62 [.16]; X_i^2 F(10,9)=.43[.90]

I_p^{gov} R^2=.99; F(9,16)=609.32 [.00]; σ =865.37; DW =3.20; VIT: .178; JIT: 1.483
AR 2 F(2,14)=7.80 [.01]; ARCH 1 F(1,14)=1.45 [.25]; N $\chi^2(2)$=3.97 [.14]
RESET F(1,15)=.89 [.36]

Probabilities in squared brackets.

Table A.5.6. Model VI. Total Aid (GOV Dataset). Diagnostic Tests.

T^{gov} RF R^2=.99; σ =1148.13; DW =1.57; IV $\chi^2(3)$=11.58 [.01]; IV β=0 $\chi^2(4)$=1042.3 [.00]
AR 2 $\chi^2(2)$=.84 [.66]; ARCH 1 F(1,19)=.01 [.94]; N $\chi^2(2)$=.50 [.78]; X_i^2 F(8,12)=.48[.84]

I_g^{gov} RF R^2=.98; σ =943.59; DW =1.24; IV $\chi^2(3)$=13.2 [.00]; IV β=0 $\chi^2(4)$=415.5 [.00]
AR 2 $\chi^2(2)$=3.20 [.20]; ARCH 1 F(1,19)=.35 [.56]; N $\chi^2(2)$=.93 [.63]; X_i^2 F(8,12)=.70 [.69]

I_p^{gov} R^2=.99; F(7,18)=372.21 [.00]; σ =1253.05; DW =2.46; VIT: .133; JIT: 1.674
AR 2 F(2,16)=.55 [.59]; ARCH 1 F(1,16)=1.08 [.31]; N $\chi^2(2)$=1.24 [.54]
RESET F(1,17)=.23 [.64]

Probabilities in squared brackets.

Appendix 6. Short Run Private Consumption Equations. Instrumental Variables.

Table A.6.1. Model I. Grants and Loans (IMF-OECD Dataset).

$$C = \underset{(2148.3)}{4372.3^{**}}\ \text{Constant} \ + \underset{(.10)}{.24^{**}}\ Yd^{imf} \ + \underset{(.18)}{.60^{**}}\ C_{t-1}$$

Diagnostic Tests : RF R^2=.99; σ =2001.14; DW =1.95; IV $\chi^2(8)$=8.21 [.41]; IV β=0 $\chi^2(2)$=1839.2[.00]

AR 2 $\chi^2(2)$=.25 [.88]; ARCH 1 F(1,21)=.03 [.87]; N $\chi^2(2)$=1.98 [.37]; X_i^2 F(4,18)=1.20[.34]

Instruments used: A_g, A_l, $A_{g,t-1}$, $A_{l,t-1}$, OF_{t-1}, $Oilt_{t-1}$, $G_{c,t-1}^{imf}$, Y_{t-1}, Dcred.

Table A.6.2. Model II. Bilateral and Multilateral Aid (IMF-OECD Dataset).

$$C = \underset{(2145.6)}{4186.3^{*}}\ \text{Constant} \ + \underset{(.10)}{.23^{**}}\ Yd^{imf} \ + \underset{(.18)}{.62^{**}}\ C_{t-1}$$

Diagnostic Tests: RF R^2=.99; σ =2000.42; DW =1.98; IV $\chi^2(8)$=10.4 [.24]; IV β=0 $\chi^2(2)$=1840.1[.00]

AR 2 $\chi^2(2)$=.08 [.96]; ARCH 1 F(1,21)=.04 [.84]; N $\chi^2(2)$=1.71 [.42]; X_i^2 F(4,18)=1.24[.33]

Instruments used: A_b, A_m, $A_{b,t-1}$, $A_{m,t-1}$, OF_{t-1}, $Oilt_{t-1}$, $G_{c,t-1}^{imf}$, Y_{t-1}, Dcred.

Table A.6.3. Model III. Total Aid (IMF-OECD Dataset).

$$C = \underset{(2152)}{4391.5^{**}}\ \text{Constant} \ + \underset{(.10)}{.25^{**}}\ Yd^{imf} \ + \underset{(.18)}{.60^{**}}\ C_{t-1}$$

Diagnostic Tests: RF R^2=.99; σ =2001.27; DW =1.95; IV $\chi^2(6)$=8.12 [.23]; IV β=0 $\chi^2(2)$=1839[.00]

AR 2 $\chi^2(2)$=.23 [.89]; ARCH 1 F(1,21)=.02 [.88]; N $\chi^2(2)$=2.00 [.37]; X_i^2 F(4,18)=1.20[.34]

Instruments used: A, A_{t-1}, OF_{t-1}, $Oilt_{t-1}$, $G_{c,t-1}^{imf}$, Y_{t-1}, Dcred.

Table A.6.4. Model IV. Grants and Loans (GOV Dataset).

$$C = \underset{(2276.7)}{4775.5^{**}}\ \text{Constant} \ + \underset{(.10)}{.26^{**}}\ Yd^{gov} \ + \underset{(.19)}{.57^{**}}\ C_{t-1}$$

Diagnostic Tests: RF R^2=.99; σ =1932.57; DW =1.94; IV $\chi^2(8)$=9.83 [.28]; IV β=0 $\chi^2(2)$=1971.5[.00]

AR 2 $\chi^2(2)$=.16 [.92]; ARCH 1 F(1,21)=.44 [.52]; N $\chi^2(2)$=1.09 [.58]; X_i^2 F(4,18)=1.39[.28]

Instruments used: A_g, A_l, $A_{g,t-1}$, $A_{l,t-1}$, OF_{t-1}, $Oilt_{t-1}$, $G_{c,t-1}^{gov}$, Y_{t-1}, Dcred.

Table A.6.5. Model V. Bilateral and Multilateral Aid (GOV Dataset).

$$C = \underset{(2280.9)}{4839.9^{**}}\ \text{Constant} \ + \underset{(.10)}{.26^{**}}\ Yd^{gov} \ + \underset{(.19)}{.56^{**}}\ C_{t-1}$$

Diagnostic Tests: RF R^2=.99; σ =1931.81; DW =1.93; IV $\chi^2(8)$=9.58 [.29]; IV β=0 $\chi^2(2)$=1973.2[.00]

AR 2 $\chi^2(2)$=.18 [.91]; ARCH 1 F(1,21)=.42 [.52]; N $\chi^2(2)$=1.12 [.57]; X_i^2 F(4,18)=1.38[.28]

Instruments used: A_b, A_m, $A_{b,t-1}$, $A_{m,t-1}$, OF_{t-1}, $Oilt_{t-1}$, $G_{c,t-1}^{gov}$, Y_{t-1}, Dcred.

Table A.6.6. Model VI. Total Aid (GOV Dataset).

$$C = \underset{(2283.6)}{5005.1^{**}}\ \text{Constant} \ + \underset{(.10)}{.27^{**}}\ Yd^{gov} \ + \underset{(.19)}{.54^{**}}\ C_{t-1}$$

Diagnostic Tests: RF R^2=.99; σ =1930.3; DW =1.90; IV $\chi^2(6)$=12.0 [.06]; IV β=0 $\chi^2(2)$=1976.2[.00]

AR 2 $\chi^2(2)$=.21 [.90]; ARCH 1 F(1,21)=.39 [.54]; N $\chi^2(2)$=1.20 [.55]; X_i^2 F(4,18)=1.35[.29]

Instruments used: A^{gov}, A_{t-1}^{gov}, OF_{t-1}, $Oilt_{t-1}$, $G_{c,t-1}^{gov}$, Y_{t-1}, Dcred.

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses.

Appendix 7. Three Stage Least Squares Results.

Table A.7.1. Model Ia. Grants and Loans (IMF-OECD Dataset). 3SLS.

	Constant	I_p^{imf}	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A_g	A_l
T^{imf}	3260^{**}	$.41^{**}$	$.46^{**}$	$.53^{*}$	-2.77	-1.08
	(1198)	(.07)	(.17)	(.26)	(3.22)	(1.05)
I_g^{imf}	-754.9	$.10^{*}$	$.32^{**}$	$.56^{**}$	-2.56	.89
	(861.3)	(.05)	(.13)	(.19)	(2.28)	(.75)

	Constant	A_g	A_l	$A_{g,t-1}$	$A_{l,t-1}$	OF_{t-1}	Y_{t-1}	Dcred
I_p^{imf}	-10840^{**}	3.94	.59	-12.2^{**}	4.15^{**}	$-.78^{**}$	$.32^{**}$	$.14^{**}$
	(1563)	(3.05)	(1.11)	(4.83)	(1.21)	(.23)	(.03)	(.03)

Diagnostic tests

T^{imf} σ=1069.5; AR 2 F(2,13)=2.52 [.12]; ARCH 1 F(1,13)=.17 [.69]; N $\chi^2(2)$=1.32 [.52]

I_g^{imf} σ=741.6; AR 2 F(2,13)=7.34 [.01]; ARCH 1 F(1,13)=.57 [.46]; N $\chi^2(2)$=5.68 [.06]

I_p^{imf} σ=1038.8; AR 2 F(2,13)=4.33 [.04]; ARCH 1 F(1,13)=.16 [.69]; N $\chi^2(2)$=1.21 [.55]

LR test of over-identifying restr. $\chi^2(13)$=43.99[.00]; VAR 2 F(18,34)=1.17 [.34]; VN $\chi^2(6)$=7.04 [.32]

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses. Probabilities in squared brackets.

Table A.7.2. Model IIa. Bilateral and Multilateral Aid (IMF-OECD Dataset). 3SLS.

	Constant	I_p^{imf}	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A_b	A_m
T^{imf}	3099^{**}	$.42^{**}$	$.41^{**}$	$.51^{**}$	-1.82^{**}	3.34
	(1134)	(.07)	(.14)	(.23)	(.67)	(3.14)
I_g^{imf}	-625.6	.08	$.32^{**}$	$.52^{**}$	.23	-.08
	(889)	(.05)	(.13)	(.19)	(.55)	(2.36)

	Constant	A_b	A_m	$A_{b,t-1}$	$A_{m,t-1}$	OF_{t-1}	Y_{t-1}	Dcred
I_p^{imf}	-7371^{**}	-.80	7.36	2.14^{**}	-13.2^{**}	$-.40^{*}$	$.26^{**}$	$.15^{**}$
	(1410)	(.92)	(5.24)	(.93)	(4.89)	(.22)	(.02)	(.03)

Diagnostic tests

T^{imf} σ=1025; AR 2 F(2,13)=4.88 [.03]; ARCH 1 F(1,13)=.36 [.56]; N $\chi^2(2)$=.16 [.92]

I_g^{imf} σ=765.9; AR 2 F(2,13)=6.45 [.01]; ARCH 1 F(1,13)=.58 [.46]; N $\chi^2(2)$=6.43 [.04]

I_p^{imf} σ=1175.8; AR 2 F(2,13)=.73 [.50]; ARCH 1 F(1,13)=.03 [.87]; N $\chi^2(2)$=1.05 [.59]

LR test of over-identifying restr. $\chi^2(13)$=38.02[.00]; VAR 2 F(18,34)=2.19 [.02]; VN $\chi^2(6)$=3.94 [.68]

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses. Probabilities in squared brackets.

Table A.7.3. Model IIIa. Total Aid (IMF-OECD Dataset). 3SLS.

	Constant	I_p^{imf}	$Oilt_{t-1}$	$G_{c,t-1}^{imf}$	A
T^{imf}	3465**	.41**	.46**	.47*	-1.47**
	(1161)	(.07)	(.16)	(.24)	(.68)
I_g^{imf}	-681.7	.08	.34**	.50**	.26
	(874.5)	(.05)	(.13)	(.19)	(.52)

	Constant	A	A_{t-1}	OF_{t-1}	Y_{t-1}	Dcred
I_p^{imf}	-8988**	.07	1.75*	-.59**	.27**	.13**
	(1467)	(.88)	(.98)	(.25)	(.02)	(.04)

Diagnostic tests

T^{imf} σ =1054.6; AR 2 F(2,15)=2.80 [.09]; ARCH 1 F(1,15)=.17 [.69]; N $\chi^2(2)$=.61 [.74]

I_g^{imf} σ =747.8; AR 2 F(2,15)=5.26 [.02]; ARCH 1 F(1,15)=.72 [.41]; N $\chi^2(2)$=7.84 [.02]

I_p^{imf} σ =1220.1; AR 2 F(2,15)=1.78 [.20]; ARCH 1 F(1,15)=.04 [.85]; N $\chi^2(2)$=1.18 [.55]

LR test of over-identifying restr. $\chi^2(11)$=34.88[.00]; VAR 2 F(18,37)=1.95 [.04]; VN $\chi^2(6)$=4.29 [.64]

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses. Probabilities in squared brackets.

Table A.7.4. Model IVa. Grants and Loans (GOV Dataset). 3SLS.

	Constant	I_p^{gov}	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A_g	A_l
T^{gov}	4688**	.30	.34*	.69	-7.26**	-.84
	(1467)	(.19)	(.19)	(.51)	(3.71)	(1.17)
I_g^{gov}	2902**	.09	.31**	.49	-6.33**	-.36
	(1109)	(.14)	(.15)	(.38)	(2.82)	(.89)

	Constant	A_g	A_l	$A_{g,t-1}$	$A_{l,t-1}$	OF_{t-1}	Y_{t-1}	Dcred
I_p^{gov}	-14070**	8.07**	2.41*	-15.7**	3.86**	-.85**	.34**	.11**
	(1699)	(3.25)	(1.18)	(5.20)	(1.29)	(.25)	(.03)	(.03)

Diagnostic tests

T^{gov} σ =1198.5; AR 2 F(2,13)=4.45 [.03]; ARCH 1 F(1,13)=.14 [.72]; N $\chi^2(2)$=.79 [.67]

I_g^{gov} σ =913.2; AR 2 F(2,13)=6.15 [.01]; ARCH 1 F(1,13)=.35 [.56]; N $\chi^2(2)$=4.22 [.12]

I_p^{gov} σ =1121.0; AR 2 F(2,13)=5.86 [.01]; ARCH 1 F(1,13)=.39 [.54]; N $\chi^2(2)$=2.16 [.34]

LR test of over-identifying restr. $\chi^2(13)$=31.88[.00]; VAR 2 F(18,34)=1.84 [.06]; VN $\chi^2(6)$=4.29 [.64]

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses. Probabilities in squared brackets.

Table A.7.5. Model Va. Total Aid (GOV Dataset). 3SLS.

	Constant	I_p^{gov}	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A_b	A_m
T^{gov}	4598^{**}	$.36^{*}$	.29	.47	-2.73^{**}	6.01^{**}
	(1339)	(.19)	(.18)	(.47)	(.81)	(3.55)
I_g^{gov}	2528^{**}	.08	$.29^{*}$	.41	-1.78^{**}	3.77^{**}
	(1087)	(.15)	(.14)	(.37)	(.66)	(2.79)

	Constant	A_b	A_m	$A_{b,t-1}$	$A_{m,t-1}$	OF_{t-1}	Y_{t-1}	Dcred
I_p^{gov}	-9901^{**}	1.07	6.2	1.59	-12.9^{**}	$-.49^{*}$	$.28^{**}$	$.12^{**}$
	(1537)	(.95)	(6.18)	(1.0)	(6.19)	(.25)	(.02)	(.04)

Diagnostic tests

T^{gov} σ =1131.9; AR 1 F(2,13)=4.44 [.03]; ARCH 1 F(1,13)=.31 [.59]; N $\chi^2(2)$=.48 [.79]

I_g^{gov} σ =896.9; AR 1 F(2,13)=7.06 [.01]; ARCH 1 F(1,13)=1.09 [.31]; N $\chi^2(2)$=3.91 [.14]

I_p^{gov} σ =1233.4; AR 1 F(2,13)=39.2 [.00]; ARCH 1 F(1,13)=.23 [.64]; N $\chi^2(2)$=.77 [.68]

LR test of over-identifying restr. $\chi^2(13)$=44.23[.00]; VAR 2 F(18,34)=1.92 [.05]; VN $\chi^2(6)$=2.57 [.86]

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses. Probabilities in squared brackets.

Table A.7.6. Model VIa. Total Aid (GOV Dataset). 3SLS.

	Constant	I_p^{gov}	$Oilt_{t-1}$	$G_{c,t-1}^{gov}$	A^{gov}
T^{gov}	2380^{**}	.31	$.71^{**}$	.47	$-.64^{*}$
	(984.2)	(.24)	(.15)	(.66)	(.33)
I_g^{gov}	1187	.08	$.58^{**}$	.27	-.30
	(820.8)	(.20)	(.13)	(.55)	(.27)

	Constant	A^{gov}	A_{t-1}^{gov}	OF_{t-1}	Y_{t-1}	Dcred
I_p^{gov}	-5668^{**}	.01	1.10^{*}	$-.61^{*}$	$.19^{**}$	$.20^{**}$
	(1086)	(.52)	(.62)	(.30)	(.03)	(.03)

Diagnostic tests

T^{gov} σ =1196.1; AR 2 F(2,16)=4.23 [.03]; ARCH 1 F(1,16)=1.23 [.28]; N $\chi^2(2)$=.01 [.99]

I_g^{gov} σ =966.4; AR 2 F(2,16)=6.91 [.01]; ARCH 1 F(1,16)=.51 [.49]; N $\chi^2(2)$=.49 [.78]

I_p^{gov} σ =1679.6; AR 2 F(2,16)=9.73 [.00]; ARCH 1 F(1,16)=.12 [.74]; N $\chi^2(2)$=5.44 [.07]

LR test of over-identifying restr. $\chi^2(8)$=33.57[.00]; VAR 2 F(18,37)=1.85 [.06]; VN $\chi^2(6)$=5.83 [.44]

*, ** denote significance at 10% and 5% respectively. Standard errors in parentheses. Probabilities in squared brackets.

Appendix 8. List of Variables: Glossary and Sources.

	IMF, International Financial Statistics, Various Issues
Y	Gross Domestic Product
C	Private Consumption
I	Gross Capital Formation
Dcred	Domestic Credit
	IMF, Government Finance Statistics Yearbook, Various Issues
I_g^{imf}	Government Capital Expenditure
I_p^{imf}	Private Investment defined as I- I_g^{imf}
G_c^{imf}	Government Current Expenditure
T^{imf}	Government Revenues
Yd^{imf}	Total Disposable Income defined as Y- T^{imf}
	Bank of Indonesia, Report for the Financial Year, Various Issues
I_g^{gov}	Government Development Expenditure
I_p^{gov}	Private Investment defined as I- I_g^{gov}
G_c^{gov}	Government Routine Expenditure
T^{gov}	Government Domestic Revenues
A^{gov}	Government Development Revenues
Yd^{gov}	Total Disposable Income defined as Y- T^{gov}
Oilt	Oil Revenues
	OECD, Geographical Distribution of Financial Flows to Developing Countries, Various Issues
A	Net Official Development Assistance (ODA)
A_g	Net ODA Grants
A_l	Net ODA Loans
A_b	Net Bilateral ODA
A_m	Net Multilateral ODA
OF	Other Net Official Financial Flows Plus Net Export Credits Plus Net Direct and Portfolio Investment

GOV Dataset	Dataset containing budgetary data from Bank of Indonesia, *Report for the Financial Year*
IMF-OECD Dataset	Dataset containing IMF data on government behaviour and OECD aid data (includes Oilt)

All data are given in billions of real rupiahs in terms of the 1985 GDP IMF deflator. Government figures have been adjusted for solar year. Aid dollar data have been converted to rupiahs by using the IMF published dollar exchange rate.

Appendix 9. Abbreviations for Diagnostic Tests.

R^2	Coefficient of determination of the regression
RF R^2	Reduced Form R^2 (Instrumental variables estimation)
T	Number of observations
k	Number of dependent variables
F(k-1/T-k)	F-test on the joint significance of all explanatory variables except the constant
σ	Standard error of the regression
DW	Durbin Watson test for first order autocorrelation
IV χ^2	χ^2 test for the validity of the choice of the instrumental variables used
IV β=0	χ^2 test on the joint significance of reduced form explanatory variables except the constant
AR 2 F, AR 2 χ^2	Breusch-Godfrey Lagrange Multiplier (LM) test for serial correlation up to the second lag (F- and χ^2 forms).
ARCH 1 F	LM F-test for autoregressive conditional heteroscedasticity up to the first lag
N χ^2	Doornik and Hansen χ^2 test for univariate normality of the residuals
X_i^2 F	White's F-test for heteroscedasticity using squares
RESET F	Ramsey's general F-test of misspecification
VIT	Variance instability test
JIT	Joint instability test for all the parameters in the model

3SLS System Diagnostics

LR test of overidentifying restr. χ^2	Likelyhood Ratio test of whether the reduced model parsimoniously encompasses the system
VAR F 2	LM F-test for system residuals autocorrelation up to the second lag
VN χ^2	χ^2 test for multivariate normality of the residuals

These tests are the standard output of the econometric package used, PcGive 8.0 and PcFiml 8.0. Full references and explanations for each test are available in most standard econometric textbooks, as well as in PcGive and PcFiml manuals.

CHAPTER 4

REAL EXCHANGE RATE BEHAVIOUR IN INDONESIA.

THEORETICAL AND STATISTICAL ISSUES.

4.1. Introduction.

This chapter analyses the behaviour of the real exchange rate (RER) for the Indonesian rupiah. In the first chapter, we have described foreign exchange policy in Indonesia since the 1960's. The analysis presented here offers a theoretical and statistical background for the understanding of the RER. It also represents the first necessary step towards the empirical implementation of a model for RER behaviour, which will be presented and discussed in the next chapter. This model includes aid among the fundamental determinants of the RER. The role of aid can therefore be studied under a different perspective than the dynamic fiscal response model presented in chapter 3. The following analysis is a technical digression aimed at ascertaining the time series properties of the Indonesian RER[1]. The main findings are reported below, so that the reader could easily skip the rest of the chapter and turn to the 5th, if she/he is not interested in technical issues.

[1] Cointegration issues are raised in the empirical implementation of the models presented in Chapter 5.

As mentioned in the first chapter, during the period under analysis, 1960-1993, Indonesia experienced five episodes of major nominal devaluation (1965, 1971, 1978, 1983 and 1986). The hyperinflation crisis of 1965 caused a massive devaluation and the Government gradually moved towards the dismantling of the then prevailing multiple exchange rate system. By 1969 the rupiah became freely convertible and its value remained pegged to the dollar until 1978. By 1971 the rupiah's exchange value versus the dollar was 30% less than it was in 1969 and after a further 50% devaluation in November 1978 the Government opted for a tightly managed float regime. The rupiah was again devalued in March 1983 by 37% and more recently, in September 1986, by 50%, when more flexibility was introduced in exchange rate management. The exchange rate regime remained a managed float regime pegged to the dollar, the yen and the Deutsche Mark until August 1997, when economic turmoil in international markets led the government to float the rupiah.

The nominal exchange rate has systematically diverged from the RER, due to inflation above that of the rest of the world. Real exchange rates are commonly used as indicators for movements in international competitiveness: this practice needs to be qualified with respect to the informational content of RER indices. In this chapter we discuss theoretical and statistical issues related to the definition and measurement of the RER. The Indonesian real effective exchange rate (REER) is calculated and tested for stationarity. A series of unit root tests is then carried out using the Augmented Dickey Fuller (ADF) test. Rolling, recursive, sequential and Perron type ADF tests are also implemented to allow for breaks in the RER behaviour. Most of the tests do not allow us to reject the null hypothesis of the presence of a unit root, i.e. of non stationarity.

Opposite results are obtained in two cases: ADF tests over the full sample (1960-1993) and ADF tests which allow for two breaks in the RER. Whether these conflicting results are essentially due to the hyperinflation of the early 1960's and/or to the inclusion of the two 'Indonesian tailored' breaks cannot be assessed with certainty. It is probably true that thirty-three years are too a short time span to ascertain the long run behaviour of the RER. As a result, our unit root test outcome must be interpreted with caution. Nevertheless, we feel more confident in relying on results from unit root tests carried out over a sub-sample which excludes the years 1960-1965.

The chapter is organised as follows. Section 4.2. presents an overview of the theoretical issues underlying RER definition. Section 4.3. focuses on the measurement of the Indonesian RER and offers some theoretical insights on measurement problems. Section 4.4. analyses the statistical behaviour on the Indonesian RER with an emphasis on unit root testing. Final remarks conclude the chapter.

4.2. Alternative Definitions of the Real Exchange Rate.

By definition, RER indexes measure relative prices expressed in a common currency. If the notion of an 'effective' rate is introduced this can be restated as relative prices adjusted for nominal effective exchange rates movements. Nominal effective exchange rates (NEER) represent the relationship between a numeraire currency and a basket of 'relevant' foreign currencies, expressed in terms of the numeraire currency. International trade considerations mainly guide the choice and the aggregation procedure used in the construction of the foreign currency composite.

Real effective exchange rates (REER) are the counterpart of NEER once RERs have been adjusted for relative prices[2]. Defined as such, REERs depend heavily on the selection of, and the weights attached to, foreign currencies and on the choice of the price indices for the reporting country and abroad. As a result, different policy questions may be addressed with differently computed REERs. The assessment of a country's international competitiveness cannot be based only on the analysis of the RER (or REER), which provides only a rough indicator for such a purpose, and needs to be complemented with a more comprehensive evaluation of that country's economic conditions[3].

The most common theoretical definitions of real exchange rate are the purchasing power parity (PPP) definition and the trade theory definition. The law of one price underlies the former formulation and is stated as EP^*/P, where E is the nominal exchange rate, P^* and P are the foreign and the domestic price levels, respectively. The trade theory definition has recently become more popular and is theoretically motivated by the Swan-Salter model[4]. It is based on the ratio of traded goods price, P_t, to non-traded goods price, P_n: P_t/P_n, or, more commonly, EP_t^*/P_n, where the '*' denotes a foreign variable.

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[2] Unit labour costs, wage differentials, productivity indexes may be used, although data limitations prevent their use for developing countries.

[3] Maciejewski (1983) presents an interesting analysis on the issue of RER definition and informational content. See also Harberger (1986) for a wide-ranging discussion of the concept of RER and on theoretical issues related to the measurement of price deflators.

[4] Salter (1959) presents a pioneering version of the model, which features both traded and non-traded goods. Incidentally, the Swan-Salter model is also known as the tradable versus non-tradable, the Australian, the dependent economy and the small open economy model.

In practice, the PPP definition usually takes the ratio of the foreign to the domestic consumer price index (most commonly the CPI), while the trade theory definition uses two different indexes. An accepted convention, suggested by Harberger (1986), is to use the wholesale price index (WPI) as a proxy for the price of traded goods[5] and the consumer price index (CPI) as a proxy for non-traded goods. The reason for such a choice is that the WPI contains mainly traded goods, while non-tradable goods and services heavily influence the CPI[6].

The use of GDP deflators for both the home and the foreign country may provide an approximation of the changes in competitiveness in production. However, GDP deflators measure the aggregate domestic production of both tradable and non-tradable goods. Their use is therefore conceptually closer to the PPP definition of RER than the trade theory interpretation[7].

Given the close correlations which exists between CPI and WPI, the two definition may not vary much. From a theoretical perspective, however, the trade theory definition is seen to have a higher informational content on the domestic economic structure. The measure of competitiveness it gives is thus preferred when analysing developing countries, whose economic structure and performance can be readily fitted into a tradable- non-tradable modelling framework.

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[5] Goldstein and Officer (1978) point out some weaknesses in the use of the WPI, while supporting the view that the WPI is the logical proxy for the traded good price. The most important ones are the possibility of double counting, as the WPI measures the price of commodities at various stages of production, and the inclusion of imports among non domestically traded goods.

[6] It should be noted that the CPI is a good proxy for the price of non-traded goods, but is not the ideal one, as some tradable enter this index.

[7] For a clear and synthetic review on the problems related to the choice of the relevant price indexes see Edwards (1988a). A more detailed and in depth analysis of this issue is presented in Maciejewski (1983).

Moreover, the trade theory definition is deemed more appropriate in cases of resource booms leading to Dutch Disease. As noted in the first chapter, a country experiencing a commodity boom is traditionally analysed in terms of 'spending' and 'resource movement' effects. The first one refers to the decline of the tradable sector and the concurrent rise in non-traded output, following the excess demand for non-tradables generated by the rise in real income. An increase in the relative price of non-tradables to tradables is then required to restore equilibrium, hence a real appreciation. The 'resource movement' effect concerns the competition of the different sectors of the economy for available resources following a commodity boom. The latter is deemed not to be relevant in the case of an oil boom, and thus in the case of Indonesia, as the oil sector does not compete with the non-oil economy for resources. The composite non-tradable biased structural adjustment of the economy is termed Dutch Disease[8]. Dutch Disease need not be necessarily brought on by a commodity boom. Capital inflows, and in particular aid, may also induce a real appreciation in the exchange rate. As they add to the recipient country's spending capacity, spending and resource movement effects may happen. Therefore, pressure on the non-tradable sector to expand at the expenses of the tradable sector may emerge.

Another theoretical reason for preferring the trade theory definition is that simplified versions of the PPP theory suggest the constancy of equilibrium RER. More specifically, absolute PPP holds when the nominal exchange rate between two

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[8] There is an extensive literature on Dutch Disease. Among the most important studies we should mention are Corden (1984), Corden and Neary (1982), Van Wijnbergen (1984, 1986a) and Neary and Van Wijnbergen (1986). See also paragraph 1.4.1, chapter 1.

currencies, E, equals the ratio of the price levels of the two countries, P and P^*. Formally,

$$E = P / P^* \tag{4.1}$$

and the RER = 1. A less strict version of the PPP hypothesis allows for a constant proportionate relationship between the price ratio and the nominal exchange rate so that

$$E = k \cdot P / P^* \tag{4.2}$$

and the RER = k. A more general version restates PPP in terms of inflation differentials, as

$$\Delta e = \Delta p - \Delta p^* \tag{4.3}$$

where e, p and p^* are the logarithm of E, P and P^* respectively and Δ is the first difference operator. Equation (4.3) embodies both the absolute and the relative PPP hypotheses and states that exchange rate movements reflect equiproportionate changes in the price ratio and are thus explained by inflation differentials[9].

Both the absolute and the relative PPP hypothesis imply that in the long run the RER is stationary. If long run PPP holds, then any large deviations of the RER from its PPP level should reflect misalignment (Edwards, 1989). In his study on real exchange rates in developing countries, Edwards finds strong evidence against the absolute PPP[10]. He also argues that the variability of the RER is better explained by taking into account the fundamental determinants of RER. As fundamentals vary so does the

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[9] Isard's survey on exchange rate economics (1995) offers a clear exposition of the PPP hypothesis and of its macroeconomic theoretical implications. See also Froot and Rogoff (1995) for an updated analysis of the theory of PPP.

[10] Bahmani-Oskooee (1993) presents an empirical study of absolute PPP formulation using cointegration techniques applied to 25 developing countries. He finds mixed evidence in support of the PPP rule. When effective real exchange rates are used PPP fails, while the use of bilateral RER leads to mixed conclusions.

equilibrium exchange rate. This approach will be discussed more in detail in the next chapter.

Apart from the choice of the relevant price index, there are other issues to take into account when constructing a real exchange rate index. First, whether to use a bilateral or a multilateral rate, and, in the latter case, which countries should be selected and what weighting procedure is preferable. Second, how to handle the existence of black market rates. Finally, whether to take into account the labour market structure and the trade restriction system, that is the degree of domestic economic protection.

4.3. The Indonesian RER.

In calculating the real exchange rate for Indonesia the following has been done. The use of a bilateral rate (usually measured against the dollar) has been considered inadequate for three reasons. The first is the increasing world exchange rate instability, especially during the 1970's. Relying only upon the dollar exchange rate may not reflect fully exchange rate variability with the other trading partners which themselves exhibit greater variability towards the dollar than they did before the collapse of Bretton Woods. The second is that the Indonesian exchange regime since 1978 has been a managed float dependent upon a basket of foreign currencies. The third is that the USA are not the only important trading partners for Indonesia. In fact, trade with Japan and Singapore is also relevant, as can be observed in graphs 4.3.1 to 4.3.3, which illustrate the relative importance of Indonesia's trading partners.

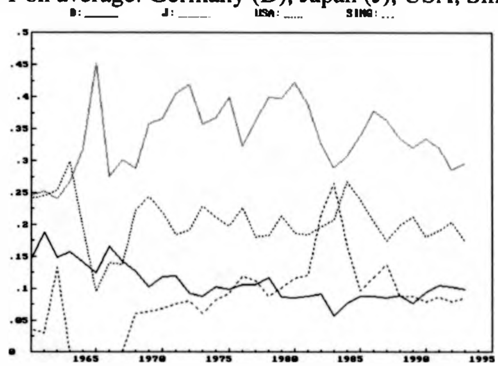
We have therefore calculated a set of multilateral nominal effective exchange rate indexes, defined as weighted averages of trading partners nominal exchange rates. An inspection of the Direction of Trade Statistical Yearbook (IMF) suggested the choice of the following trading partners: USA, Japan, Australia, Singapore, Hong Kong, Korea, Malaysia, Germany, Netherlands, France, UK, Italy and Belgium. Three sets of weights have been derived from the IMF *Direction of Trade Yearbook*: export shares, import shares and (export+import) or trade shares[11]. As the sum of each set of weights has to be unity, we have scaled all the shares, in that any residual share in trade has been proportionally distributed to all the thirteen partners' weight. Appendix 10 reports the average weights of the individual countries. Graph 4.3.1, 4.3.2 and 4.3.3 show import, export and trade weights plots. Note that data for Singapore was not available for the years 1963 to 1967.

The use of import shares is of particular relevance in the Indonesian case (see Pinto, 1987). As oil exports represent a significant share in Indonesian exports, using import weights 'cleans' REER of the importance of oil. The non-oil sector is thus implicitly focused on. In addition, the use of import shares gives an indication of purchasing power over foreign goods. Nevertheless, the descriptive statistics (reported in appendix 2) show very high positive correlations (around .99) between REER calculated with the three different weights.

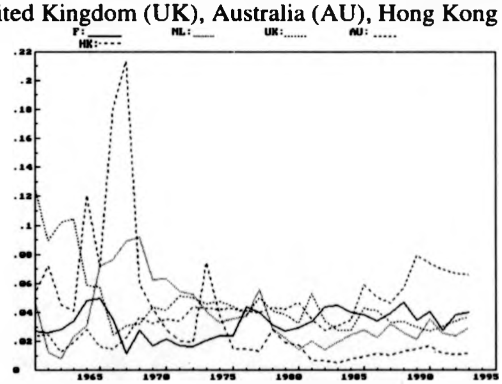
[11] The use of current weights leads to a RER index which is essentially the inverse of a Paasche index. More specifically it correspond to the Palgrave formulation of a weighted index number. On the contrary, if we were to use fixed weights, this would result in a standard Laspeyres Index number.

Graph 4.3.1. Import Weights.

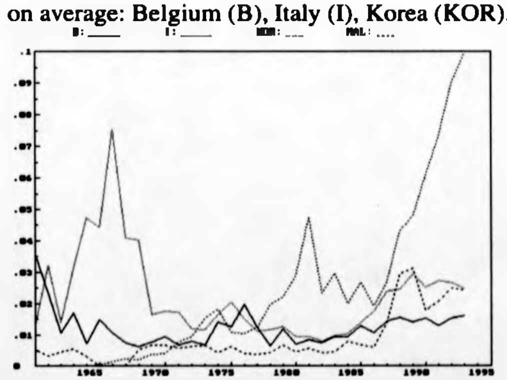
Range: .08 to 1 on average: Germany (D), Japan (J), USA, Singapore (SING).



Range: .03 to .08 on average: France (F), the Netherlands (NL), United Kingdom (UK), Australia (AU), Hong Kong (HK).



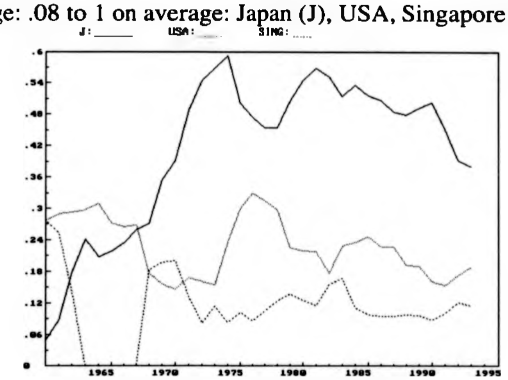
Range: .00 to .03 on average: Belgium (B), Italy (I), Korea (KOR), Malaysia (MAL).



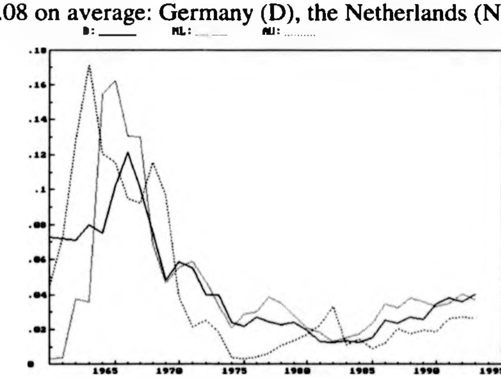
Source: IMF, *Direction of Trade Yearbook*, various issues.

Graph 4.3.2. Export Weights.

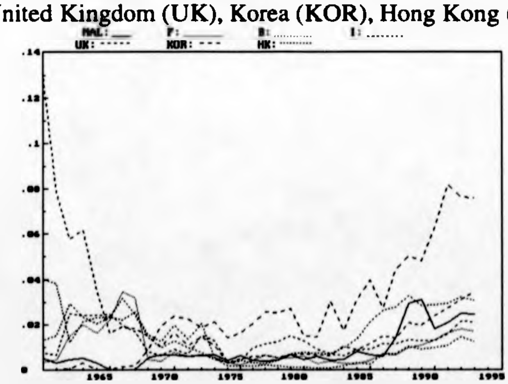
Range: .08 to 1 on average: Japan (J), USA, Singapore (SING).



Range: .03 to .08 on average: Germany (D), the Netherlands (NL), Australia (AU).



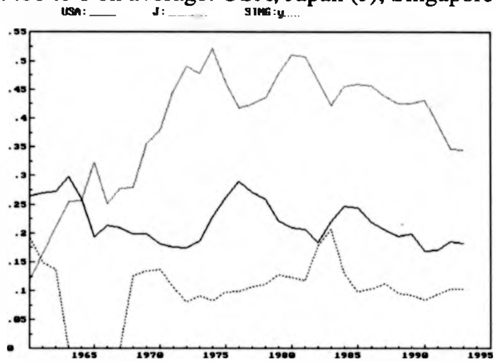
Range: .00 to .03 on average: Malaysia (MAL), France (F), Belgium (B), Italy (I), United Kingdom (UK), Korea (KOR), Hong Kong (HK)



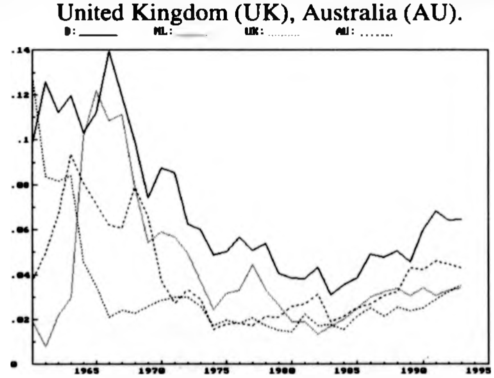
Source: IMF, *Direction of Trade Yearbook*, various issues.

Graph 4.3.3. Trade Weights.

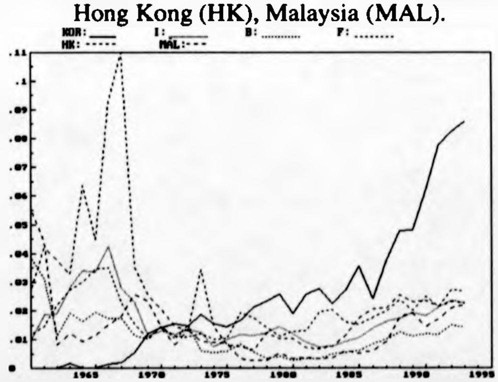
Range: .08 to 1 on average: USA, Japan (J), Singapore (SING).



Range: .03 to .08 on average: Germany (D), the Netherlands (NL), United Kingdom (UK), Australia (AU).



Range: .00 to .03 on average: Korea (KOR), Italy (I), Belgium (B), France (F), Hong Kong (HK), Malaysia (MAL).



Source: IMF, *Direction of Trade Yearbook*, various issues.

Maciejewski (1983) argues that the choice of the weighting procedure does not play a significant role. However, we opted for the geometric weighted average procedure, which is deemed superior in terms of statistical properties, most importantly symmetry[12]. Moreover, differenced logarithms of geometrically weighted averaged indexes are equal to the sum of the growth rates of its components. The geometrically trade weighted averaged REER is thus defined as:

$$GREER_t = \prod_{i=1}^{n} \frac{(E_{i,t} P^*_{i,t})^{\alpha_{i,t}}}{P_t} \tag{4.4}$$

where t is the time subscript, subscript i refers to the i-th trading partner, E denotes the exchange rate index between the home country and the trading partner, P^* and P are the foreign and home country price indices respectively, α refers to the relevant trade weight and $\sum_{i=1}^{n} \alpha_i = 1$. An increase (decrease) in the index implies real depreciation (appreciation) or an indication of rising (falling) competitiveness.

The corresponding multilateral effective nominal exchange rate is defined as:

$$GNEER_t = \prod_{i=1}^{n} E_{i,t}^{\alpha_{i,t}} \tag{4.5}$$

where notation is as above. Arithmetic weighted indexes have also been calculated for comparison purposes. The very high correlation between the arithmetic averaged indexes and their corresponding geometric counterparts demonstrate the validity of Macijewski' s statement[13]. We have also chosen to use all the annual data from 1960 to

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[12] Depreciations and appreciations are treated symmetrically. Among the other properties, we mention that the logarithm of the geometric mean is equivalent to the arithmetic average of the logarithms of the terms and that the geometric mean is invariant with respect to measurement units.

[13] None are less than .99.

1992 to have annual weights, instead of considering an average over the period (which is a common practice in this literature)[14].

Three sets of multilateral REERs have been constructed: the PPP REER, the trade theory REER and REER defined in terms of GDP deflators. Within each set a further breakdown was calculated: non competitors, non-oil competitors, oil competitors and competitors indexes.

Non competitor partners are USA, Japan, Australia, Germany, Netherlands, France, UK, Italy and Belgium; they have been attached the same weights as above once these have been reproportioned to sum to unity. Singapore, Hong Kong, Malaysia, Korea, Thailand and the Philippines have been selected as the main non-oil competitors and an equal weight of 1/6 has been attributed to each of them. The chosen oil competitor countries are OPEC members Algeria, Iran, Iraq, Libya, Nigeria, Oman, Qatar, Saudi Arabia, Venezuela, once again equally weighted (by 1/10). It should be noted that a more appropriate weighting procedure for competitors would be to attach to them weights reflecting each competitor's main export goods relative importance in world trade. However, this method is very data intensive and not too relevant for our comparative analysis purposes. Finally, a composite competitors REER has been calculated as the weighted average of non-oil and oil competitors REERs, the weights being the non-oil and oil proportion in total Indonesian exports.

In addition, we have computed a set of corresponding bilateral (rupiah/dollar) REERs, for comparison purposes.

[14] Correlations between indexes built with variable weights and the corresponding ones computed using average weights, employing both arithmetic and geometric averaging procedure, were all greater than .99.

All the data on consumer and wholesale price indexes, GDP deflators and nominal exchange rates are taken from the IMF sources. It should be noted that the complete series for WPI for Indonesia, Malaysia, Singapore and Hong Kong are not available, so the CPI has been used instead in the calculation of the trade theory REER.

We have not taken into account black market premia as they were not relevant, especially after 1969[15]. Finally, the lack of data prevented the use of an effective rate which takes into account the degree of trade restrictions and the labour market structure. The base year for all the indexes is 1985.

The following table lists the exchange rates computed. The second column indicates the set of foreign countries to which each index is referred. The third column shows which price ratio has been used. The final column gives the available weighting option: X for Export, M for Import and (X+M) for trade weights. Suffixes X, M and XM, corresponding to weights used, are attached to REER labels, where appropriate, in the remainder of the text.

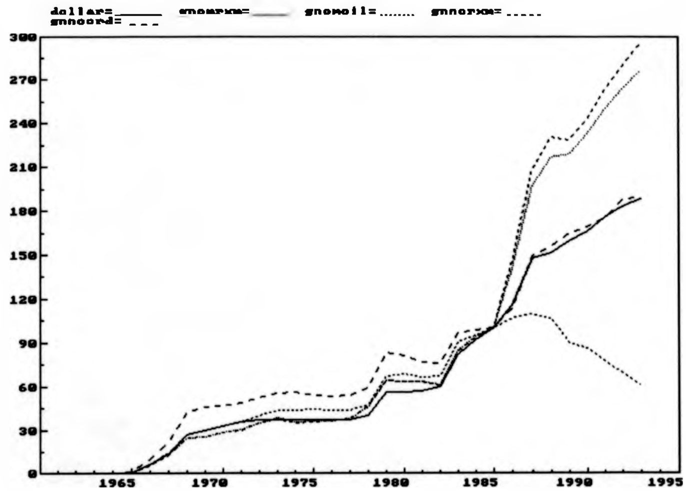
[15] Correlation between the official rupiah/dollar nominal exchange rate and the black market rate is .99 over the period 1960-1983, for which we have data. Figures for black market rates have been taken from Wood (1987).

Table 4.3.1. Real Effective Exchange Rate Index Names.

Index name	Foreign Countries	Price Index Ratio	Weights Used
GRWCPI	all trading partners	WPI/CPI	X, M, (X+M)
GRCPI	all trading partners	CPI/CPI	X, M, (X+M)
GRERD	all trading partners	GDP Deflator	X, M, (X+M)
GRNCWC	non competitors	WPI/CPI	X, M, (X+M)
GRNCCC	non competitors	CPI/CPI	X, M, (X+M)
GRNCD	non competitors	GDP Deflator	X, M, (X+M)
GRNOCWC	non-oil competitors	WPI/CPI	equal weight
GRNOCCC	non-oil competitors	CPI/CPI	equal weight
GRNOCD	non-oil competitors	GDP Deflator	equal weight
GROILWC	oil competitors	WPI/CPI	equal weight
GROILCC	oil competitors	CPI/CPI	equal weight
GROILD	oil competitors	GDP Deflator	equal weight
GRCOMPWC	competitors	WPI/CPI	oil proportion/ non-oil proportion
GRCOMPCC	competitors	CPI/CPI	oil proportion/ non-oil proportion
GRCOMPD	competitors	GDP Deflator	oil proportion/ non-oil proportion
BRERWCPI	USA	WPI/CPI	----
BRERCPI	USA	CPI/CPI	----
BRERD	USA	GDP Deflator	----

The following graphs, 4.3.4 to 4.3.8, show the historical pattern of selected NEERs and REERs. The notation for the latter is as in table; where suffix 'xm' appears it refers to trade weighting procedure, that is exports+imports.

Graph 4.3.4. Rupiah/Dollar Exchange Rate and Selected Nominal Effective Exchange Rates 1960-1993.



dollar: rupiah/dollar NER; gnomrxm: all trading partners NEER (trade weighted); gnomoil: oil competitors NEER; gnncrxm: non competitors NEER (trade weighted); gnnocrd: non oil competitors NEER.

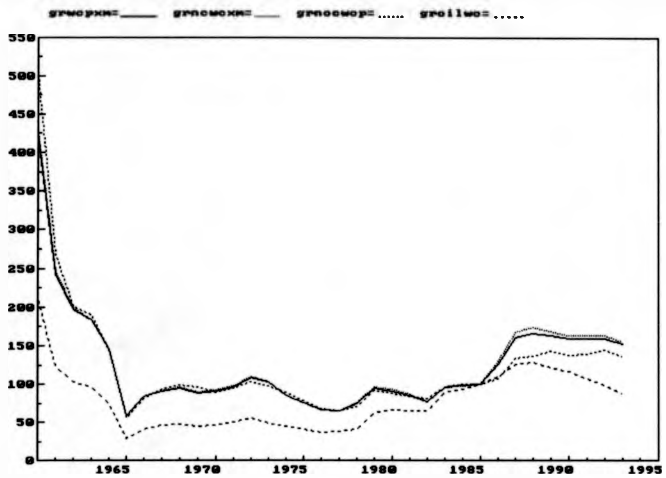
Source: Author's calculations.

In 1986 the broader nominal exchange peg introduced in 1978, which includes the dollar, the yen and the Deutsche Mark[16], was actively applied. This explains the sharper devaluation of the NEER for all trading and non competitor partners (gnomrxm and gnncrxm, respectively) relative to the dollar exchange rate since 1986[17], which can be observed in graph 4.3.4.

[16] As shown in graphs 4.3.2 to 4.3.4, Japan and Germany are important non competitor trading partners for Indonesia.

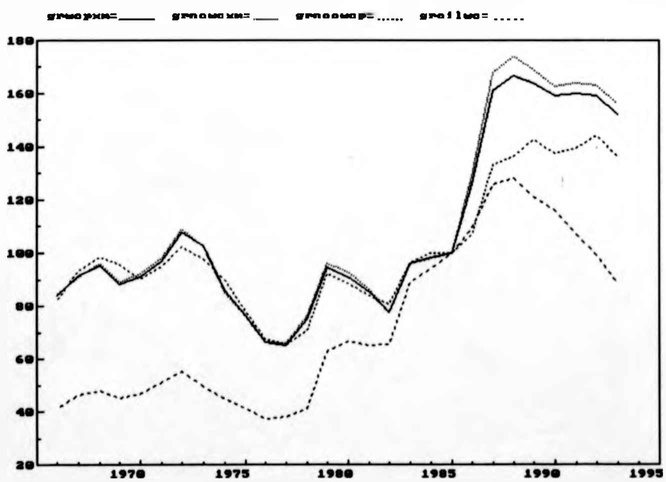
[17] In addition, in 1986 the dollar devalued by 29% against the yen.

Graph 4.3.5. Selected Real Effective Exchange Rates 1960-1993.



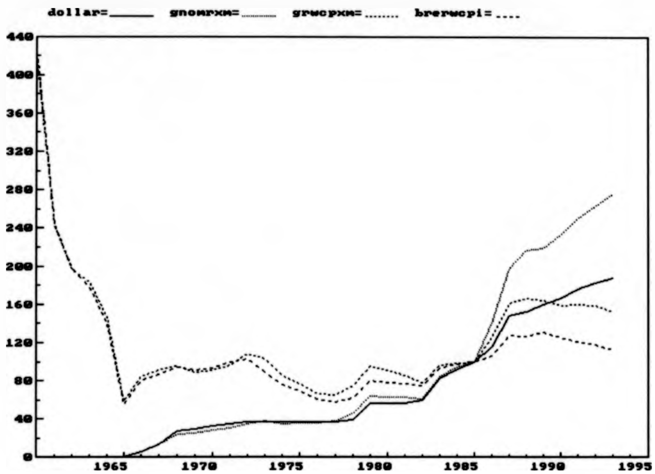
Source: Author's calculations.

Graph 4.3.6. Selected Real Effective Exchange Rates 1966-1993.



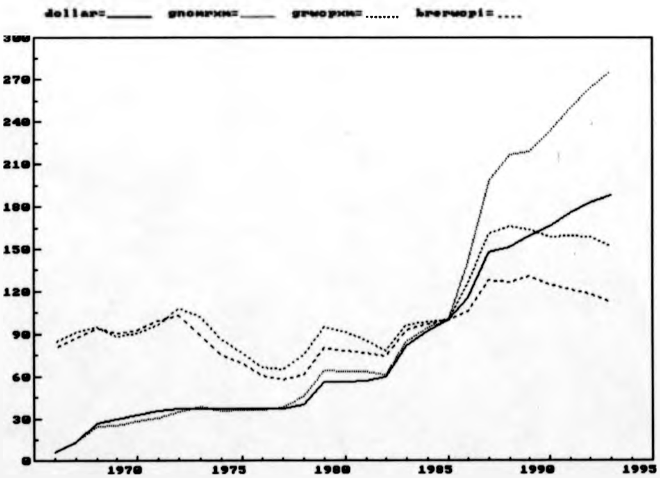
Source: Author's calculations.

Graph 4.3.7. Selected Nominal Versus Real Effective Exchange Rates: All Trading Partners and the USA 1960-1993.



Source: Author's calculations.

Graph 4.3.8. Selected Nominal Versus Real Effective Exchange Rates: All Trading Partners and the USA 1966-1993.



Source: Author's calculations.

Table 4.3.2. Selected Real Effective Exchange Rates 1960-1993. Index Numbers: 1985=100.

	grwcpxm	grcpxm	grerdxm	brerwcpi	grncwcxm	grnocwcp	groilwc	grcompwc
1960	420.5	361.7	370.9	425.8	427.5	501.7	212.0	400.3
1961	242.5	205.0	362.3	243.7	245.6	268.9	123.5	207.6
1962	196.6	164.7	285.9	197.2	199.6	201.3	103.1	162.9
1963	183.4	151.8	244.4	178.3	183.4	190.2	95.6	145.8
1964	146.0	119.9	215.9	138.9	146.3	143.7	74.4	112.7
1965	58.3	47.4	180.3	55.7	58.4	55.7	29.5	43.6
1966	84.0	71.2	151.5	80.1	84.4	82.0	41.3	66.8
1967	91.2	78.2	136.2	86.8	91.1	93.2	46.2	72.4
1968	95.2	84.2	123.8	94.2	96.2	98.5	47.8	73.4
1969	88.2	78.1	112.6	90.5	89.0	95.7	45.3	72.7
1970	90.9	81.2	116.5	92.9	92.4	90.1	46.7	70.6
1971	96.8	88.2	130.0	99.4	98.0	95.0	50.9	74.3
1972	107.8	99.4	139.4	103.2	109.1	102.3	55.5	74.9
1973	102.7	92.2	126.9	89.1	102.4	97.6	49.6	69.5
1974	86.0	72.2	93.5	75.3	85.3	89.8	44.7	55.2
1975	76.5	67.7	90.7	69.2	76.0	78.1	41.2	48.8
1976	66.2	60.0	84.0	60.4	66.4	67.5	37.6	44.6
1977	65.3	60.9	83.1	57.7	65.8	65.7	38.1	45.5
1978	74.9	72.2	96.4	61.3	76.1	70.6	41.2	49.3
1979	94.7	89.8	108.4	80.6	96.2	92.2	62.7	72.2
1980	91.0	82.3	89.3	78.2	92.9	88.6	66.7	72.3
1981	85.5	78.8	80.1	76.6	86.5	84.0	65.3	68.5
1982	77.8	73.2	77.1	74.7	77.8	80.9	65.6	68.4
1983	96.2	92.8	92.1	93.0	96.2	96.6	89.2	91.1
1984	98.4	95.9	96.7	97.3	98.1	99.8	94.0	95.6
1985	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1986	125.7	134.1	143.0	106.1	129.1	107.1	109.2	108.2
1987	161.0	175.5	176.5	127.7	167.7	133.3	125.8	129.5
1988	166.4	183.1	185.4	126.2	174.0	136.6	128.2	133.2
1989	163.9	180.2	177.5	130.7	168.7	142.7	121.1	133.9
1990	159.0	177.7	180.0	125.2	162.8	137.4	115.9	127.4
1991	159.8	182.8	186.1	121.4	163.7	139.7	106.9	126.0
1992	159.1	185.4	188.9	118.3	162.9	144.2	99.1	128.4
1993	152.1	182.0	170.3	112.5	155.9	136.6	88.6	121.9

The hyperinflation of the early 1960's is clearly reflected in graphs 4.3.5. and 4.3.7. The very low value of the Indonesian price deflator index accounts for the very large figures for the REERs between 1960 and 1965. In graphs 4.3.6 we observe a real appreciation following the first oil shock (1973). This trend is temporarily reversed when the rupiah was devalued in 1978. Between the 1979 oil shock and the 1983 devaluation, real appreciation occurs again. A turning point is the year 1986, when the application of the broader nominal peg increases variability between the REER for all trading and non competitor partners (grwcpxm and gnncwcxm, respectively) and the oil/ non-oil competitors REER (groilwc and gnocwcp, respectively). With the exception of groilwc, these REERs had all moved closely together since 1960. The jump following the 1986 devaluation is followed by a less variable behaviour of the REER (except for oil competitors REER) relative to the earlier periods. This seems to partly confirm government success in targeting real exchange stability. It is evident from graphs 4.3.7 and 4.3.8 that nominal and real exchange rates did not move together. Although nominal devaluations episodes are closely matched by real devaluations, the behaviour of the REER with respect to the nominal rate is quite different.

Finally, it worth mentioning that the PPP and the trade theory definition REERs are unsurprisingly closely correlated. The use of the three different weighting sets seems not to alter the REERs. Appendix 11 reports basic statistical properties of the calculated indexes, such as mean, standard deviations and correlations between relevant sets of REER[18].

[18] Correlations involving GDP deflated RER are lower. The GDP deflator based REER diverges strongly from the other two in the 1960s because of a very low value of the domestic deflator.

4.4. A Test of the PPP Proposition.

As stated above, the PPP hypothesis implies that the RER is stationary, so that any large deviation of the RER from its equilibrium value should be temporary and reflect possible misalignment. We have tested this proposition by adopting the strategy used by Edwards (1989). We detrended the logarithms of the REERs and subsequently tested it for residual autocorrelation in the residuals. In all cases our results allow us to reject the null of no autocorrelation in the residuals from the detrended REERs: both F-tests on the coefficients of up to six lags and the Portmanteau tests for six lags strongly reject the absence of residuals autocorrelation. As a result, we cannot accept the hypothesis that the REER behaviour can be described by a trend stationary process with white noise errors over the full sample, hence the absolute version of PPP cannot be accepted. As for the long run, testing for autocorrelation in the residuals from the detrended series implies the assumption of trend stationary process. Questions as to whether a trend is actually present and whether it is a stochastic rather than a deterministic one is not addressed. A more rigorous time series analysis is therefore needed to assess the time series properties of REER.

The analysis of the RER behaviour can be used to test the long run PPP proposition. Whether a variable is stationary depends on whether it has a unit root. If there is a unit root, the variable is said to be integrated of order one, I(1), and non-stationary. If there is no unit root, the variable is said to be integrated of order zero, I(0), and stationary. In the PPP context, if the RER shows no tendency to return to its mean or trend, long run PPP cannot be confirmed. On the contrary, a tendency of the RER to return to its mean value is regarded as a necessary condition for PPP to hold.

Testing for unit root is not the only possible way of testing PPP. Boucher Breuer (1994) assesses the evidence on PPP focusing on the most recent developments. Among the various methods used since the mid-1980's she points out Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) unit root tests, Perron type tests which allow for structural breaks, variance ratio tests, Engle and Granger cointegration technique, Johansen and Juselius maximum likelihood approach for cointegration, and fractional integration methods. The conclusions from her in-depth survey on recent evidence on PPP point towards a reinterpretation of the PPP concept. She argues that while recent studies claim to have found support for long run PPP, they have instead supported a weaker version of it. However, they have been interpreted as rejecting the original Casselian concept. Her proposed new interpretation is based on three main weakenings of the absolute, or relative, PPP statement. The first one is the distinction between the short and the long run. The second one is the requirement of stationarity rather than constancy of the RER. The final weakness is due to disregarding the coefficient restriction required in the original PPP concept, namely symmetry (domestic and foreign price levels with the same magnitudes but opposite signs) and proportionality (price coefficient of opposite signs and equal to one in absolute value). As a conclusion, the PPP rule can be reinterpreted as an ultra-long run constraint which nevertheless allows for temporary short run and even long run real shocks.

The next two sub-sections show results from a series of unit root tests for the Indonesian REER. We use traditional DF/ADF tests and rolling, recursive, sequential and Perron type DF/ADF tests which allow for breaks.

4.4.1. Time Series Properties of the RER: Testing for Unit Roots.

The following tables presents the results of ADF unit root tests for a selection of REERs. We have implemented a sequential testing procedure, proposed by Perron (1988), which starts with a general specification and then eliminates unnecessary nuisance parameters. In particular, we first use the following regression model to test for the null hypothesis of a stochastic trend (non-stationarity) against the alternative of a deterministic trend (stationarity):

$$\Delta y_t = \rho y_{t-1} + \alpha + \beta t + \sum_{i=0}^{p-1} \varphi_i \Delta y_{t-i} + u_t \qquad where \qquad u_t \approx IID(0,\sigma^2) \qquad (4.6)$$

where p is the lag length, and the relevant tests are τ_τ, $\tau_{\beta\tau}$, $\tau_{\alpha\tau}$, Φ_3, Φ_2, reported in tables 4.4.1 and 4.4.2, columns 2 to 6. τ_τ, $\tau_{\beta\tau}$ and $\tau_{\alpha\tau}$ are the tests on the significance of ρ, β and α, respectively; Φ_3 tests the hypothesis that ρ and β are jointly zero and Φ_2 tests the joint significance of ρ, β and α[19]. We then test a regression model which allows for the constant but eliminates the trend, the null being of a unit root series with non-zero mean[20], as follows:

$$\Delta y_t = \rho y_{t-1} + \alpha + \sum_{i=0}^{p-1} \varphi_i \Delta y_{t-i} + u_t \qquad where \qquad u_t \approx IID(0,\sigma^2) \qquad (4.7)$$

and the relevant tests are τ_μ, $\tau_{\alpha\mu}$, Φ_1, reported in columns 7 to 9 of tables 4.4.1 and 4.4.2. τ_μ and $\tau_{\alpha\mu}$ are the tests on the significance of ρ and α, respectively and Φ_1 tests the hypothesis that ρ and μ are jointly zero. The last step is to use a more restricted

[19] The null hypotheses for Φ_3 and Φ_2 are that y_t is an I(1) series with drift α or with zero drift, respectively. (see Dickey and Fuller, 1981).

[20] The alternative hypothesis is that y_t is stationary around a constant mean but has no trend. Note that in the preceding model, under the alternative hypothesis y_t is trend stationary.

model, which tests for a unit root when the overall mean of the series is zero, formalised as:

$$\Delta y_t = \rho y_{t-1} + \sum_{i=0}^{p-1} \varphi_i \Delta y_{t-i} + u_t \qquad where \qquad u_t \approx IID(0,\sigma^2) \tag{4.8}$$

and the relevant test is τ, which tests for the significance of ρ, reported in the final column of tables 4.4.1 and 4.4.2. For all models, lag length p has been determined looking at the significance of additional lags. In fact, no significant Δy_{t-i} was found. As a result, all the tests are ADF(0), that is DF tests.

The relevant critical values for the tests are reported in the last rows of the tables, given that τ- and Φ-statistics do not follow the standard distributions of the corresponding t- and F-statistics, respectively. In particular, critical values for $\tau_{\beta\tau}$, $\tau_{\alpha\tau}$,$\tau_{\alpha\mu}$, Φ_3, Φ_2 and Φ_1 are taken from Dickey and Fuller (1981); while the critical values for τ_τ , τ_μ and τ are obtained using MacKinnon's (1991) response surface parameters.

Over the full sample the results are ambiguous. The calculated statistics do not allow us to unambiguously reject the null hypothesis of non-stationarity. The ambiguity arises when we compare the full sample tests (1960-93) with the post-hyperinflation sample tests (1967-93). In the first case, it appears that we could reject the null of non-stationarity, even if the values of the statistics are very close to the critical values (see in particular τ_τ's). However, this could be due to the u-shaped nature of the exchange rate, as seen in graphs 4.3.5 and 4.3.7. For sub-sample 1967-93, the conclusion is an unambiguous acceptance of the unit root hypothesis.

The sub-sample tests suggests REER behaviour in Indonesia is indeed characterised by non-stationarity. However, if we consider the full sample, we should rather move towards the stationarity hypothesis. A possible explanation for this ambiguity is that thirty-three years are too a short time span to assess long run time series properties of RER. Most importantly, the hyperinflation of the early 1960's explains the steady and dramatic real appreciation between 1960 and 1965. This exceptional event has probably strongly influenced the full sample unit root test statistics. As a consequence, results from full sample tests may not be reliable and should be interpreted with caution.

Table 4.4.1. Unit Roots Tests. Full Sample: 1960-93.
All Variables in Logarithms.

	τ_τ	$\tau_{\beta\tau}$	$\tau_{\alpha\tau}$	Φ_3	Φ_2	τ_μ	$\tau_{\alpha\mu}$	Φ_1	τ
GRWCPIX	-3.57	2.42	2.98	10.09	7.04	-3.52	3.43	6.58	-1.04
GRCPIX	-3.55	3.37	2.85	10.77	7.33	-2.76	2.68	3.97	-0.78
GRWCPIM	-3.70	2.38	3.13	10.42	7.27	-3.63	3.54	7.01	-1.05
GRCPIM	-3.43	3.06	2.88	9.08	6.14	-2.63	2.58	3.57	-0.64
GRWCPXM	-3.62	2.41	3.03	10.21	7.12	-3.56	3.47	6.74	-1.04
GRCPXM	-3.52	3.25	2.88	10.12	6.88	-2.72	2.66	3.85	-0.73
GRNCWCX	-3.56	2.48	2.96	10.10	7.04	-3.47	3.38	6.41	-1.03
GRNCCCX	-3.46	3.45	2.75	10.33	7.01	-2.54	2.48	3.37	-0.71
GRNCWCM	-3.66	2.44	3.09	10.24	7.12	-3.54	3.45	6.65	-1.02
GRNCCCM	-3.39	3.17	2.83	8.93	6.02	-2.46	2.41	3.12	-0.59
GRNCWCXM	-3.60	2.46	3.01	10.14	7.06	-3.50	3.40	6.49	-1.03
GRNCCCXM	-3.42	3.32	2.78	9.65	6.53	-2.50	2.45	3.24	-0.66
GRNOCWC	-4.12	2.01	3.48	12.92	9.14	-4.46	4.33	10.6	-1.28
GRNOCCC	-4.00	2.10	3.33	12.79	9.01	-4.36	4.24	10.2	-1.24
GROILWC	-3.68	3.18	3.04	9.15	6.31	-2.52	2.43	3.41	-0.91
GROILCC	-4.08	3.63	3.42	11.41	7.80	-2.63	2.55	3.68	-0.85
GRCOMPWC	-3.85	2.75	3.08	11.60	8.11	-3.59	3.47	6.93	-1.16
GRCOMPCC	-4.00	2.90	3.23	12.87	8.95	-3.74	3.63	7.45	-1.13
Critical values:		N=50	N=50	N=50	N=50		N=50	N=50	
10%	-3.208	2.38	2.75	5.61	4.31	-2.62	2.18	3.94	-1.62
5%	-3.55	2.81	3.14	6.73	5.13	-2.95	2.56	4.86	-1.95
2.5%		3.18	3.47	7.81	5.94		2.89	5.80	
1%	-4.26	3.60	3.87	9.31	7.02	-3.64	3.28	7.06	-2.63

Table 4.4.2. Unit Roots Tests. Sub-Sample: 1967-93.
All Variables in Logarithms.

	τ_τ	$\tau_{\beta\tau}$	$\tau_{\alpha\tau}$	Φ_3	Φ_2	τ_μ	$\tau_{\alpha\mu}$	Φ_1	τ
GRWCPIX	-1.45	1.44	1.40	0.09	1.16	-0.64	0.70	0.68	0.94
GRCPIX	-1.36	1.54	1.27	1.77	1.51	-0.28	0.40	1.02	1.39
GRWCPIM	-1.47	1.33	1.45	1.42	1.14	-0.75	0.81	0.80	0.97
GRCPIM	-1.38	1.46	1.35	1.08	1.50	-0.39	0.50	1.13	1.44
GRWCPXM	-1.45	1.39	1.41	1.21	1.14	-0.68	0.73	0.72	0.96
GRCPXM	-1.36	1.50	1.31	1.12	1.49	-0.32	0.43	1.06	1.41
GRNCWCX	-1.45	1.42	1.40	1.10	1.14	-0.66	0.72	0.69	0.93
GRNCCCX	-1.39	1.59	1.31	1.33	1.57	-0.25	0.37	1.02	1.40
GRNCWCM	-1.49	1.36	1.46	1.24	1.16	-0.74	0.80	0.78	0.97
GRNCCCM	-1.41	1.47	1.38	1.93	1.54	-0.40	0.52	1.17	1.46
GRNCWCXM	-1.45	1.39	1.41	1.14	1.14	-0.68	0.74	0.72	0.95
GRNCCCXM	-1.38	1.54	1.33	1.65	1.54	-0.30	0.42	1.07	1.42
GRNOCWC	-1.41	1.25	1.39	1.92	1.07	-0.79	0.84	0.81	0.96
GRNOCCC	-1.20	1.27	1.16	0.79	1.06	-0.56	0.61	0.76	1.08
GROILWC	-1.13	0.73	1.27	0.15	0.98	-1.01	1.12	1.22	1.08
GROILCC	-1.28	0.95	1.41	0.41	1.61	-1.00	1.15	1.97	1.61
GRCOMPWC	-1.44	1.48	1.37	1.60	1.15	-0.54	0.62	0.61	0.93
GRCOMPCC	-1.37	1.59	1.29	1.87	1.39	-0.31	0.40	0.78	1.20
Critical values:		N=25	N=25	N=25	N=25		N=25	N=25	
10%	-3.228	2.39	2.77	5.90	4.67	-2.63	2.20	4.12	-1.62
5%	-3.59	2.85	3.20	7.24	5.68	-2.97	2.61	5.18	-1.95
2.5%		3.25	3.59	8.65	6.75		2.97	6.30	
1%	-4.34	3.74	4.05	10.61	8.21	-3.70	3.41	7.88	-2.65

Sub-sample results (table 4.4.2) suggest non-stationarity in the REER's. Therefore, we have tested whether the series are I(2) against the alternative of being I(1)[21]. This is done testing, for each series, the null hypothesis that the first difference Δy_t is non-stationary against the alternative of stationarity. Failure to reject the null implies Δy_t is I(1), and thus y_t is I(2). Once again we use an ADF type regression model of the form:

$$\Delta^2 y_t = \rho y_{t-1} + \alpha + \sum_{i=0}^{p-2} \varphi_i \Delta^2 y_{t-i} + u_t \qquad where \qquad u_t \approx IID(0,\sigma^2) \qquad (4.9)$$

where Δ^2 denotes second difference operator. The τ_μ-tests on ρ are reported in column 2 and 4 of the following table for both the full sample and the sub-sample[22]. In addition, we have replicated the tests using (4.9) without the constant term α. The relevant τ-tests on ρ for the two sample periods are reported in columns 3 and 5 of table 4.4.3[23]. Critical values for τ_μ and τ are obtained as above, using MacKinnon's (1991) response surface parameters.

Results unambiguously suggest none of the series for the REER are I(2).

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[21] It has been argued (Dickey and Pantula, 1987) that the correct testing procedure is to start with taking the largest number of unit root likely to be present in the series, and then to reduce the order each time the null of non-stationarity is rejected. In practice, this usually would involve starting with the hypothesis of y_t being I(2): if the null is rejected, the next step is to test for a single unit root.

[22] Full sample tests have been carried out for completeness.

[23] As in the preceding tests the chosen value for p is zero, given the insignificance of lagged second differences.

Table 4.4.3. Unit Roots Tests. Differenced Logarithms.

	1962-1993		1968-1993	
	Constant Included	No Constant	Constant Included	No Constant
	τ_μ	τ	τ_μ	τ
GRWCPIX	-5.4149**	-5.5044**	-3.3567*	-3.3826**
GRCPIX	-5.1823**	-5.2860**	-3.4972*	-3.4327**
GRWCPIM	-5.4276**	-5.5161**	-3.3835*	-3.4050**
GRCPIM	-5.7440**	-5.6800**	-3.4517*	-3.3776**
GRWCPXM	-5.4240**	-5.5130**	-3.3614*	-3.4224**
GRCPXM	-5.3875**	-5.5933**	-3.4913*	-3.3851**
GRNCWCX	-5.3474**	-5.4368**	-3.3204*	-3.3445**
GRNCCCX	-5.1721**	-5.2761**	-3.4416*	-3.3737**
GRNCWCM	-5.4293**	-5.5200**	-3.3424*	-3.3563**
GRNCCCM	-5.4786**	-5.5830**	-3.4321*	-3.3378**
GRNCWCXM	-5.3928**	-5.4832**	-3.3192*	-3.3393**
GRNCCCXM	-5.3499**	-5.4553**	-3.4413*	-3.3629**
GRNOCWC	-5.4441**	-5.5202**	-3.8072*	-3.8580**
GRNOCCC	-5.3901**	-5.4763**	-3.7003*	-3.7346**
GROILWC	-5.2336**	-5.3251**	-3.3856*	-3.4058**
GROILCC	-5.3942**	-5.4961**	-3.6856*	-3.5419**
GRCOMPWC	-5.5555**	-5.6480**	-3.5466*	-3.5671**
GRCOMPCC	-5.6303**	-5.7322**	-3.6736*	-3.6339**
Critical values: 5%	-2.95	-1.95	-2.98	-1.95
1%	-3.65	-2.63	-3.70	-2.65

* and ** denote 5% and 1% significance level, respectively.

4.4.2. Testing for Breaks.

A visual inspection of the REER graphs suggests that the standard unit root testing procedure might be inappropriate as there appears to be two breaks in the series: around 1965 and around 1986 for most of the calculated REERs. This is the reason why we have carried out a series of unit roots tests which allow for the presence of a break: recursive, rolling, sequential and Perron type ADF tests[24].

Recursive minimum ADF τ_τ are computed in two ways: forward and backwards. Forward ADF tests use sub-samples t=1962,....,k for k=1967,..., 1993. Backwards ADF tests use sub-samples t=k,...., 1993 for k=1962,..., 1988. The minimum value of τ_τ is corrected for k_t/T, where k_t=(k-1962+1) in the forward tests and k_t=(1993-k+1) in the backward tests, and where T is the size of the sample. Table 4.4.4, columns 3 and 4, reports minimum τ_τ's for each REER and table 4.4.5, columns 3 and 4, shows results from the same tests over the sub-sample 1967-1993. The relevant critical values are obtained from Banerjee, Lumsdaine and Stock's (1992) tables, reproduced in Harris (1995). Results show that there is no evidence for rejecting the unit root null hypothesis.

Rolling minimum ADF τ_τ are computed using sub-samples, which are a constant fraction of the full sample (namely 11/32), rolled through the sample. We start with testing sub-sample 1962-72, then 1962-73, and so on. The last sub-sample used is

[24] All are ADF(1) tests.

1983-93. Once again, τ_τ tests are corrected for k_t/T, where k_t=11,...,32, and the minimum value is reported in table 4.4.4, column 5. As above, the relevant critical values are taken from Banerjee, Lumsdaine and Stock's tables. In all cases, except for GRCOMPWC, results do not show evidence against the null unit root.

Sequential mean- and trend-shift ADF statistics are computed estimating the following equation over the full sample:

$$\Delta y_t = \rho y_{t-1} + \sum_{i=0}^{p-1} \varphi_i \Delta y_{t-i} + \mu_0 + \mu_1 t + \mu_2 D + u_t \qquad (4.10)$$
$$where \qquad u_t \approx IID(0, \sigma^2)$$

where in the mean shift model D denotes a step dummy, or a change in the intercept:

$D=1$ for $t>k$
$D=0$ for $t\leq k$

and in the trend shift model D is a 'trend-step' dummy, that is a change in the growth rate (as we are using logarithms):

$D=t$ for $t>k$
$D=0$ for $t\leq k$

We start with k=3 (corresponding to 1964), i.e. with a regression which includes a dummy with 0 value up to 1964, and equal to 1 (or to trend) afterwards. Once again, τ_τ tests are corrected for k/T. In addition, an F-test on the joint significance of y_{t-1} and D is carried out using the null H_0:μ_2=ρ=0. Tables 4.4.4, columns 6 to 9, and 4.4.5, columns 5 to 8, report the minimum values of the τ_τ statistics and the maximum value for the F-statistics calculated over the full sample and over the sub-sample 1967-93. Once again, we obtained critical values from Banerjee, Lumsdaine and Stock's tables. Results are overall suggesting that there is no evidence for rejecting unit root even after allowing for the presence of breaks in the mean or in the trend. Only in a few cases, namely full sample trend shift F-tests for GRNOCWC, GRNOCCC, GROILWC, GROILCC and GRCOMPCC, the null of joint zero values for μ_2 and ρ cannot be accepted, thus suggesting the possibility of a break in trend in 1966.

Table 4.4.4. Recursive, Rolling and Sequential Augmented Dickey-Fuller Tests on Unit Roots. Full Sample 1962-1993.

All Variables in Logarithms. All τ-tests ADF(1).

Variable	τ_τ	Recursive Forward	Recursive Backward	Rolling (11 obs)	Mean Shift		Trend Shift	
		min τ_τ	min τ_τ	min τ_τ	min τ_τ	max F	min τ_τ	max F
GRWCXM	-2.81	-2.81	-3.48	-3.24	-2.58	7.58	-2.47	11.73
GRWCX	-2.76	-2.76	-3.43	-3.27	-2.61	7.38	-2.51	11.24
GRWCM	-2.88	-2.88	-3.62	-3.29	-2.71	8.05	-2.61	12.42
GRCCXM	-2.73	-2.73	-3.11	-2.63	-2.74	6.78_a	-2.64	11.26
GRCCX	-2.75	-2.75	-3.02	-2.65	-2.75	6.80_a	-2.64	10.81
GRCCM	-2.73	-2.73	-3.30	-2.74	-2.75	6.82_a	-2.67	12.04
GRNCWCXM	-2.80	-2.80	-3.42	-3.03	-2.70	7.23	-2.59	11.47
GRNCWCX	-2.77	-2.77	-3.36	-3.03	-2.68	7.05	-2.57	11.04
GRNCWCM	-2.85	-2.85	-3.56	-3.13	-2.75	7.72	-2.65	12.15
GRNCCCXM	-2.64	-2.64	-3.04	-2.50	-2.77	6.09_a	-2.66	10.28
GRNCCCX	-2.66	-2.66	-2.97	-2.59	-2.77	6.05_a	-2.65	9.76
GRNCCCM	-2.69	-2.69	-3.23	-2.52	-2.81	6.43_a	-2.72	11.32
GRNOCWC	-3.16	-3.16	-4.02	-3.74	-2.58	9.95	-2.54	15.46
GRNOCCC	-3.00	-3.00	-3.58	-3.81_b	-2.52	8.82_a	-2.50	14.29
GROILWC	-2.84	-2.84	-3.55	-3.81_c	-2.17_d	8.00_a	-2.06_e	14.09
GROILCC	-3.23	-3.23	-4.42	-3.25	-2.38_d	11.8_a	-2.16_f	19.92
GRCOMPWC	-2.89	-2.89	-3.20	-5.52_c	-2.33_d	8.01_a	-2.25_f	12.90
GRCOMPCC	-3.02	-3.02	-3.36	-3.42_c	-2.41_d	9.33_a	-2.39_f	14.75
min τ_τ and max F values refer to the years or periods indicated here		1962-93	1965-93	1965-75 or b:1976-86 c:1979-89	1986 or d:1983	1965 or a:1966	1986 or e:1979 f:1983	1966

Critical Values

T=100	τ_τ	Recursive min τ_τ	Rolling min τ_τ	Mean shift min τ_τ	max F	Trend shift min τ_τ	max F
2.5%	-3.73	-4.62	-5.29	-5.07	20.83	-4.76	19.15
5%	-3.45	-4.33	-5.01	-4.80	18.62	-4.48	16.30
10%	-3.15	-4.00	-4.71	-4.54	16.20	-4.20	13.64

Table 4.4.5. Recursive, Rolling and Sequential Augmented Dickey-Fuller Tests on Unit Roots. Sub-Sample 1967-1993.

All Variables in Logarithms. All τ-tests ADF(1).

Variable	τ_τ	Recursive Forward	Recursive Backward	Mean Shift		Trend Shift	
		min τ_τ	min τ_τ	min τ_τ	max F	min τ_τ	max F
GRWCXM	-2.35	-2.35	-2.62	-3.01	9.36	-2.91	8.64
GRWCX	-2.38	-2.38	-2.65_a	-3.01	9.34	-2.92	8.68
GRWCM	-2.36	-2.36	-2.53_a	-3.07	9.78	-2.97	9.01
GRCCXM	-2.13	-2.13	-2.62	-2.65	9.12	-2.91	8.59
GRCCX	-2.13	-2.13	-2.64	-2.95	9.02	-2.89	8.55
GRCCM	-2.15	-2.15	-2.59	-3.05	9.73	-2.98	9.13
GRNCWCXM	-2.37	-2.37	-2.68	-3.14	10.22	-3.03	9.35
GRNCWCX	-2.39	-2.39	-2.71	-3.12	10.01	-3.01	9.25
GRNCWCM	-2.38	-2.38	-2.65	-3.23	10.83	-3.11	9.89
GRNCCCXM	-2.17	-2.17	-2.68	-3.15	10.29	-3.07	9.66
GRNCCCX	-2.20	-2.20	-2.70	-3.17	10.39	-3.11	9.90
GRNCCCM	-2.15	-2.15	-2.65	-3.19	10.72	-3.11	9.94
GRNOCWC	-2.20	-2.20	-2.74_b	-2.29	7.60_c	-2.26	6.88_d
GRNOCCC	-2.02	-2.02	-2.75_b	-2.12	4.63	-2.13	4.65
GROILWC	-1.97	-1.97	-1.97	-1.87_e	7.79_f	-1.55_g	7.29_h
GROILCC	-1.92	-1.92	-1.92	-1.97_e	6.07_i	-1.62_g	4.71_h
GRCOMPWC	-2.14	-2.14	-2.49_a	-1.97_e	6.05_l	-1.98_g	6.28_h
GRCOMPCC	-1.98	-1.98	-3.11_a	-1.90_e	9.06_l	-2.03_g	6.60_d
min τ_τ and max F values refer to the years or periods indicated here		1967-93	1973-93 or a:1974-93 b:1975-93	1986 or e:1983	1986 or c:1975 f:1979 i:1983 l:1974	1986 or g:1983	1986 or d:1973 h:1979

Critical Values

T=100	τ_τ	Recursive min τ_τ	Rolling min τ_τ	Mean shift min τ_τ	max F	Trend shift min τ_τ	max F
2.5%	-3.73	-4.62	-5.29	-5.07	20.83	-4.76	19.15
5%	-3.45	-4.33	-5.01	-4.80	18.62	-4.48	16.30
10%	-3.15	-4.00	-4.71	-4.54	16.20	-4.20	13.64

An alternative approach is the use of a Perron type ADF/DF test. Following Perron (1989), we assume that the date of the breaks is known and use his testing methodology. He develops three models summarised as follows. Under the null hypothesis of a unit root, model A, or the 'crash' model, includes a dummy which takes the value of one at the time of the break. Under the alternative hypothesis of trend stationarity, a change in the intercept of the trend function is allowed. Model B, or the 'changing growth' model, describes a unit root process whith a change in the drift parameter μ (see equation 4.11 below) at the time of the break under the null hypothesis. The alternative hypothesis entails a one-time change in the slope of the trend function at the time of the break. Finally, model C embodies model A and model B: under the alternative hypothesis the break will be followed by both a change in the intercept and a change in the growth path. Formally, model A and model B can be written out as:

Model A: 'crash' hypothesis:

$$
\begin{aligned}
&H_0: y_t = \mu + \delta\, D(TB)_t + y_{t-1} + e_t \\
&H_A: y_t = \mu_1 + \beta t + (\mu_2 - \mu_1)\, DU_t + e_t \\
&\qquad \textit{where} \\
&D(TB)_t = 1 \quad \textit{if} \quad t = T_B + 1, \quad 0 \quad \textit{otherwise}; \\
&DU_t = 1 \quad \textit{if} \quad t > T_B, \quad 0 \quad \textit{otherwise}; \\
&\qquad \textit{and} \\
&A(L)e_t = B(L)v_t \qquad v_t \approx i.i.d.(0, \sigma)
\end{aligned}
\tag{4.11}
$$

where A(L) and B(L) are polynomials of order p and q, respectively, in the lag operator L[25]. The corresponding regression equation is constructed nesting the null and the alternative hypothesis in an ADF type regression equation:

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[25] The error term e_t is thus specified as an ARMA(p,q) process and allows the variable y_t to represent a general process.

$$y_t = \mu + \alpha y_{t-1} + \delta D(TB)_t + \gamma DU_t + \beta t + \sum_{i=1}^{p} \varphi_i \Delta y_{t-i} + e_t \qquad (4.12)$$

Model B: 'change in growth' hypothesis:

$$\begin{aligned} &H_0: y_t = \mu_1 + (\mu_2 - \mu_1) DU_t + y_{t-1} + e_t \\ &H_A: y_t = \mu + \beta_1 t + (\beta_2 - \beta_1) DT_t^* + e_t \\ &DT_t^* = t - T_B \quad if \quad t > T_B, \quad and \quad 0 \quad otherwise. \end{aligned} \qquad (4.13)$$

and the regression equation is constructed nesting the null and the alternative hypothesis in an ADF type regression equation:

$$y_t = \mu + \alpha y_{t-1} + \eta DT_t^* + \beta t + \sum_{i=1}^{p} \varphi_i \Delta y_{t-i} + e_t \qquad (4.14)$$

However, Perron does not allow for a change in growth and a change in the intercept happening at different years. In his 'Model C' he considers the case when at a particular year there is a change in both the intercept and the growth rate. As we deem more appropriate for our case to consider different break years, we have developed a 'Model D' which allows for a change in growth and a crash at different years and is formalised as:

Model D: crash and 'change in growth' hypothesis at different years:

$$\begin{aligned} &H_0: y_t = \mu_1 + \delta D(TB)_t + (\mu_2 - \mu_1) DU_t + y_{t-1} + e_t \\ &H_A: y_t = \mu_1 + (\mu_3 - \mu_1) DV_t + \beta_1 t + (\beta_2 - \beta_1) DT_t^* + e_t \\ &where \\ &D(TB)_t = 1, \quad if \quad t = T_{B,1} + 1, \quad and \quad 0 \quad otherwise; \\ &DU_t = 1, \quad if \quad t > T_{B,2} \quad and \quad 0 \quad otherwise; \\ &DV_t = 1, \quad if \quad t > T_{B,2} \quad and \quad 0 \quad otherwise; \\ &DT_t^* = t - T_{B,1} \quad if \quad t > T_{B,1}, \quad and \quad 0 \quad otherwise. \end{aligned} \qquad (4.15)$$

and the regression equation is constructed nesting the null and the alternative hypothesis in an ADF type regression equation:

$$y_t = \mu + \alpha y_{t-1} + \delta D(TB)_t + \theta DU_t + \gamma DV_t + \eta DT_t^* + \beta t + \sum_{i=1}^{p} \varphi_i \Delta y_{t-i} + e_t \qquad (4.16)$$

The following tables report the results from the Perron tests of model A, B, and of our model D. For completeness, all the estimated parameters are reported alongside the respective significance tests. However, the focus is on τ_α, which directly tests the unit root null. The critical values for τ_α for model A and B (tables 4.4.6 and 4.4.7) are drawn from Perron. For model D the critical values for τ_α (tables 4.4.8 and 4.4.9) are: -3.76 at 10%, -4.06 at 5% and -4.34 at 2.5%[26].

The results from model A and model B indicate that in most cases the null hypothesis of non-stationarity cannot be rejected at the 2.5% significance level. However, the tests statistics from model D give an opposite indication. These results suggest that the REERs series are stationary, if two breaks are simultaneously allowed. This point of the double break changing the outcome of the unit root tests must be taken with caution. As it has been stressed above, the sample size is too small to be able to ascertain very long run behaviour of the series. Moreover, one could argue that series may be forced to look stationary provided enough breaks are included. As a result, we must treat these result with caution: they may indicate a stationary behaviour of the REER over the very long run, but the sample size used and the above mentioned hyperinflation of the early 1960's prevents us to rely on this indication.

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[26] These critical values were calculated, using a Fortran programme.

Table 4.4.6. Model A: 'Crash' Hypothesis at Year T_B . ADF Tests. Sample 1967-1993. T=27.

All Variables in Logarithms. All ADF(1) tests.

Variable	λ	α	τ_α	μ	τ_μ	δ	τ_δ	γ	τ_γ	β	τ_β	St.err
GRWCXM	.67	-.48	-3.45	2.12	3.37_a	.015	.13	.26	2.50_b	.001	.34	.086
GRWCX	.67	-.47	-3.44	2.08	3.36_a	.02	.18	.26	2.47_b	.001	.39	.087
GRWCM	.67	-.50	-3.56	2.24	3.50_a	-.01	-.01	.27	2.64_b	.001	.30	.085
GRCCXM	.67	-.47	-3.22	1.96	3.14_a	.03	.22	.31	2.45_b	.004	1.11	.096
GRCCX	.67	-.46	-3.19	1.93	3.10_a	.04	.28	.31	2.41_b	.005	1.11	.098
GRCCM	.67	-.49	-3.35	2.08	3.29_a	.01	.08	.31	2.61_b	.005	1.15	.092
GRNCWCXM	.67	-.49	-3.50	2.16	3.42_a	.02	.20	.28	2.57_b	.001	.31	.088
GRNCWCX	.67	-.48	-3.46	2.10	3.38_a	.03	.27	.28	2.50_b	.001	.32	.089
GRNCWCM	.67	-.52	-3.65	2.33	3.59_a	.00	.00	.30	2.76_b	.001	.30	.086
GRNCCCXM	.67	-.49	-3.32	2.04	3.24_a	.03	.25	.34	2.56_b	.005	1.22	.098
GRNCCCX	.67	-.48	-3.33	2.00	3.23_a	.04	.31	.34	2.53_b	.005	1.28	.099
GRNCCCM	.67	-.51	-3.42	2.17	3.37_a	.01	.08	.35	2.72_b	.005	1.22	.095
GRNOCWC	.67	-.44	-3.28	1.97	3.23_a	-.07	-.76	.20	2.32_b	.001	.164	.082
GRNOCCC	.67	-.38	-2.98	1.69	2.92_a	-.06	-.62	.19	2.13_b	.000	-.01	.084
GROILWC[1]	.56	-.30	-2.18	1.08	2.13_c	.21	1.71_d	.13	1.16	.006	1.16	.099
GROILCC[1]	.56	-.30	-2.03	1.10	2.05_c	.19	1.90_d	.11	1.23	.006	1.25	.077
GRCOMPWC[1]	.56	-.26	-2.32	1.05	2.19_c	.15	1.23	.15	1.39	.002	.36	.097
GRCOMPCC[1]	.56	-.24	-2.12	.97	2.03_c	.14	1.23	.14	1.42	.001	.34	.087

λ: proportion of the sample before the break.
1: break at 1982: i.e. step dummy is =1 for t>1982. In all other cases: break 1985. (step=1 for t>1985)
a denotes significance at 1%, **b** at 2.5%, **c** at 5% and **d** at 10% (t-statistics).

Critical Values for τ_α

λ	**.50**	**.60**	**.70**
2.5%	-4.01	-4.09	-4.07
5%	-3.76	-3.76	-3.80
10%	-3.46	-3.47	-3.51

Table 4.4.7. Model B: Change in Growth Hypothesis at Year T_B . DF Tests. Sample 1961-1993. T=34.

All Variables in Logarithms. All ADF(1) tests.

Variable	λ	α	τ_α	μ	τ_μ	η	τ_η	β	τ_β	St.err.
GRWCXM	.18	-.48	-3.77	2.74	3.04_a	.13	1.94_d	-.12	-1.82_d	.176
GRWCX	.18	-.46	-3.70	2.64	2.97_a	.13	1.89_d	-.11	-1.76_d	.176
GRWCM	.18	-.51	-3.90	2.94	3.18_a	.14	2.06_c	-.13	-1.94_d	.175
GRCCXM	.18	-.43	-3.45	2.33	2.66_a	.12	1.63	-.10	-1.46	.189
GRCCX	.18	-.40	-3.34	2.12	2.50_a	.11	1.50	-.09	-1.33	.184
GRCCM	.18	-.48	-3.67	2.68	2.96_a	.14	1.91_d	-.12	-1.74_d	.191
GRNCWCXM	.18	-.47	-3.69	2.67	2.96_a	.13	1.87_d	-.12	-1.74_d	.178
GRNCWCX	.18	-.45	-3.62	2.56	2.88_a	.12	1.80_d	-.11	-1.68_d	.180
GRNCWCM	.18	-.50	-3.85	2.89	3.12_a	.14	2.02_d	-.13	-1.89_d	.177
GRNCCCXM	.18	-.41	-3.36	2.20	2.56_b	.11	1.55	-.09	-1.37	.193
GRNCCCX	.18	-.38	-3.25	2.01	2.41_a	.10	1.43	-.08	-1.25	.189
GRNCCCM	.18	-.47	-3.58	2.55	2.85_a	.13	1.82_d	-.11	-1.64	.195
GRNOCWC	.18	-.59	-4.36	3.53	3.58_a	.18	2.42_b	-.17	-2.32_c	.167
GRNOCCC	.18	-.52	-3.93	3.06	3.14_a	.15	2.01_d	-.13	-1.91_d	.173
GROILWC	.18	-.48	-3.77	2.43	2.94_a	.15	1.96_d	-.12	-1.79_d	.182
GROILCC	.18	-.62	-4.66	3.31	3.84_a	.20	2.79_a	-.18	-2.61_b	.159
GRCOMPWC	.18	-.44	-3.59	2.35	2.68_b	.12	1.65	-.11	-1.51	.188
GRCOMPCC	.18	-.48	-3.81	2.63	2.91_a	.14	1.86_d	-.12	-1.72_d	.179

λ: proportion of the sample before the break. Break is at 1965.

a denotes significance at 1%, **b** at 2.5%, **c** at 5% and **d** at 10% (t-statistics).

Critical Values for τ_α

λ	.10	.20
2.5%	-3.94	-4.08
5%	-3.65	-3.80
10%	-3.36	-3.49

Table 4.4.8. Model D: 'Crash' and Change in Growth Hypothesis. ADF Tests.

Sample 1962-1993. T=34. All Variables Are In Logarithms. All ADF(1) tests.

Crash in 1986 (or 1983 where indicated) and change in growth in 1965.

Variable	λ_1	λ_2	α	τ_α	μ	τ_μ	δ	τ_δ	θ	τ_θ	γ	τ_γ	η	τ_η	β	τ_β	Δ_{t-1}	St.err.
GRWCXM	.18	.76	-1.05	-6.58	6.35	5.91	-.24	-1.51	-.38	-1.68	.61	4.38a	.22	2.09c	-.22	-2.08c	5%	.135
GRWCX	.18	.76	-1.01	-6.42	6.17	5.74a	-.23	-1.42	-.39	-1.68	.60	4.27a	.21	1.98d	-.21	-1.96d	7%	.137
GRWCM	.18	.76	-1.10	-6.96	6.69	6.29a	-.26	-1.68	-.38	-1.73d	.61	4.60a	.24	2.32c	-.23	-2.30c	3%	.131
GRCCXM	.18	.76	-1.03	-6.19	6.08	5.48a	-.27	-1.48	-.34	-1.40	.70	4.39a	.23	2.05d	-.22	-1.97d	7%	.146
GRCCX	.18	.76	-.97	-5.97	5.78	5.22a	-.24	-1.72	-.33	-1.38	.69	4.26a	.22	1.96d	-.21	-1.89d	8%	.145
GRCCM	.18	.76	-1.11	-6.61	6.53	5.98a	-.30	-1.70	-.36	-1.49	.70	4.62a	.24	2.21c	-.23	-2.11c	5%	.145
GRNCWCXM	.18	.76	-1.05	-6.58	6.39	5.92a	-.25	-1.51	-.37	-1.63	.63	4.74a	.22	2.14c	-.22	-2.12c	5%	.136
GRNCWCX	.18	.76	-1.02	-6.36	6.18	5.69a	-.23	-1.39	-.37	-1.60	.63	4.32a	.21	2.01d	-.21	-2.00d	6%	.138
GRNCWCM	.18	.76	-1.11	-7.06	6.78	6.41a	-.28	-1.75d	-.38	-1.73d	.64	4.79a	.24	2.40c	-.24	-2.37c	3%	.131
GRNCCCXM	.18	.76	-1.03	-6.27	6.07	5.60a	-.27	-1.50	-.35	-1.42	.75	4.56a	.23	2.05d	-.22	-1.96d	6%	.146
GRNCCCX	.18	.76	-.98	-6.07	5.77	5.33a	-.25	-1.36	-.35	-1.44	.74	4.34a	.22	1.95d	-.21	-1.87d	7%	.145
GRNCCCM	.18	.76	-1.11	-6.69	6.52	6.08a	-.31	-1.72d	-.36	-1.45	.74	4.78a	.25	2.26c	-.24	-2.15c	4%	.145
GRNOCWC	.18	.76	-1.07	-6.66	6.69	5.90a	-.26	-1.67	-.36	-1.56	.47	3.79a	.26	2.37c	-.26	-2.35c	4%	.136
GRNOCCC	.18	.76	-.97	-5.89	6.07	5.13a	-.26	-1.53	-.32	-1.29	.47	3.49a	.23	1.96d	-.23	-1.95d	8%	.147
GROILWC[1]	.18	.68	-.84	-5.02	4.63	4.44a	-.02	-.11	-.30	-1.10	.45	2.71b	.22	1.77d	-.20	-1.65	9%	.160
GROILCC[1]	.18	.68	-1.06	-6.59	5.77	5.92a	-.07	-.48	-.39	-1.72d	.43	3.43a	.26	2.59b	-.24	-2.37c	6%	.130
GRCOMPWC[1]	.18	.68	-.74	-4.54	4.29	3.77a	-.11	-.55	-.26	-.89	.45	2.61b	.17	1.28	-.17	-1.26	45%	.172
GRCOMPCC[1]	.18	.68	-.79	-4.81	4.58	4.00a	-.15	-.75	-.28	-1.03	.44	2.75b	.18	1.38	-.17	-1.34	51%	.162

λ_1: proportion of sample before the first break; λ_2: proportion of sample before the first break.

1 : break at 1982 : i.e. step dummy is =1 for t>1982. In all other cases : break 1985. (step=1 for t>1985).

a denotes significance at 1%, **b** at 2.5%, **c** at 5% and **d** at 10% (t-statistics). For Δ_{t-1} significance levels are reported explicitly.

Table 4.4.9. Model D: 'Crash' and Change in Growth Hypothesis. DF Tests.

Sample 1961-93. T=34. All Variables Are In Logarithms.

Crash at 1986 (or 1983 where indicated) and change in growth at 1965

Variable	λ_1	λ_2	α	τ_α	μ	τ_μ	δ	τ_δ	θ	τ_θ	γ	τ_γ	η	τ_η	β	τ_β	St.err
GRWCXM	.18	.76	-.94	-6.23	5.39	5.40a	-.20	-1.19	-.41	-2.16c	.52	3.87a	.15	1.96d	-.14	-1.90d	.141
GRWCX	.18	.76	-.92	-6.13	5.26	5.31a	-.19	-1.13	-.41	-2.20c	.53	3.83a	.14	1.85d	-.13	-1.79d	.141
GRWCM	.18	.76	-.97	-6.44	5.62	5.62a	-.21	-1.29	-.40	-2.14c	.52	3.96a	.16	2.15c	-.15	-2.09c	.139
GRCCXM	.18	.76	-.92	-5.91	5.13	5.07a	-.21	-1.16	-.37	-1.82d	.61	3.97a	.16	1.94d	-.15	-1.82d	.151
GRCCX	.18	.76	-.87	-5.69	4.92	4.84a	-.19	-1.05	-.35	-1.75d	.61	3.87a	.16	1.92d	-.15	-1.80d	.149
GRCCM	.18	.76	-.98	-6.23	5.45	5.44a	-.24	-1.31	-.39	-1.91d	.61	4.08a	.16	2.04d	-.15	-1.90d	.152
GRNCWCXM	.18	.76	-.94	-6.20	5.42	5.38a	-.20	-1.18	-.39	-2.09c	.55	3.96a	.15	1.99d	-.15	-1.94d	.142
GRNCWCX	.18	.76	-.91	-6.02	5.25	5.21a	-.19	-1.09	-.39	-2.06c	.55	3.85a	.14	1.88d	-.14	-1.83d	.143
GRNCWCM	.18	.76	-.98	-6.53	5.72	5.71a	-.22	-1.34	-.40	-2.14c	.55	4.15a	.17	2.23c	-.16	-2.17c	.138
GRNCCCXM	.18	.76	-.92	-5.96	5.12	5.12a	-.22	-1.16	-.38	-1.91d	.66	4.12a	.15	1.88d	-.14	-1.75d	.151
GRNCCCX	.18	.76	-.88	-5.78	4.93	4.91a	-.19	-1.06	-.37	-1.88d	.65	4.04a	.15	1.88d	-.14	-1.74d	.149
GRNCCCM	.18	.76	-.98	-6.22	5.44	5.44a	-.24	-1.30	-.39	-1.90d	.64	4.21a	.16	2.04d	-.15	-1.89d	.152
GRNOCWC	.18	.76	-.94	-6.23	5.52	5.34a	-.22	-1.37	-.37	-1.94d	.38	3.15a	.18	2.23c	-.17	-2.16c	.143
GRNOCCC	.18	.76	-.86	-5.64	5.01	4.74a	-.22	-1.28	-.34	-1.73d	.39	3.02a	.15	1.77d	-.14	-1.73d	.151
GROILWC[1]	.18	.68	-.77	-4.82	3.83	4.00a	.02	.08	-.39	-1.75d	.38	2.35c	.12	1.38	-.10	-1.20	.164
GROILCC[1]	.18	.68	-.96	-6.31	4.97	5.46a	-.03	-.20	-.40	-2.19c	.37	2.97a	.19	2.57b	-.17	-2.29c	.134
GRCOMPWC[1]	.18	.68	-.72	-4.83	3.88	3.87a	-.10	-.52	-.34	-1.53	.43	2.66b	.11	1.18	-.10	-1.14	.168
GRCOMPCC[1]	.18	.68	-.77	-5.19	4.25	4.21a	-.14	-.72	-.34	-1.60	.42	2.83a	.13	1.47	-.12	-1.42	.158

λ_1: proportion of sample before the first break; λ_2: proportion of sample before the first break.

1 : break at 1982 : i.e. step dummy is =1 for t>1982. In all other cases : break 1985. (step=1 for t>1985)

Note : **a** denotes significance at 1%, **b** at 2.5%, **c** at 5% and **d** at 10% (t-statistics).

4.5. Concluding Remarks.

This chapter has presented an overview of the main problems related to the definition and measurement of the real exchange rate. A set of REER indexes for the Indonesian rupiah has been computed and their statistical properties analysed. Unit root testing has been extensively used in order to ascertain the time series properties of the Indonesian REER. Their importance will become apparent in the empirical implementation of the models presented in the following chapter. As a conclusion, we have consistently rejected the hypothesis of REER stationarity except in those cases in which the full sample series have been used and/or two breaks in REER behaviour have been allowed. In those cases results show stationarity, but we should treat them more as indicative than as definitive. A much longer time series would be most appropriate, and results from a test based on a much larger sample size would be less suspicious.

The analysis of the REER behaviour has also served as a test on the long run PPP proposition. The rejection of the hypothesis of REER stationarity in the majority of cases implies that long run PPP cannot be confirmed. Incidentally, PPP should be tested on PPP defined REERs; all the tests based on trade theory defined REERs can thus be interpreted as robustness checks.

Note that the models used in chapter 5 are closely linked with the tradable versus non-tradable modelling tradition. Consequently, we use a trade theory defined REER. In particular, we have chosen GRWCPXM which considers all the trading partners and is constructed using trade shares, so that purchasing power in buying from and selling to trading partners is considered.

Finally, further research could bring a comparative perspective in order to determine whether the behaviour of the Indonesian REER matches other countries REERs.

Appendix 10.

Table A.10.1. Average Individual Countries' Weights. Percentages of Exports (X), Imports (M) and Trade (XM) Relative to Total Indonesian Exports, Imports and Trade.

Japan (averages: X=41.2%, M=33.8%, XM=38.5%)	USA (averages: X=22.8%, M=20.4%, XM=21.9%)
Singapore (averages: X=11.1%, M=8.6%, XM=10%)	Germany (averages: X=4.4%, M=10.9%, XM=7%)
Netherlands (averages: X=4.5% M=3.7%, XM=4.2%)	Australia(averages: X=4.3% M=4.1%, XM=4%)
United Kingdom (averages: X=2.2%, M=4.7%, XM=3.2%)	Hong Kong (averages: X=1.7%, M=3.9%, XM=2.6%)
Korea (averages: X=2.5%, M=2.3%, XM=2.4%)	France (averages: X=.8%, M=3.2%, XM=1.9%)
Italy (averages: X=1.3%, M=2.2%, XM=1.7%)	Malaysia (averages: X=1.7%, M=.9%, XM=1.3%)
Belgium (averages: X=1.2%, M=1.2%, XM=1.1%)	

Source: IMF, *Direction of Trade Yearbook*, various issues.

Appendix 11. Descriptive Statistics and Correlation Matrixes for Calculated REER and NEER.

Descriptive Statistics: Nominal Effective Exchange Rates.

The present sample is: 1960 to 1993

Means

gnomrx	gnomrm	gnomrxm	gnomoil	gnncrx	gnncrm
80.05	80.13	79.98	50.40	83.12	82.59
gnncrxm	gnnocrd	gnercomp	dollar		
82.75	74.02	62.40	64.69		

Standard Deviations

gnomrx	gnomrm	gnomrxm	gnomoil	gnncrx	gnncrm
89.05	85.63	87.64	35.41	94.98	90.21
gnncrxm	gnnocrd	gnercomp	dollar		
92.95	58.93	46.56	60.54		

Correlation matrixes

	dollar	gnomrxm	gnncrxm	gnnocrd	gnomoil	gnercomp
dollar	1.000					
gnomrxm	0.9909	1.000				
gnncrxm	0.9881	0.9998	1.000			
gnnocrd	0.9901	0.9732	0.9691	1.000		
gnomoil	0.8128	0.7379	0.7260	0.8422	1.000	
gnercomp	0.9726	0.9377	0.9315	0.9866	0.9151	1.000

	dollar	gnomrx	gnncrx	gnnocrd	gnomoil	gnercomp
dollar	1.000					
gnomrxm	0.9899	1.000				
gnncrx	0.9866	0.9997	1.000			
gnnocrd	0.9901	0.9711	0.9665	1.000		
gnomoil	0.8128	0.7327	0.7189	0.8422	1.000	
gnercomp	0.9726	0.9348	0.9276	0.9866	0.9151	1.000

	dollar	gnomrm	gnncrm	gnnocrd	gnomoil	gnercomp
dollar	1.000					
gnomrm	0.9921	1.000				
gnncrm	0.9900	0.9998	1.000			
gnnocrd	0.9901	0.9765	0.9733	1.000		
gnomoil	0.8128	0.7459	0.7367	0.8422	1.000	
gnercomp	0.9726	0.9422	0.9373	0.9866	0.9151	1.000

	gnomrx	gnomrm	gnomrxm
gnomrx	1.000		
gnomrm	0.9995	1.000	
gnomrxm	0.9999	0.9998	1.000

	gnncrx	gnncrm	gnncrxm
gnncrx	1.000		
gnncrm	0.9993	1.000	
gnncrxm	0.9999	0.9997	1.000

Descriptive Statistics: Real Effective Exchange Rates.

The present sample is: 1960 to 1993

Means

grwcpix	grwcpim	grwcpxm	grcpix	grcpim	grcpxm
125.2	125.9	125.4	120.5	118.8	119.7
grerdx	grerdm	grerdxm	brerwcpi	brercpi	brerd
153.6	152.0	152.8	113.8	110.3	141.4
grncwcx	grncwcm	grncwcxm	grnccpx	grnccpm	grnccpxm
127.1	127.6	127.2	121.1	119.6	120.2
grncdx	grncdm	grncdxm	grnoccp	grnocwcp	grnocd
153.8	153.1	153.3	126.5	123.7	157.0
groilwc	groilcc	groild	grcompcc	grcompwc	grcompd
78.30	78.84	82.12	107.5	102.0	119.9

Standard Deviations

grwcpix	grwcpim	grwcpxm	grcpix	grcpim	grcpxm
68.17	67.77	68.01	67.14	58.05	63.60
grerdx	grerdm	grerdxm	brerwcpi	brercpi	brerd
77.36	68.89	73.91	68.05	61.81	75.21
grncwcx	grncwcm	grncwcxm	grnccpx	grnccpm	grnccpxm
70.30	68.58	69.57	67.59	59.15	63.74
grncdx	grncdm	grncdxm	grnoccp	grnocwcp	grnocd
74.83	68.55	72.00	82.81	79.50	91.78
groilwc	groilcc	groild	grcompcc	grcompwc	grcompd
38.83	37.22	31.27	70.85	65.18	66.71

Correlation matrixes

	grwcpxm	grncwcxm	grnocwcp	groilwc	grcompwc
grwcpxm	1.000				
grncwcxm	0.9997	1.000			
grnocwcp	0.9807	0.9770	1.000		
groilwc	0.8905	0.8957	0.8231	1.000	
grcompwc	0.9902	0.9892	0.9845	0.9036	1.000

	grcpxm	grnccpxm	grnoccp	groilcc	grcompcc
grcpxm	1.000				
grnccpxm	0.9969	1.000			
grnoccp	0.9028	0.8666	1.000		
groilcc	0.9447	0.9430	0.8379	1.000	
grcompcc	0.9339	0.9037	0.9929	0.8902	1.000

	grerdxm	grncdxm	grnocd	groild	grcompd
grerdxm	1.000				
grncdxm	0.9980	1.000			
grnocd	0.9566	0.9376	1.000		
groild	0.8031	0.8073	0.7269	1.000	
grcompd	0.9673	0.9537	0.9783	0.8423	1.000

	grwcpix	grncwcx	grnocwcp	groilwc	grcompwc
grwcpix	1.000				
grncwcx	0.9998	1.000			
grnocwcp	0.9797	0.9772	1.000		
groilwc	0.8912	0.8951	0.8231	1.000	
grcompwc	0.9901	0.9896	0.9845	0.9036	1.000

	grcpix	grnccpx	grnoccp	groilcc	grcompcc
grcpix	1.000				
grnccpx	0.9973	1.000			
grnoccp	0.9153	0.8841	1.000		
groilcc	0.9438	0.9443	0.8379	1.000	
grcompcc	0.9444	0.9190	0.9929	0.8902	1.000

	grerdx	grncdx	grnocd	groild	grcompd
grerdx	1.000				
grncdx	0.9977	1.000			
grnocd	0.9602	0.9408	1.000		
groild	0.8066	0.8107	0.7269	1.000	
grcompd	0.9715	0.9578	0.9783	0.8423	1.000

	grwcpim	grncwcm	grnocwcp	groilwc	grcompwc
grwcpim	1.000				
grncwcm	0.9996	1.000			
grnocwcp	0.9821	0.9769	1.000		
groilwc	0.8887	0.8956	0.8231	1.000	
grcompwc	0.9900	0.9884	0.9845	0.9036	1.000

	grcpim	grnccpm	grnoccp	groilcc	grcompcc
grcpim	1.000				
grnccpm	0.9976	1.000			
grnoccp	0.8772	0.8434	1.000		
groilcc	0.9427	0.9392	0.8379	1.000	
grcompcc	0.9111	0.8824	0.9929	0.8902	1.000

	grerdm	grncdm	grnocd	groild	grcompd
grerdm	1.000				
grncdm	0.9985	1.000			
grnocd	0.9489	0.9342	1.000		
groild	0.7961	0.8038	0.7269	1.000	
grcompd	0.9577	0.9485	0.9783	0.8423	1.000

	grwcpix	grwcpim	grwcpxm
grwcpix	1.000		
grwcpim	0.9995	1.000	
grwcpxm	0.9999	0.9998	1.000

	grcpix	grcpim	grcpxm
grcpix	1.000		
grcpim	0.9948	1.000	
grcpxm	0.9993	0.9978	1.000

	grerdx	grerdm	grerdxm
grerdx	1.000		
grerdm	0.9972	1.000	
grerdxm	0.9996	0.9988	1.000

	grwcpxm	grcpxm	grerdxm
grwcpxm	1.000		
grcpxm	0.9627	1.000	
grerdxm	0.8857	0.8200	1.000

	grwcpix	grcpix	grerdx
grwcpix	1.000		
grcpix	0.9703	1.000	
grerdx	0.8904	0.8326	1.000

	grwcpim	grcpim	grerdm
grwcpim	1.000		
grcpim	0.9458	1.000	
grerdm	0.8698	0.7972	1.000

	grncwcx	grncwcm	grncwcxm
grncwcx	1.000		
grncwcm	0.9996	1.000	
grncwcxm	0.9999	0.9998	1.000

	grnccpx	grnccpm	grnccpxm
grnccpx	1.000		
grnccpm	0.9951	1.000	
grnccpxm	0.9990	0.9984	1.000

	grncdx	grncdm	grncdxm
grncdx	1.000		
grncdm	0.9982	1.000	
grncdxm	0.9997	0.9993	1.000

	grncwcxm	grnccpxm	grncdxm
grncwcxm	1.000		
grnccpxm	0.9458	1.000	
grncdxm	0.8801	0.8097	1.000

	grncwcx	grnccpx	grncdx
grncwcx	1.000		
grnccpx	0.9557	1.000	
grncdx	0.8851	0.8239	1.000

	grncwcm	grnccpm	grncdm
grncwcm	1.000		
grnccpm	0.9317	1.000	
grncdm	0.8720	0.7911	1.000

	grnoccp	grnocwcp	grnocd
grnoccp	1.000		
grnocwcp	0.9994	1.000	
grnocd	0.8872	0.8863	1.000

	groilwc	groilcc	groild
groilwc	1.000		
groilcc	0.9947	1.000	
groild	0.9085	0.9018	1.000

	grcompcc	grcompwc	grcompd
grcompcc	1.000		
grcompwc	0.9971	1.000	
grcompd	0.9121	0.9068	1.000

Descriptive Statistics: Bilateral Real Exchange Rates (Indonesia versus USA).

The present sample is: 1960 to 1993

Means

brerwcpi	brercpi	brerd
113.8	110.3	141.4

Standard Deviations

brerwcpi	brercpi	brerd
68.05	61.81	75.21

Correlation matrixes

	brerwcpi	brercpi	brerd
brerwcpi	1.000		
brercpi	0.9879	1.000	
brerd	0.8226	0.8040	1.000

	grwcpxm	grcpxm	grerdxm
brerwcpi	0.9779		
brercpi		0.9411	
brerd			0.9501

Guide to Variables' Labels.

Variables have been labelled following a five fields coding procedure. This is outlined below and serves as a rough guide to the interpretation of the index names. Some minor deviations were introduced in a few cases.

The five fields refer to: 1) the averaging procedure used; 2) the type of exchange rate computed; 3) the countries selected in the calculation of the index; 4) the price index ratio used; and 5) the weights employed. They are described as follows:

1) Averaging procedure field

g / * / * / * / *	: denotes geometric weighted averaging
b / * / * / * / *	: denotes geometric weighted averaging for bilateral rate (Indonesia versus USA only)

2) Type of exchange rate field

* / n (or nom) / * / * / *	: denotes nominal effective exchange rate
* / r (or rer) / * / * / *	: denotes real effective exchange rate

3) Foreign countries field

* / * / - / * / *	: unspecified fields denotes all trading partners
* / * / nc / * / *	: denotes non competitors trading partners
* / * / noc / * / *	: denotes nominal non-oil competitors
* / * / oil / * / *	: denotes oil competitors
* / * / comp / * / *	: denotes competitors (both oil and non-oil)

4) Price index ratio field

* / * / * / wc(pi) / *	: denotes foreign WPI / domestic CPI
* / * / * / cc(pi) / *	: denotes foreign CPI / domestic CPI
* / * / * / d / *	: denotes foreign GDP deflator / domestic GDP deflator

5) Weights field

* / * / * / * / xm	: denotes trade weights (imports+exports shares)
* / * / * / * / x	: denotes export weights
* / * / * / * / m	: denotes import weights.

CHAPTER 5

REAL EXCHANGE RATE MODELLING:

THE CASE OF INDONESIA.

5.1. Introduction.

The real exchange rate (RER) is commonly used as a key indicator of the overall competitiveness of a country. The trade theory defined RER (see chapter 4) also signals long run intersectoral growth patterns, for instance the expansion of the tradable sector or the contraction of the agricultural sector.

The link between RER behaviour and economic performance has recently been emphasised in policy discussions and in the literature on economic development. In particular, the role of RER stability and of correct real exchange alignment is increasingly regarded as crucial in development strategies (Edwards and Ahamed, 1986; Cottani, Cavallo and Khan, 1990; Edwards, 1988a, 1989 and 1994; Elbadawi, 1994 and 1994; Harberger, 1986; Khan and Lizondo,1987; Pfeffermann, 1985; Pick and Vollrath, 1994; Serven and Solimano, 1992; White and Wignaraja, 1991 and 1992; Williamson, 1994).

RER stability reduces uncertainty and can thus result in attracting foreign capital and in stimulating domestic investments, given a greater confidence in the domestic and foreign business community in the country's economic performance. Correct RER alignment results in internal and external equilibrium, for given sustainable macroeconomic conditions and economic policies, and can be conducive to greater equality. The consequences of misalignment can be critical for developing countries. In particular, overvalued exchange rates undermine the profitability of producing exports and import substitutes. Exports are hurt by reduced competitiveness. Incentives to produce import substitutes decline as relatively cheaper imports are stimulated, provided import restrictions are not imposed. If protection against imports is introduced, the costs to subsidise import competing industries can widen the fiscal deficit and resource allocation can be less efficient. Overvaluation, therefore, is particularly detrimental to export-led growth strategies. Widening current account deficits will be also reflected in increased borrowing requirements which exert pressures on the capital account and may worsen the external debt servicing burden. Another important effect of overvalued exchange rates is the negative impact on the agricultural sector. The decline in competitiveness and in relative prices caused by the overvaluation reduces incentives for farmers to produce[1]. This has dramatic welfare effects, given the key role of agriculture in countries at the early stages of development.

RER misalignment occurs when nominal exchange rates are not allowed to adjust fully in response to changes in economic conditions, such as unsustainable monetary and fiscal policies, trade and capital controls, increasing domestic inflation and costs. Determining the correct RER alignment requires the introduction of an equilibrium concept, relative to which misalignment can be established and the appropriate policy adjustments undertaken. Therefore, it is necessary to define an equilibrium level of the RER which reflects a country's economic fundamentals. In practice, the quantification of RER disequilibrium is not easy. Purchasing power parity

[1] Agriculture usually does not enjoy the same level of protection as industry does.

(PPP) theory provides a simple way to estimating misalignment. However, as mentioned in chapter 4, PPP underestimates the role of economic fundamentals and does not offer a reliable guide to policy makers. An alternative approach is proposed by Edwards (1989) who presents a modelling approach to equilibrium and disequilibrium RER focused on the role of domestic and external determinants of the RER.

In this chapter we present two strictly related models for the RER and their empirical application for the case of Indonesia. We start with the modelling approach proposed by Edwards. A brief description of his model[2] and of its implications precedes the empirical time series estimation for Indonesia. We then present a modified version of Edwards' model, an Error Correction Mechanism (ECM) model, which develops the concept of equilibrium RER. Once again the empirical estimation is implemented for Indonesia and simulation exercises are conducted. Final remarks conclude the chapter.

5.2. Models of RER Determination: Edwards' Approach.

5.2.1 The Model.

In modelling the behaviour of the RER we adopt the seminal approach proposed by Edwards (1989). He develops a highly stylised benchmark intertemporal general equilibrium model in order to analyse how the equilibrium RER reacts to real disturbances. Duality theory is applied in a two period framework. The model is

[2] For a detailed description of the model see Edwards (1989, 1994).

characterised by full employment, flexible prices, perfect competition and perfect foresight. This small open economy is composed of optimising producers and consumers and a government. Since there is no money or nominal assets, the model is completely defined in real terms.

Perfectly competitive firms maximise their profits in the two periods and produce three goods - exportables, importables and non-tradable goods. Constant returns to scale technology is assumed. Households maximise their present and future utility from the consumption of the three goods, subject to an intertemporal budget constraint. The government has to balance the discounted value of its budget, that is, the equality must hold between the present values of government current and future expenditures and revenues. This implies that borrowing from abroad is possible; however, by the end of period two international debt must be repaid.

Equilibrium RER (ERER) is defined in terms of economic fundamentals and results in the simultaneous attainment of internal and external equilibrium across the two periods. Internal equilibrium requires current and expected future clearing of the non-tradable goods market. External equilibrium occurs when current account balances (current and future) satisfy the intertemporal budget constraint, that states that the discounted sum of current and future current accounts is zero. According to this definition of ERER, changes in the variables that affect internal and/or external balance will result in changes in the ERER. As a consequence, the RER itself is a function of a number of variables, or economic fundamentals, which determine the ERER. Using Edwards' (1988) classification, fundamentals can be separated into external and internal. External fundamentals include terms of trade, capital flows and international transfers such as aid. Internal fundamentals can be further divided into those which are policy related such as exchange and capital controls, government expenditure and domestic investment, and those which are not affected by policy changes, most importantly technological progress. Given the two-period nature of the model, exogenous shocks will affect the ERER through intertemporal and intratemporal effects on resource allocation and consumption and production decision.

The attractiveness of Edwards' modelling approach is that instead of a unique equilibrium value of the RER the model generates a vector of ERER, which will fluctuate over time. In contrast to the PPP alternative, misalignment of the RER is thus interpreted as a sustained departure of the RER from its equilibrium path, rather than being defined as deviation from a constant equilibrium value.

While in the long run RER depends only on real economic fundamentals, the dynamics of the RER in the short run is affected also by non-fundamental variables, such as nominal devaluation and monetary and fiscal policies. Therefore, the following equation is introduced:

$$\Delta \log RER_t = \theta(\log ERER_t - \log RER_{t-1}) - \lambda(MACROIMB_t) + \varphi(NOMDEV_t) \quad (5.1)$$

where ERER is the equilibrium RER, MACROIMB is an indicator of macroeconomic imbalances, i.e. of domestic monetary and fiscal policies, and NOMDEV is nominal devaluation.

Short run RER movements respond to three factors. First, there is a self-adjusting process of the RER to its equilibrium value, captured by the first, partial adjustment, term. The smaller is the speed at which the self-correcting process takes place, captured by the parameter θ, the slower is convergence towards equilibrium and the longer is the persistence of misalignment. Second, macroeconomic policies affect the RER, and this is captured by MACROIMB. Unsustainable macroeconomic policies lead to misalignment of RER. Finally, nominal devaluations (revaluations) are directly linked to the RER in the short run, and this is accounted for by NOMDEV. This term captures the impact effect of nominal devaluations (revaluations) on RER, although this effect does not necessarily last over the longer run.

However, the above dynamic model cannot be directly tested because ERER is not observable. According to the definition, the ERER is a function of economic fundamentals. Edwards thus proposes the following logarithmic specification for the ERER:

$$\begin{aligned}\log ERER_t = {} & \beta_0 + \beta_1 \log TOT_t + \beta_2 \log GCN_t + \beta_3 \log CAPCONTROLS_t \\ & + \beta_4 \log EXCHCONTROLS_t + \beta_5 \log TECHPRO_t \\ & + \beta_6 \log INVY_t + u_t\end{aligned} \tag{5.2}$$

where TOT are the external terms of trade, GCN is government consumption on non-tradables, CAPCONTROLS is a measure of capital flows controls, EXCHCONTROLS is a measure of trade restrictions and exchange rate controls, TECHPRO is technical progress, INVY is the ratio of investment to the country's gross domestic product (GDP), u is the error terms and the subscript t denotes time.

An equation which can be empirically tested is finally obtained after substituting the expression for ERER (5.2) in the dynamic equation for the RER (5.1).

$$\begin{aligned}\log RER_t = {} & \gamma_0 + \gamma_1 \log TOT_t + \gamma_2 \log GCN_t + \gamma_3 \log CAPCONTROLS_t \\ & + \gamma_4 \log EXCHCONTROLS_t + \gamma_5 \log TECHPRO_t \\ & + \gamma_6 \log INVY_t + (1-\theta) \log RER_{t-1} \\ & - \lambda MACROIMB_t + \phi NOMDEV_t + u_t\end{aligned} \tag{5.3}$$

where $\gamma_i = \beta_i * \theta$. From the empirical estimates of $\hat{\gamma}_i$ and $\hat{\theta}$ the $\hat{\beta}_i$ can be derived.

Moreover, if we exclude the influence of the non-fundamental variables, by imposing $\lambda = \phi = 0$, the long-run coefficients of the ERER equation can be computed as $\hat{\beta}_i = \hat{\gamma}_i / \hat{\theta}$. This will generate estimated series of long-run ERERs.

The model allows for a formal analysis of the impact of changes in the fundamentals on the ERER. A brief summary of the theoretical expectation about the direction of ERER movements follows in the next section.

5.2.2. Fundamentals' Disturbances to the ERER.

In order to study the response of the ERER to real disturbances, Edwards uses various simplified versions of the benchmark model for each particular distortion. This allows us to establish the sign (positive, negative or ambiguous) of the impact of changes in the level of the fundamentals on the ERER. The most significant results are described in this section[3].

Terms of Trade. A worsening of the terms of trade (that is a decrease) implies a higher price for importables relative to that of exportables. Real income is reduced and the demand for tradables declines. To restore equilibrium there has to be a reduction in the relative price of non-tradables, i.e. a real depreciation. However, a substitution

[3] For the detailed formal analysis see Edwards' (1989).

effect and intertemporal ramifications[4] lead to a shift to consuming more non-tradables, given the higher price for tradables. This will put pressure on the non-tradable price. Theoretically, the final effect of a deterioration of the terms of trade is ambiguous; however, it is commonly believed that the income effect dominates the substitution effect and statistical evidence supports this view. As a result, worsening terms of trade are usually expected to cause an ERER depreciation.

Government Consumption. An increase in government consumption due to an increase in the proportion of non-tradables will induce demand pressure in the non-tradable goods market and thus an equilibrium real appreciation. The greater is the marginal propensity to consume non-tradables, the larger will be the real appreciation. On the contrary, if the increase in government consumption falls mainly on tradable goods, then an equilibrium real depreciation is expected. These results may become ambiguous when both tradable and non-tradable consumption rise.

Exchange Rate and Capital Controls. Relaxation of exchange rate and capital controls encourages capital inflows and foreign borrowing. Higher demand will ensue and to maintain internal equilibrium an increase in the price of non-tradables is necessary, and thus an equilibrium real appreciation follows. However, since foreign borrowing has to be repaid in future periods, debt repayment will result in a real depreciation. Therefore, the long run effect is ambiguous.

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[4] Given the two period nature of the model, economic agents decisions involve both the present and the future period. As a result, the total substitution effect will consist of an intratemporal and an intertemporal component.

Trade Controls. Following the imposition of, or increase in, tariffs a similar outcome to the one related to terms of trade deterioration occurs. Higher import tariffs lead to a rise in import prices and consequently to a reduction in the demand for importables. Higher demand for non-tradables follows. In order to maintain equilibrium[5] in the non-tradable market an increase in non-tradable prices is required and an equilibrium real appreciation follows. Similarly, trade liberalisation will usually lead to equilibrium real depreciation.

Technical Progress. According to the Balassa-Ricardo hypothesis countries experiencing faster productivity growth will face a real appreciation (see Balassa, 1964 and Isard, 1995). This proposition on the negative link between technical progress and the RER is rooted in the PPP literature but can be easily fitted in the trade theory framework. The underlying hypothesis is that in all countries productivity gains are larger in the tradable sector than in the non-tradable sector and thus induce a tendency of the relative price of tradables to non-tradables to decline over time (i.e. a trade theory defined RER appreciation). Given that tradable goods prices are internationally determined, productivity growth differentials across countries and sectors will cause a PPP defined RER appreciation.

Investment. The effect of higher capital accumulation is dependent on its composition and goal[6]. For instance, investments in the housing sector will involve

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[5] In general, this is what we expect to happen, but results may become ambiguous if we take into account the initial level of the tariffs (see Edwards 1989).

[6] Note that in Edwards' model investment decisions will have intertemporal effects on the supply side (see Edwards, 1989, p.37).

mainly the non-tradable sector and thus may induce an ERER appreciation. On the contrary, investment aimed at promoting the export sector may help restore competitiveness and thus cause an ERER depreciation. In general, it is not possible to establish the sign of its impact.

5.2.3. Empirical Estimation. The Indonesian RER.

In order to specify an empirical equation for the Indonesian RER we use Edwards' equation (5.3). However, problems related to data availability arise. In fact, we have reliable time series data only for the terms of trade and the ratio of investment to GDP.

As a proxy to government consumption on non-tradables, for which we have no time series data, we use the ratio of government consumption (GC) to GDP. Since the government consumes both tradables and non tradables, the use of this proxy allows for an impact on the RER not only through changes in the level of non-tradable consumption, but also through changes in the composition of GC. GC may increase either for an increase in non-tradable consumption, given a fixed level of tradable consumption, or for the opposite situation, or even for an increase in both types of goods consumption. Therefore, results obtained when using this proxy must be interpreted with care. An operational definition for controls on capital flows in and out the country is difficult and time series data are not available. An eligible proxy is the lagged ratio of net capital flows to GDP. In preliminary dynamic estimations of the model, the short run coefficient for this proxy and its associated long run coefficient turned out to be consistently insignificantly different from zero. In order to save degrees of freedom, this variable is excluded[7]. Exchange rate and trade restrictions have been proxied by the ratio of tariff revenues to import plus exports. We include tariffs on exports, and thus exports in the denominator, because of the importance of revenues from oil export duties in Indonesia. Unfortunately, this proxy ignores non-tariff barriers, for which it is very difficult to obtain consistent time series data. As for exchange rate controls, these are not particularly relevant in the case of Indonesia. The related indicator of the black market exchange rate closely follows the nominal official rate. Finally, real GDP growth rate proxies technological progress. This is done frequently in the empirical literature to take into account the Ricardo-Balassa effect, which associate faster technological progress to real appreciation[8].

Finally, the role of macroeconomic policy in RER behaviour is captured by MACROIMB. We have defined it as the ratio of fiscal deficit to previous period high powered money (DEH). This reflects fiscal policy, in particular, the monetisation of fiscal deficit. Various measures of monetary policy have also been included in MACROIMB in preliminary estimations, such as money growth, domestic credit growth and excess supply for domestic credit. However, all these variables proved not to add to the statistical significance of the model.

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[7] Specifically, we have adopted the general to specific modelling strategy in order to determine the dynamics of the model.

[8] International differences in productivity growth in the tradable sector would cause discrepancies in the RER in different countries, ceteris paribus.

The econometric specification for RER behaviour for Indonesia is then obtained from equation (5.3) by simply substituting some fundamentals with their relevant proxies:

$$\begin{aligned}\log RER_t = (1-\theta)\log RER_{t-1} + \gamma_0 + \gamma_1 \log INVY_t + \gamma_2 \log TOT_t + \gamma_3 \log AIDY_t \\ + \gamma_4 \log GCY_t + \gamma_5 GROWTH_t + \gamma_6 \log TAR_t \\ - \lambda\ DEH_t + \phi\ NOMDEV_t + u_t\end{aligned} \quad (5.4)$$

where the parameters correspond to those of equation (5.3) (and thus $\gamma_i = \beta_i * \theta$, see equations (5.1) and (5.2)) and where INVY is domestic investment expressed as a ratio to GDP, TOT are the external terms of trade, AIDY are aid inflows expressed as a ratio to GDP, GCY is Government consumption expressed as a ratio to GDP, GROWTH is real GDP growth, TAR is the ratio of tariff revenues to the value of export plus imports, DEH is the ratio of fiscal deficit to previous period high powered money (DEH), NOMDEV is nominal effective exchange rate devaluation and u_t is the error term.

To address the issues of the relevance of aid inflows and oil price shock for the determination of the Indonesian RER, we have introduced two further fundamentals, namely the ratio of aid inflows to GDP and the ratio of oil export price[9] to import price (P_{OIL}). Notice that this latter variable represents an alternative definition of the terms of trade[10]. Accordingly, two sets of regressions have been run: Model 1 and 2 use TOT while Model 3 and 4 use P_{OIL}. Models 1 and 3 include all the fundamentals of equation (5.4) while Models 2 and 4 exclude some of them, namely GC, GROWTH and TAR.

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[9] More specifically, it is the unit export value of oil as defined in IMF, *International Financial Statistics*.

[10] Given the great weight of oil exports for the Indonesian external trade, P_{OIL} and TOT are closely related (see graph 1.4.1.2).

The latter distinction has been introduced to emphasise the role of aid and of the external terms of trade (or oil price index)[11]. Note also that the relationship between aid and the RER can be interpreted in terms of the Dutch Disease effect of aid inflows even without considering sectors.

Equation (5.4) has been estimated dynamically over the sub-sample 1967-1993 using OLS technique[12] and the static long run solution has been derived. As in the estimation of the fiscal response model, we have deliberately excluded the period 1960 to 1966 in order not to take into account the hyperinflation years. However, for completeness and comparison purposes, the estimates over the full sample are reported in appendix 13. Note that an impulse dummy for 1965 has been included in the full sample equations given the 1965 peak in inflation.

The dependent variable is the trade theory defined REER. Specifically, the index employed in the estimations is constructed using the ratio of all trading partners WPI's to the Indonesian CPI and trade shares as weights in the geometric averaging. It corresponds to the index GRWCPXM constructed and analysed in chapter 4 (refer to chapter 4 for source of data and further details). NOMDEV is the corresponding NEER.

Data for GDP, investment, export, imports, the oil price index and high powered money are drawn from the IMF, *International Financial Statistics* (various issues). Data for government consumption and fiscal deficit are taken from the IMF,

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[11] Edwards (1989, 1994) uses alternative specifications of the estimation equation which exclude one or more fundamental. We have tested several versions of the model and the best performing models among them are reported here.

[12] The econometric package used is PcGive 8.0.

Government Finance Statistics (various issues). The figures for tariff revenues are obtained form the Bank of Indonesia, *Report for the Financial Year* (various issues) and have been adjusted for solar year. Aid dollar data come from OECD, *Geographical Distribution of Financial Flows to Developing Countries* (various issues) and have been converted to rupiahs using the IMF published exchange rate. Finally, World Bank, *World Tables* (various issues) are the source for the terms of trade series.

The following tables presents the results[13]: table 5.2.3.1 shows the results of the dynamic estimation and table 5.2.3.2 reports the results for the estimated long run solution. Appendix 14 reports the results obtained from Instrumental Variable estimation of Models 1 to 4 where the endogenous variable (the 'instrumented' variable) is nominal devaluation. Note that since the estimated equations are expressed in logarithmic terms the estimated coefficients can be readily interpreted as elasticities.

Time series properties of the real exchange rates have been described in chapter 4. Formal unit root tests for all the regressors are reported in appendix 12. As can be seen from tables A.12.1 to A.12.3, none of the variables are I(2), some of them, namely NOMDEV, GROWTH and DEH, are unambiguously I(0) and all the others are shown to have a unit root[14]. Appendix 15 provides a brief guide to the diagnostic tests used.

[13] Δ denotes first differences.

[14] To be precise, the results hold unambiguously over the subsample. Over the period 1960-93 logGCY does not appear to have a unit root.

Table 5.2.3.1. Edwards' Model OLS Estimates. Sample: 1967-1993.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
	Coeff (t-value)	Coeff (t-value)	Coeff (t-value)	Coeff (t-value)
log RER_{-1}	0.66 (11.35***)	0.75 (15.67***)	0.67 (10.13***)	0.75 (14.80***)
CONSTANT	1.84 (3.51***)	1.01 (3.89***)	1.49 (2.78**)	0.83 (3.37***)
log INVY	0.22 (3.89***)	0.25 (4.34***)	0.23 (3.74***)	0.26 (4.20***)
log TOT	-0.22 (-4.33***)	-0.16 (-4.50***)		
log P_{OIL}			-0.16 (-3.57***)	-0.12 (-4.20***)
Δ log AIDY	0.27 (4.52***)	0.19 (3.27***)	0.20 (3.08***)	0.14 (2.33*)
Δ log GCY	-0.22 (-2.51**)		-0.20 (-2.06*)	
GROWTH	0.009 (1.95*)		0.008 (1.60)	
log TAR	-0.10 (-1.93°)		-0.09 (-1.52)	
NOMDEV	0.20 (2.10**)	0.39 (5.47***)	0.26 (2.69**)	0.43 (5.71***)
DEH	0.09 (1.14)	0.19 (2.44**)	0.07 (0.82)	0.17 (2.10*)

°, * , **, *** denote significance at 10%, 5%, 2,5% and 1%, respectively.

Diagnostic Tests

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
R^2	0.987	0.980	0.984	0.979
F-test on Regressors	144 (0.00)	166.1 (0.00)	119.7 (0.00)	155.2 (0.00)
σ	0.041	0.047	0.045	0.048
Durbin Watson	1.96	1.89	1.90	1.84
RSS	0.029	0.044	0.035	0.047
AR 2 F	0.59 (0.57)	0.08 (0.92)	0.36 (0.70)	0.17 (0.84)
ARCH 1 F	1.68 (0.21)	0.49 (0.49)	0.92 (0.35)	1.19 (0.29)
Normality χ^2	1.20 (0.55)	1.09 (0.58)	0.05 (0.97)	1.60 (0.45)
RESET F	2.19 (0.16)	2.49 (0.13)	2.95 (0.10)	3.10 (0.10)
X_i^2 F		0.45 (0.89)		0.63 (0.77)
VIT	0.053	0.045	0.085	0.066
JIT	2.29	1.94	2.04	1.94
Restrictions[a] on log AIDY	0.098 (0.76)	0.0001 (0.99)	0.002 (0.96)	0.020 (0.89)
Restrictions[a] on log GCY	0.062 (0.81)		0.004 (0.95)	
Joint Restriction[a] on log AIDY and log GCY	0.070 (0.93)		0.004 (0.99)	

Significance levels in parentheses.

a: F-tests on the following three sets of coefficient restrictions: 1) log AIDY=log $AIDY_{-1}$; 2) log GCY=log GCY_{-1}; 3) log AIDY=log $AIDY_{-1}$ and log GCY=log GCY_{-1} jointly.

Table 5.2.3.2. Edwards' Model OLS Estimates. Sample: 1967-1993. Long-run Solutions: Solved Static Long-Run Equations.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
CONSTANT	5.50 (0.92**)	4.12 (0.70**)	4.55 (0.98**)	3.34 (0.66**)
log INVY	0.66 (0.19**)	1.04 (0.20**)	0.71 (0.22**)	1.05 (0.20**)
log TOT	-0.66 (0.10**)	-0.66 (0.13**)		
log P_{OIL}			-0.50 (0.09**)	-0.51 (0.10**)
Δ log AIDY	0.80 (0.18**)	0.77 (0.26**)	0.60 (0.22**)	0.57 (0.27**)
Δ log GCY	-0.66 (0.24**)		-0.60 (0.27**)	
GROWTH	0.027 (0.013*)		0.024 (0.015)	
log TAR	-0.30 (0.13**)		-0.27 (0.15)	
NOMDEV	0.59 (0.34*)	1.61 (0.47**)	0.81 (0.40*)	1.73 (0.49**)
DEH	0.28 (0.26)	0.80 (0.37**)	0.23 (0.29)	0.69 (0.37*)

Standard errors in parentheses. * and ** denote 10% and 5% significance level, respectively.

Diagnostic Tests.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Wald Test χ^2	137.5 (0.00)	56.7 (0.00)	109.3 (0.00)	54.4 (0.00)
Unit Root t-test	-5.72*	-5.08*	-4.93*	-4.88*

For Unit Root t-test * denotes 5% significance level.

The equations perform well and there is no evidence of mis-specification. Moreover, cointegration is not rejected in any equation (see table 5.2.3.2)[15]. Results also support Edwards' view that nominal and real variables influence RER behaviour.

In general, the signs of the coefficients meet theoretical expectations and are significant, with some exceptions, most importantly real growth and DEH, and will be discussed in turn.

The positive and highly significant impact of investment suggests that investment in infrastructures and in export promotion has been successful in increasing

[15] The cointegration test used is the standard Pc-Give unit root tests for the residuals, which indicates cointegration if it is significant.

competitiveness. It should be reminded that the theoretical sign of the effect of investment on the ERER is ambiguous, as it depends on its composition and purpose. Similar results are obtained by Edwards (1989) and Pick and Vollrath (1994), although the size of the estimated coefficients is smaller in their works[16]. Note also the robustness of the coefficients, which range between .22 in model 1 and .23 in model 4 in the short run, while in the long run there is a larger difference between models 1 and 3 (with coefficients of .66 and .71) and the more restricted models 2 and 4 (with coefficients of 1.04 and 1.05).

There is evidence of a negative and highly significant impact of the terms of trade and of the real price of oil on the ERER. Comparing the two sets of regressions which use the terms of trade, model 1 and 2, with those which use the real price of oil, model 3 and 4, we can observe a slightly larger effect of the terms of trade relative to the real price of oil. This is more evident in the long run solution, where results are particularly robust, with -.66 for TOT and -.50/-.51 for P_{OIL} As mentioned above, given the large proportion of oil exports among Indonesian exports, the real price of oil is used as an alternative definition for the terms of trade. The RER appreciation which followed the 1973 and 1979 oil price shocks can thus be partly ascribed to the increase in the real price of oil. Although theoretically the effect of the terms of trade is ambiguous, our results confirm the common belief that the income effect dominates the substitution effect, which implies an equilibrium depreciation following worsening terms of trade. This is also in line with results obtained by Cottani, Cavallo and Khan (1990), Edwards (1989 and 1994), and Pick and Vollrath, although the size of the

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[16] Coefficients on investment range between: .073 and .148 in Edwards' pooled regressions and -.015 in Pick and Vollrath's pooled regressions, who use a RER definition which is the inverse of ours, so that the negative sign compares to our results.

estimated coefficients shows a great variability among these works. In contrast, White and Wignaraja (1992) obtain a positive sign[17].

As predicted by the theory, higher tariffs are shown here to induce an equilibrium real appreciation. However, the estimated coefficients for tariffs is moderately significant in model 1 (at 10%) and insignificant in model 3, while in the long run results for model 1 indicate a highly significant coefficient of -.30 and confirm an insignificant impact of tariffs for model 3. The short run findings confirms Edwards' (1994) results and suggests that the chosen proxy for trade controls, tariffs, may not be appropriate.

In contrast to theoretical expectations, the sign on real growth is positive although significant at 5% in model 1 and insignificant in model 4, and the same is obtained in the long run estimation. Once again, this may suggest that real growth is not a good proxy technological progress.

A notable feature of our empirical estimation is the finding that aid inflows and government consumption in differences not levels affect the ERER. We found that the specification using differenced logarithms performs better and simple F-tests, reported in table 5.2.3.1, provide statistical evidence for this finding. Both the growth rates of aid and of government consumption significantly affect the RER, positively and negatively, respectively, in the short run as well as in the long run. An increase in the rate of aid inflows leads to real depreciation, while accelerating public consumption causes real appreciation. As for aid, this results appear to contrast theoretical arguments

[17] Coefficients on the terms of trade range between: -4.7 and -.07 in Cottani et.al.'s pooled regressions; -003 and -.062 in Edwards' (1994) pooled regressions; .078 in Pick and Vollrath's pooled regressions, who use a RER definition which is the inverse of ours, so that the positive sign compares to our results; .121 in White and Wignaraja time series regression for the case of Sri Lanka.

that aid and capital inflows in general may induce real appreciation, a view which finds support in some empirical studies (see White and Wignaraja, who use aid inflows, and Cottani et. al., Edwards, Pick and Vollrath, who use capital inflows). However, the comparison with other empirical works is not straightforward given the different way in which aid influence the ERER, that is in differences and not in levels. In addition, it will be shown in the simulation exercise, presented in the next section, how aid contributed to stabilise, at least partly, RER behaviour. Our results confirm the need to interpret the macroeconomic impact of aid in dynamic terms, which we have stressed in chapter 3. The economic interpretation is that increasing aid inflows provide additional resources for implementing export oriented investments. This is confirmed by our earlier finding of aid's pro-investment bias in the fiscal response model presented in chapter 3. In addition, growing aid inflows may signal the business community, both domestic and foreign, of restored creditworthiness, of recipients' ability to use effectively additional resources and of good economic prospects. It should be stressed that the main issue here is not a sectoral analysis of the possible Dutch disease effect of aid on the RER, but rather on the role of aid inflows in influencing RER behaviour. However, even if sectoral issues are not considered here, as the RER represents the relative tradable/non-tradable price, the impact of aid on the real exchange rate can be linked to Dutch disease analysis.

As for government consumption, the interpretation of its impact on the ERER is more intuitive. Ever increasing public spending accelerates internal demand and is most likely to exhibit a pro-non-tradable bias, thus generating downward pressures on the ERER.

The disequilibrium sources of the RER dynamics are captured by the 'non-fundamental' disturbances, namely lagged RER, nominal devaluation and the measure of macroeconomic imbalance DEH (see equation (5.1)). Remember that the coefficient on lagged RER corresponds to (1-θ). As in equation (5.1), it gives an indication of the speed of adjustment of the RER to its equilibrium level. The estimated coefficients are highly significant in all regressions, but are slightly smaller than the values found by Edwards (ranging between .74 and .96) and White and Wignaraja (.82), although they are comparable to the value of .754 obtained by Pick and Vollrath. In economic terms, our results imply a moderately slow self-adjustment process of the RER to its equilibrium level, other things given.

Nominal devaluation significantly affects RER and has the correct sign. Its impact is relatively small when compared to Edwards' estimates of more than .40, but is closely comparable to Pick and Vollrath coefficient of .24. The implication of our results is that a nominal devaluation will be only partly reflected in RER depreciation, by inducing on impact a real depreciation which will range between 20% and 43%.

As for DEH, the corresponding coefficients are insignificnat in models 1 and 3, and significant in the more restricted models 2 and 4, both in the short and in the long run. The estimated coefficients are not very robust and, contrary to Edwards' findings, are positively signed, suggesting real depreciation coupled with growing monetised fiscal deficit.

5.2.4. Equilibrium RER.

An estimate of the equilibrium RER is obtained from the empirical equation for RER. In order to derive the ERER, we have to assume that no macroeconomic imbalances are present and that no nominal devaluation is occurring. This amounts to imposing that the coefficients of DEH and NOMDEVXM be equal to zero in equation (5.3). The parameters of ERER equation (equation (5.2)) are then calculated using the estimated coefficients of the regressions. In fact, these correspond to the long-run estimated coefficients on the fundamentals obtained in the solved static long run equations. Finally, ERER is computed using equation (5.3) and five years moving averages of the fundamentals, in order to smooth their time series behaviour[18].

From the estimate of the ERER it is possible to derive an indication not only of the ERER variability induced by changes in the levels of its fundamentals, but also of the deviation of the actual RER from its equilibrium level.

The following graph illustrates the estimated ERER obtained from model 1 ($ERER_1$, which includes the terms of trade among the fundamentals) and 3 ($ERER_3$, which includes the real price of oil among the fundamentals). The calculated percentage misalignment of the RER with respect to the ERER is also plotted. The formulas used in the calculations are also reported below.

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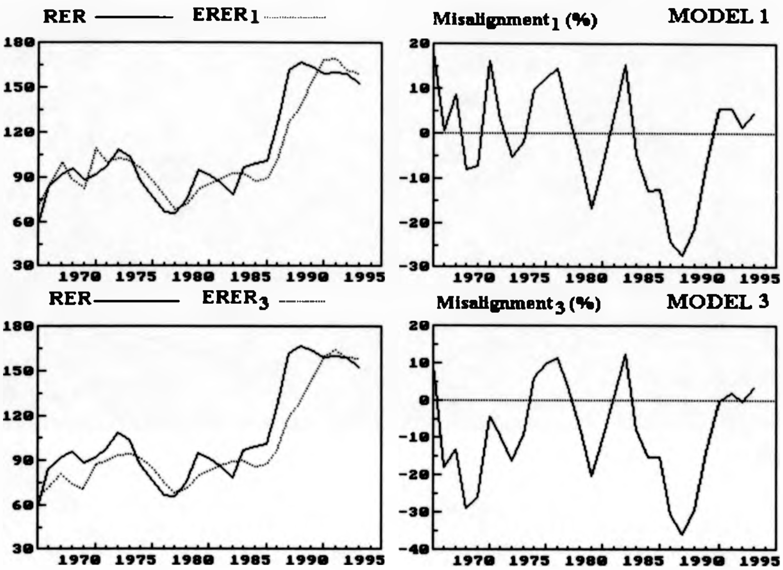
[18] The rational behind the choice of a five year time span for the moving averaging will be made clear in the next subsection. In short, we find a shock will be absorbed by simple RER self-adjustment in around 5 years.

Graph 5.2.4.1. Equilibrium Real Exchange Rates and Misalignment.



Where MA(.) is the moving average operator and for Model 1:

$\log ERER_1 = \; 5.50 \; +0.66*MA(\log INVY) -0.66*MA(\log TOT)$
$\qquad -0.30*MA(\log TAR) \; +0.027*MA(GROWTH)$
$\qquad +0.80*MA(\Delta\log AIDY) \; -0.66*MA(\Delta\log GCY)$

$Misalignment_1 = (ERER_1 - RER) / ERER_1 * 100$

and for Model 3:

$\log ERER_3 = \; 4.55 \; +0.71*MA(\log INVY) -0.50*MA(\log P_{OIL})$
$\qquad -0.27*MA(\log TAR) \; +0.024*MA(GROWTH)$
$\qquad +0.60*MA(\Delta\log AIDY) \; -0.60*MA(\Delta\log GCY)$

$Misalignment_3 = (ERER_3 - RER) / ERER_3 * 100$

Note that positive misalignment reflects overvaluation.

The figures support Edwards' proposition on the variability of the ERER, which therefore partly explain the actual RER variability. The two calculated ERER indices provide conflicting evidence for the pre-oil boom period. This is hardly surprising, given the relatively smaller weight of the oil sector in the Indonesian economy up to the early 1970's. The RER observed overvaluation after the 1973 oil price shock is reflected in positive misalignment for both ERER's between 1974 and 1978. The 1978 devaluation can be seen as being successful in reversing the rising appreciation of previous years and also in delaying the effects of the 1979 oil price shock. In fact, the second oil shock appears to have caused real appreciation in 1981. The devaluation in 1982 inaugurates a period of large negative misalignment, that is, of RER depreciation well above the equilibrium depreciation. In this respect, the 1986 devaluation appears to have widened even more the gap between the RER and its equilibrium level, thus demonstrating the strong pro-export stance of policy makers. The new exchange rate policy of the early 1990's, as mentioned in chapter 1 and 4, is aimed at maintaining a constant RER. From the graph, it appears not only that RER variability has considerably declined, but also that misalignment is now smaller than in previous decades. The economic implication is that actual RER reflects more realistically the Indonesian economy. What will happen under the newly introduced floating exchange regime (1997) will strongly depend on the policy makers' ability to closely monitor the behaviour of the fundamentals, given that nominal devaluation and monetary policy instruments cannot be relied upon anymore.

5.2.5. Final Remarks on Edwards' Approach.

To sum up, Edwards' approach has a number of advantages, but also some shortcomings. It is elegant though simple and gives a dynamic perspective to the issue of misalignment. Defining the RER in terms of fundamental determinants is more appealing than the PPP constancy (or relative constancy) statement. There exists a set of equilibrium values for the RER which are allowed to vary over time. Moreover, the model allows for short to medium run effects from non-fundamentals. Macroeconomic imbalances and nominal devaluations (revaluations) do affect the RER in the short to medium run (see also Isard, 1995), even if in the longer run their effect may disappear.

However, the presence of nominal devaluation in the empirical (reduced form) equation is a cause for concern. Given that the RER is defined as the ratio of tradable price to non-tradable price, in practice tradable price is obtained as the product of nominal exchange rate (NER) and international price (variously defined). NER is therefore present in both the right and the left hand side of the equation. Excluding nominal devaluation 'tout court' would eliminate any source of short-run fluctuation directly caused by nominal devaluations (revaluations). The existing empirical literature (Edwards, Pick and Vollrath, White and Wignaraja) consistently uses nominal devaluation as explanatory variable and its effect is always shown to be relevant. In following this empirical tradition we introduce an error correction equation for the Indonesian RER, which will be discussed in the next section. The error correction specification conceptually justifies the presence of nominal devaluation in the short run dynamic equation.

Another way to solve this problem is to explicitly model NER as an endogenous variable in the system. However, given that the model is completely real, this would complicate substantially the model. Moreover, the issue of NER determination is still a matter of debate. This particular aspect of RER determination is beyond the scope of this study and represents a fruitful future extension of the model and of RER determination research agenda.

5.3. An Error Correction Model for the RER.

Edwards' empirical specification for the ERER can be reinterpreted in terms of the Error Correction Model (ECM). Engle and Granger (1987) show that an adequate representation of cointegrated processes is given by the ECM.

More formally, consider a dependent variable y_t and a set of n explanatory variables x_{it}, where i=1,..,n. Suppose they all are non stationary, i.e. they contain a stochastic trend, and are integrated of the same order 1[19]. If there exists some linear combination of these series such that the disturbance term u_t from regressing y_t on the n x_{it}'s is stationary, i.e. of order I(0), then y_t and the n x_{it}'s are defined as cointegrated. Less technically, cointegrated series form an equilibrium long-run relationship and move together closely over time: even though they are themselves non stationary their relationship converges over time towards a long run equilibrium[20]. Moreover, the error correction theorem states that an error correction model exists for these cointegrated series (and conversely, that an ECM generates series which are cointegrated).

The error correction specification also represents a reparameterisation of a dynamic model. The error correction term reflects deviations from the long run equilibrium relationship and the coefficient attached to it measures the speed of adjustment to equilibrium. The impact effect is captured by the coefficients on the differenced explanatory variables. The appeal of the ECM lies therefore not only in its

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[19] A set of variables are said to be integrated of the same order *d*, I(*d*), if they have to be differenced *d* times to become stationary. I(1) variables need therefore to be differenced once.

[20] Note that the absence of cointegration gives rise to the problem of spurious regression.

statistical properties (classical inference is valid) but also in the long run and short run information on the properties of the process considered.

If a cointegrating relationship holds between the RER and its fundamental determinants, an ECM representation is an appropriate specification for the underlying data generating processes, as shown by Engle and Granger. More specifically, we can specify a long-run static (cointegrating) relationship and its related short-run dynamic model, the ECM representation.

Elbadawi (1994) presents an ECM model for the RER, which he then tests for the cases of Chile, Ghana and India. His model is related to Edwards' approach to modelling the behaviour of the RER in relation to its fundamentals, but is more parsimonious and assumes a forward looking behaviour for the ERER. The ECM modelling approach presented here is based on the RER model by Edwards, described in the preceding section. Therefore, it differs from Elbadawi's model not only on the theoretical ground but also at the empirical level, as different fundamentals are used, although a loose comparison can be established.

5.3.1. ECM Econometric Specification.

The econometric specification for RER behaviour for Indonesia is obtained from equation (5.4) by simply leaving out nominal devaluation and macroeconomic imbalances (DEH):

$$\begin{aligned} \log RER_t = (1-\theta)\log RER_{t-1} + \gamma_0 + \gamma_1 \log INVY_t + \gamma_2 \log TOT_t + \gamma_3 \log AIDY_t \\ + \gamma_4 \log GCY_t + \gamma_5 GROWTH_t + \gamma_6 \log TAR_t + u_t \end{aligned} \quad (5.5)$$

where the parameters correspond to those of equation (5.3) (and thus $\gamma_i = \beta_i * \theta$, see equations (5.1) and (5.2)) and the variables are defined as above (see equation (5.4)). The long run solution of equation (5.5) can then be derived and tested for cointegration and is given by:

$$\begin{aligned} \log RER = \beta_0 + \beta_1 \log INVY + \beta_2 \log TOT + \beta_3 \log AIDY \\ + \beta_4 \log GCY + \beta_5 GROWTH + \beta_6 \log TAR + u \end{aligned} \tag{5.6}$$

where $\beta_i = \gamma_i / \theta$. Note that equation (5.6) is directly comparable to the ERER specification of Edwards' model (i.e. equation (5.2)). If cointegration in equation (5.6) is not rejected, this equation can then be interpreted as the long run cointegrating equilibrium relationship between the RER and its fundamentals and can be rewritten in an ECM specification as follows:

$$\begin{aligned} \Delta \log RER_t = & \gamma_0 + \gamma_1 \Delta \log INVY_t + \gamma_2 \Delta \log TOT_t + \gamma_3 \Delta \log AIDY_t \\ & + \gamma_4 \Delta \log GCY_t + \gamma_5 GROWTH_t + \gamma_6 \Delta \log TAR_t \\ & - \theta ECM_{t-1} - \lambda\, DEH_t + \phi\, NOMDEV_t + u_t \end{aligned} \tag{5.7}$$

where Δ is the first difference operator and the parameters are as above. The coefficients γ_i's, can be reinterpreted as the impact effects of changes in the fundamentals. A self correcting mechanism is then given by the correction term ECM_{t-1}, which is defined as:

$$\begin{aligned} ECM_{t-1} = & \log RER_{t-1} - (\beta_0 + \beta_1 \log INVY_{t-1} + \beta_2 \log TOT_{t-1} + \beta_3 \log AIDY_{t-1} \\ & + \beta_4 \log GCY_{t-1} + \beta_5 GROWTH_{t-1} + \beta_6 \log TAR_{t-1}) \end{aligned} \tag{5.8}$$

This represents the RER short run deviation from its long run equilibrium level, as the terms in parenthesis incorporate the long run response, the β_i's, of the RER to the fundamentals. The advantage of the ECM specification is given by its ready economic interpretation: changes in the fundamentals' levels modify the equilibrium RER and thus call for an adjustment in the next period. The coefficient attached to the error correction term, θ, represents the feedback effect which removes disequilibrium each period following the resulting deviation. Therefore, it gives a measure of the speed of adjustment to equilibrium. A negative deviation implies a short term overvaluation which will be partly removed by the self correcting mechanism in the next period through a real devaluation, given the negative sign of θ. The higher is the value of θ the quicker the adjustment. Moreover, this parameter can be manipulated to derive the numbers of years necessary to eliminate a given percentage of exogenous shocks. The following formula can be used to compute the number of years it will take for the automatic adjustment to absorb an exogenous shock:

$$\log Y = T \log(1-\theta) \tag{5.9}$$

where Y is the percentage adjustment still to take place after T years, θ is as defined above and T is the number of years required to clear a proportion of (1-Y) of the shock[21].

In addition to the response to temporary changes in the fundamentals, short run dynamics may be influenced by macroeconomic imbalances and nominal devaluation. The terms NOMDEV and DEH, defined as in previous paragraph, capture these effects.

The ECM model described thus far can be shown to be equivalent to Edwards' partial adjustment specification of RER dynamics. Equation (5.1) is equivalent to equation (5.7) once the ERER, as defined in equation (5.4), is substituted into the partial adjustment term of equation (5.1). Conversely, if the long run specification (5.6) is interpreted as describing ERER, then the ECM term can be reinterpreted as:

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[21] An exogenous shock will be absorbed by θ in the first year following the shock, leaving out a residual (1-θ) times the shock. The adjustment in the second year will be equal to θ(1-θ) times the shock, while in the third year this will be given by $\theta(1-\theta)^2$ times the shock, and this continues until we have a residual $(1-\theta)^T$ times the shock at the T-th year. A logarithmic transformation of $(1-\theta)^T$ gives the formula (5.9).

$$ECM_{t-1} = \log RER_{t-1} - \log ERER_{t-1} \quad (5.10)$$

Therefore, if we add and subtract $\theta\,\beta_0$, $\theta\,\beta_1 \log INVY_t$, $\theta\,\beta_2 \log TOT_t$, $\theta\,\beta_3 \log AIDY_t$, $\theta\,\beta_4 \log GCY_t$, $\theta\,\beta_5\, GROWTH_t$, $\theta\,\beta_6 \log TAR_t$ to equation (5.7), we obtain equation (5.1), given that $\theta{*}\beta_i$'s=γ_i's.

5.3.2. Econometric Estimation.

The econometric estimation of the ECM model is implemented in three steps: first, we estimate the dynamic equation (5.5); second, the long run relation, equation (5.6), is derived and tested for cointegration; third, the ECM model, equation (5.7), is estimated. Note that the RER short run dynamics is fully captured by the ECM specification and not by equation (5.5), which represents the short run counterpart of the equilibrium RER.

The same variables and time sample used in the estimation of Edwards' model are also used here. As in the above estimations, we run two sets of regressions: Model 5, 7 and 8 use TOT while Model 6, 9 and 10 use P_{OIL}. Models 8 and 10 exclude Δ logTAR given its insignificance (see results for Models 7 and 9).

The following tables presents the results[22]: table 5.3.2.1 shows the results of the dynamic estimation and the estimated long run solution, while table 5.3.2.2 shows the results from the ECM regressions. The final table 5.3.2.3 reports the tests for the ECM

[22] As noted above, Δ denotes the difference operator.

model reduction. As noted above, since the equations are expressed in logarithmic terms the estimated coefficients can be readily interpreted as elasticities.

Time series properties of the real exchange rates have been described in chapter 4. Formal unit root tests for all the regressors are reported in appendix 12 and have been already commented in paragraph 5.2.3. Appendix 15 provides a brief guide to the diagnostic tests used.

Table 5.3.2.1. Dynamic Model OLS Estimates. Short Run and Long Run Cointegrating Regressions Sample: 1967-93.

	MODEL 5 Short Run Coeff (t-value)	MODEL 6 Coeff (t-value)	MODEL 5 Long Run Coeff (St.Err.)	MODEL 6 Coeff (St.Err.)
log RER_{-1}	0.60 (11.41***)	0.60 (8.87***)		
CONSTANT	2.43 (5.49***)	2.21 (4.14***)	6.05 (0.63***)	5.49 (0.72***)
log INVY	0.20 (3.86***)	0.18 (2.97***)	0.50 (0.12***)	0.44 (0.15***)
log TOT	-0.26 (-5.25***)		-0.64 (0.08***)	
log P_{OIL}		-0.20 (-3.84***)		-0.49 (0.08***)
Δ log AIDY	0.34 (8.18***)	0.31 (6.03***)	0.85 (0.15***)	0.78 (0.20***)
Δ log GCY	-0.32 (-3.98***)	-0.32 (-3.46***)	-0.79 (0.21***)	-0.81 (0.25***)
GROWTH	0.014 (3.42***)	0.014 (2.94***)	0.034 (0.01***)	0.035 (0.01***)
log TAR	-0.17 (-3.81***)	-0.17 (-2.99***)	-0.42 (0.09***)	-0.41 (0.11***)

Note: for t- values °, * , **, *** denote respectively 10%, 5%, 2,5% and 1% significance levels.

Diagnostic Tests

	MODEL 5 Short run	MODEL 6	MODEL 5 Long Run	MODEL 6
R^2	0.984	0.977		
F-test on Regressors (Short Run)	163.5 (0.00)	117.8 (0.00)		
Wald χ^2 (Long Run)			174.6 (0.00)	127.01 (0.00)
σ	0.044	0.051		
Durbin Watson	2.41	2.52		
RSS	0.037	0.051		
Unit Root t-test			-7.65***	-5.97***
AR 2 F	1.07 (0.37)	1.92 (0.18)		
ARCH 1 F	0.11 (0.74)	0.38 (0.55)		
Normality χ^2	0.43 (0.81)	0.29 (0.86)		
RESET F	1.10 (0.31)	0.90 (0.35)		
X_i^2 F	0.25 (0.98)	0.27 (0.97)		
VIT	0.106	0.226		
JIT	1.15	1.02		
Restrictions[a] on log AIDY	0.063 (0.80)	0.904 (0.35)		
Restrictions[a] on log GCY	0.201 (0.66)	0.038 (0.85)		
Joint Restriction[a] on log AIDY and log GCY	0.154 (0.86)	0.507 (0.61)		

Significance levels in parentheses. For Unit-Root t-test * and *** denote 5% and 1%, respectively.
a: F-test on the following three sets of coefficient restrictions: 1) log AIDY=log $AIDY_{-1}$;
2) log GCY=log GCY_{-1}; 3) log AIDY=log $AIDY_{-1}$ and log GCY=log GCY_{-1} jointly.

Table 5.3.2.2. ECM Model OLS Estimates. Sample: 1968-93.

	MODEL 7	MODEL 8	MODEL 9	MODEL 10
	Coeff (t-value)	Coeff (t-value)	Coeff (t-value)	Coeff (t-value)
CONSTANT	-0.07 (-3.14***)	-0.06 (-2.93***)	-0.07 (-3.08***)	-0.07 (-3.06***)
Δ log $INVY_{-1}$	-0.18 (-2.69**)	-0.19 (-2.75**)	-0.16 (-2.35*)	-0.16 (-2.38*)
Δ log TOT	-0.15 (-2.80**)	-0.11 (-2.55**)		
Δ log P_{OIL}			-0.11 (-2.39*)	-0.09 (-2.41*)
Δ Δ log AIDY	0.16 (3.81***)	0.13 (3.81***)	0.15 (3.74***)	0.14 (3.80***)
Δ Δ log GCY	-0.15 (-3.54***)	-0.14 (-3.28***)	-0.16 (-3.57***)	-0.15 (-3.55***)
GROWTH	0.007 (2.16*)	0.007 (2.02°)	0.007 (2.07°)	0.007 (2.08*)
Δ log TAR	-0.06 (-1.21)		-0.04 (-0.71)	
NOMDEV	0.48 (5.97***)	0.51 (6.64***)	0.50 (6.45***)	0.51 (6.82***)
$NOMDEV_{-1}$	-0.26 (-4.80***)	-0.27 (-4.86***)	-0.24 (-4.45***)	-0.24 (-4.51***)
DEH	-0.14 (-2.81**)	-0.13 (-2.65**)	-0.12 (-2.32*)	-0.12 (-2.30*)
ECM_{-1}	-0.47 (-8.40***)	-0.46 (-8.19***)	-0.46 (-7.66***)	-0.45 (-7.75***)

Note: for t- values °, * , **, *** denote respectively 10%, 5%, 2,5% and 1% significance levels.

Diagnostic Tests

	MODEL 7	MODEL 8	MODEL 9	MODEL 10
R^2	0.953	0.948	0.946	0.944
F-test on Regressors	30.5 (0.00)	32.7 (0.00)	26.3 (0.00)	30.1 (0.00)
σ	0.032	0.033	0.035	0.034
Durbin Watson	1.70	1.80	1.87	1.89
RSS	0.016	0.017	0.018	0.019
AR 2 F	0.68 (0.52)	0.51 (0.61)	0.64 (0.54)	0.52 (0.60)
ARCH 1 F	0.16 (0.69)	0.05 (0.82)	0.29 (0.60)	0.44 (0.52)
Normality χ^2	0.16 (0.92)	2.13 (0.34)	0.33 (0.85)	0.80 (0.67)
RESET F	0.09 (0.77)	0.12 (0.74)	0.01 (0.92)	0.003 (0.96)
VIT	0.396	0.380	0.168	0.202
JIT	2.67	1.86	2.00	1.50
Restrictions[a] on log AIDY	0.399 (0.54)		0.199 (0.66)	
Restrictions[a] on log GCY	0.0004 (0.98)		0.029 (0.87)	
Joint Restriction[a] on log AIDY and log GCY	0.200 (0.82)		0.127 (0.88)	
F-test[b] $Ecm(pos)_{-1}=Ecm(neg)_{-1}$	0.11 (0.75)[c]	0.02 (0.88)[d]	0.14 (0.71)[e]	0.20 (0.66)[f]

Significance levels are indicated in parentheses.
a: F-test on the following three sets of coefficient restrictions: 1) Δ log AIDY=Δ log $AIDY_{-1}$; 2) Δ log GCY=Δ log GCY_{-1}; 3) Δ log AIDY=Δ log $AIDY_{-1}$ and Δ log GCY=Δ log GCY_{-1} jointly.
b: F-test on the restriction that the coefficients on positive and negative values of the Ecm are the same.
c: Coefficient on positive and negative values of Ecm_{-1} respectively: -.50 and -0.45.
d: Coefficient on positive and negative values of Ecm_{-1} respectively: -.47 and -0.45.
e: Coefficient on positive and negative values of Ecm_{-1} respectively: -.41 and -0.48.
f: Coefficient on positive and negative values of Ecm_{-1} respectively: -.40 and -0.48.

Table 5.3.2.3. Tests for ECM Model Reduction.

Model Reduction	Degrees of Freedom	Model with Δ log TOT Test (Significance Level)	Model with Δ log P_{OIL} Test (Significance Level)
Model 1 → 2	F(1,12)	1.05 (0.33)	1.63 (0.22)
Model 1 → 3	F(3,12)	0.48 (0.70)	0.63 (0.61)
Model 2 → 3	F(2,13)	0.20 (0.82)	0.13 (0.88)
Model 1 → 4	F(4,12)	0.69 (0.61)	0.59 (0.67)
Model 2 → 4	F(3,12)	0.57 (0.64)	0.23 (0.87)
Model 3 → 4	F(1,15)	1.48 (0.24)	0.50 (0.49)

Model 1: Variables: CONSTANT, Δ log INVY, Δ log $INVY_{-1}$, Δ log TOT (or Δ log P_{OIL}), Δ log AIDY, Δ log $AIDY_{-1}$, Δ log GCY, Δ log GCY_{-1}, GROWTH, Δ log TAR, NOMDEV, $NOMDEV_{-1}$, DEH, ECM_{-1}, (k=14).

Model 2: Variables: CONSTANT, Δ log $INVY_{-1}$, Δ log TOT (or Δ log P_{OIL}), Δ log AIDY, Δ log $AIDY_{-1}$, Δ log GCY, Δ log GCY_{-1}, GROWTH, Δ log TAR, NOMDEV, $NOMDEV_{-1}$, DEH, ECM_{-1}, (k=13).

Model 3: Variables: CONSTANT, Δ log $INVY_{-1}$, Δ log TOT (or Δ log P_{OIL}), ΔΔ log AIDY, ΔΔ log GCY, GROWTH, Δ log TAR, NOMDEV, $NOMDEV_{-1}$, DEH, ECM_{-1}, (k=11).

Model 4: Variables: CONSTANT, Δ log $INVY_{-1}$, Δ log TOT (or Δ log P_{OIL}), ΔΔ log AIDY, ΔΔ log GCY, GROWTH, NOMDEV, $NOMDEV_{-1}$, DEH, ECM_{-1}, (k=10).

All the equations perform well and there is no evidence of mis-specification. In particular, the PcGive unit root tests shown in table 5.3.2.1 reject the null of no cointegration at 1% significance level for both Models 5 and 6 and thus suggest a cointegrating long run relationship between the RER and the fundamentals. Since the long run relationship is well determined, the error correction representation is a valid transformation of equation (5.5). The final short run dynamic model, see table 5.3.2.3, is then obtained using a general to specific sequential procedure, and the relevant F-tests are reported in table 5.3.2.3.

Unsurprisingly, the estimated coefficients confirm the results obtained from the estimation of Edwards' model (refer to paragraph 5.2.3 for their interpretation). Their signs are the same, although there are some slight differences in their magnitude, most notably the impact of aid and of government consumption. For instance, comparing Model 3 (table 5.2.3.1) with Model 6 (column 3, table 5.3.2.1), we can see that the impacts of aid and of government consumption rise from 0.20 to 0.31 and from -0.20 to -0.32, respectively. Other notable differences are that results here are more robust across each set of regressions (i.e. across Models 5 and 6 and across Models 7 to 10) and that all the coefficients are highly significant, with the only exception of lagged tariffs in Models 7 and 9[23]. As in previous regressions, the specification using differenced logarithms for aid inflows and government consumption perform better and simple F-tests, reported in table 5.3.2.1, provide statistical evidence for this finding. The same is found for the ECM regressions, where second differences are used and tested in a similar way (see table 5.3.2.2).

The ECM model discussed above explains the sources of short run dynamics of the RER: transitory movements in the fundamentals, macroeconomic imbalances, nominal devaluation and the self correcting mechanism. These will be discussed in turn.

As for transitory movements in the fundamentals, all of them but tariffs influence the RER in the short run. In general, their effect is consistent with the long run impacts, suggesting that worsening terms of trade, declining real oil price,

[23] In particular, all the coefficients are significant at the 1% level in Models 5 and 6. For the ECM regressions, almost all the coefficients are significant at the 5% level, with few exceptions, namely real growth in Models 8 and 9, significant at the 10% level, and tariffs, insignificant in Models 7 and 9.

accelerating aid inflows, decelerating government consumption and higher real growth lead to RER depreciation. However, as noted above, temporary changes in trade restriction, captured by Δ log TAR, do not exhibit a significant impact. In addition, in the ECM regression we found Δ log INVY to be significant only after on period, i.e. lagged, and with an opposite sign with respect to the long run impact. The interpretation is that higher investment leads to real equilibrium depreciation, but temporary movements will be felt in the next period following the increase. Since these have a negative impact (i.e. cause RER appreciation), they will almost entirely offset the ERER depreciation, but only in the short run. This result is interesting, as it shows the possibility of RER fluctuations arising after temporary shocks around the ERER.

Macroeconomic imbalances, proxied by DEH, lead to real appreciation, so that monetisation of fiscal deficit lead to real appreciation. This is in contrast to what was found in the estimation of Edwards' model, but meets theoretical expectations on the direction of its influence. It should be noted, that the coefficients on DEH where not particularly robust across Model 1 to 4, while in the ECM regressions they are robust and always significant at the 5% level.

As for nominal devaluation, the interesting finding is that on impact it explains around 50% of RER short run variation, which is higher than in the corresponding short run version of Edwards' model regressions. However, in the period following the devaluation episode, less than half of the nominal devaluation will be offset, although the total effect (impact plus lagged) is still positive. Given the high statistical significance of the coefficients attached to NOMDEV and lagged NOMDEV, this suggests that nominal devaluations may help convergence towards a higher ERER, that is real equilibrium depreciation. The same conclusion is drawn by Elbadawi for Chile and India.

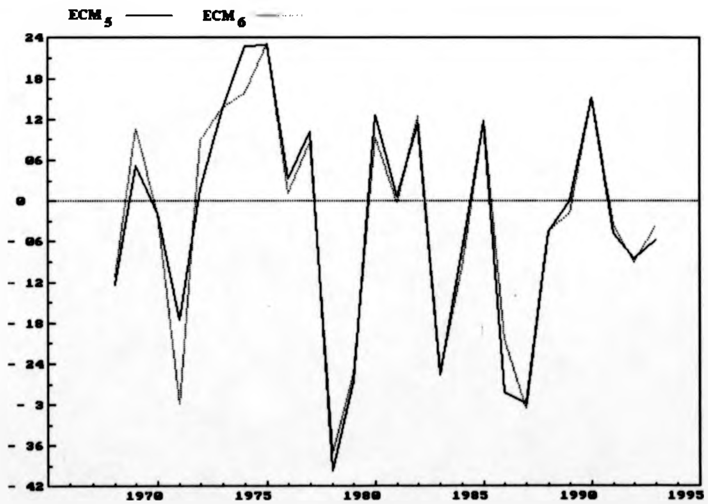
Finally, the highly significant and robust coefficients on the error correction term in Models 7 to 10 strongly support the ECM approach in modelling RER short run dynamics. The estimated values for θ range between .45 and .47 and show that RER adjusts moderately slowly to deviations from its equilibrium value, other things given. This implies that if changes in the fundamentals determine an ERER depreciation relative to the observed RER, in the subsequent period the dynamic self correcting mechanism will clear almost 50% of this disequilibrium and the RER will depreciate. Our estimate of the speed of adjustment is considerably lower than Elbadawi's values of .78 to .67, but confirm our earlier finding of a moderately slow adjustment process. The estimated (1-θ)'s in Models 1 to 4 (see table 5.2.3.1) range between .66 and 75, thus the θ's range between .44 and .35. Therefore, according to Edwards' model, the speed of adjustment is even slower. We have also tested whether a negative ECM has the same impact of a positive ECM using F-tests reported at the bottom of table 5.3.2.2. These show that the restriction that coefficients on positive and negative values of the ECM are the same cannot be rejected.

Using the formula (5.9) and the mean value of the estimated θ*'s* (-0.46), we have also found that in general the self correcting mechanism will clear 50%, 90% and 99.9% of an exogenous shock in 1.12, 3.74 and 7.47 years, respectively. In other words, in less than four years 90% of an exogenous shock will be automatically absorbed. By the end of the fifth year, there will only be a residual 2% of the shock to be cleared.

This justifies the choice of a five period moving average in the calculation of the ERER (see paragraph 5.2.4. and paragraph below).

The following graph illustrates the historical pattern of the error correction terms obtained from Model 5 (ECM_5) and 6 (ECM_6). These represent percentage deviations of the actual RER to its long run path over the period 1968-93 and are predominantly negative[24]. In particular, it can be seen that RER was considerably off equilibrium during the oil boom era and in the years immediately preceding the main devaluation episodes (1978, 1983 and 1986).

Graph 5.3.2.1. Dynamic Cointegrating Relations: Error Correction Terms for Model 5 (ECM_5) and Model 6 (ECM_6) 1968-1993. (Percentages)



[24] The mean for both ECM_5 and ECM_6 is -.03.

5.3.3. Equilibrium RER.

As in the preceding section on Edwards' model, we have derived an estimate of the equilibrium RER and the corresponding measure of misalignment. The long run solution estimated parameters for both Model 5 and 6 have been used together with five years moving averages of the fundamentals. While in theory the ERER's obtained from Edwards' model and from the ECM approach should correspond, in practice, this may not happen. In fact, the long run coefficients used in the first case are obtained from the static long run solution of the estimated dynamic model, which includes nominal devaluation and macroeconomic imbalances alongside the fundamentals. Even if non-fundamentals' disturbances are not included in the actual calculation of the ERER, they implicitly influence the ERER via the estimated coefficients on the fundamentals[25], except when they are not shown to be significant. In contrast, the estimated ERER obtained with the ECM approach is not influenced by temporary disturbances. This explain the slight discrepancies in the two sets of estimated ERER and in the corresponding measure for misalignment.

The graph below illustrates the behaviour of the estimated ERER for Models 5 ($ERER_5$) and 6 ($ERER_6$) and the corresponding measures of misalignment. The formulas used in the calculations are also reported.

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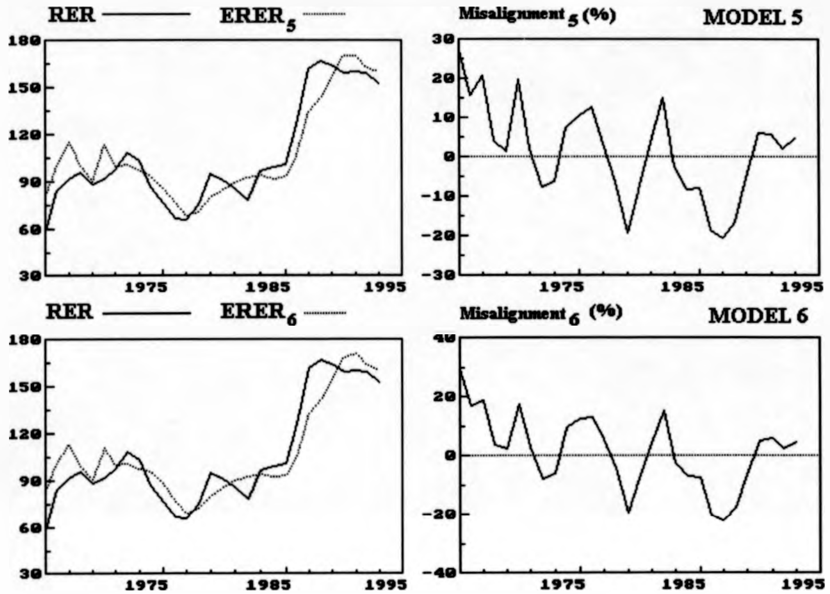
[25] Since nominal devaluation and macroeconomic imbalance are generally significant in Models 1 to 4, their omission would alter the value of the other coefficients.

Graph 5.3.3.1. Equilibrium Real Exchange Rates and Misalignment.



Where MA(.) is the moving average operator and for Model 5:

$$\log ERER_5 = 6.05 + 0.50*MA(\log INVY) - 0.64*MA(\log TOT) - 0.42*MA(\log TAR) + 0.034*MA(GROWTH) + 0.85*MA(\Delta \log AIDY) - 0.79*MA(\Delta \log GCY)$$

$$Misalignment_5 = (ERER_5 - RER) / ERER_5 * 100$$

and for Model 6:

$$\log ERER_6 = 5.49 + 0.44*MA(\log INVY) - 0.49*MA(\log P_{OIL}) - 0.41*MA(\log TAR) + 0.035*MA(GROWTH) + 0.78*MA(\Delta \log AIDY) - 0.81*MA(\Delta \log GCY)$$

$$Misalignment_6 = (ERER_6 - RER) / ERER_6 * 100$$

A comparison between graph 5.2.4.1 and the above figure shows that differences between $ERER_{1,3}$ and $ERER_{5,6}$ are more marked in the pre-oil boom period, especially for the ERER which includes the real price of oil. Once again, this can be imputed to the relatively smaller weight of the oil sector before the oil boom. However, the historical pattern of misalignment basically coincide after 1973 and confirm our earlier economic interpretation of misalignment (refer to paragraph 5.2.4).

It is also useful to compare the graphical patterns of the ECM and misalignment. Although they both describe disequilibrium patterns, these appear to be different. As noted above, the ECM describes the short run deviation of the actual RER from its long run equilibrium. This in turn is the cointegrating long run relation between the RER and its fundamentals. However, the measure of ERER which we obtain does not coincide with the long run estimated RER, because five years moving averages of the fundamentals are used in the calculation of the ERER instead of their actual values. Therefore, while the ECM reflects also temporary movements in the fundamentals, the calculated misalignment is obtained after smoothing out short run fluctuations in the fundamentals. This explains the different behaviour and the grater variability of the ECM compared to misalignment. In economic terms, we can interpret the ECM and misalignment as a measure of short run and long run disequilibrium, respectively, and can be both useful in policy making.

5.3.4. Simulation Exercise.

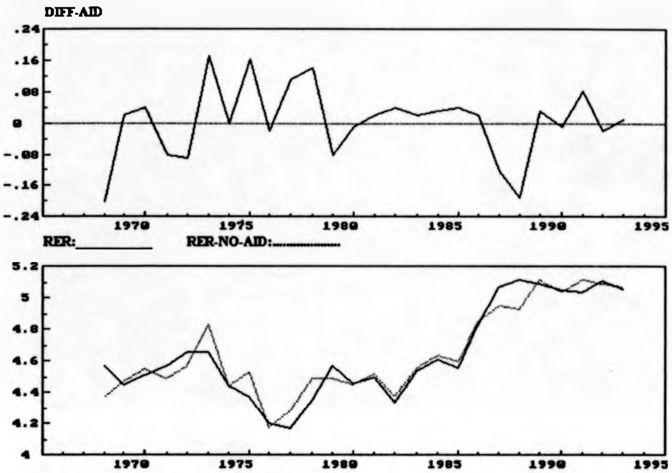
The question what would have happened to the Indonesian RER if a series of events had not happened can be answered simulating the ECM model described and estimated above[26]. In particular, we address the following questions: how much have aid inflows contributed to RER stability?; what has the role of government consumption been?; what would have happened to the RER had the oil price shocks not taken place?; what would have been the response of the RER in the absence of corrective nominal devaluations?; how much do trade controls influence the RER?; what is the overall effect of policy making on the RER? The simulations give an answer to past events and may thus offer a guide for the future.

The following graphs show the percentage difference between the base RER and the simulated RER which exclude some of the fundamentals or some exogenous shock. In particular, graph 5.3.4.1. refers to the simulation where $\Delta \log AIDY$ is zero, which implies either a constant flow of aid or no aid; graph 5.3.4.2 refers to the situation where government consumption grows at a constant rate; graph 5.3.4.3 demonstrates aid and government consumption's contribution to RER stability; graph 5.3.4.4 shows the hypothetical RER behaviour in the absence of the oil price shocks; the next graph describes how much the devaluations of 1978, 1983 and 1986 contributed to preventing real appreciation; graph 5.3.4.6 demonstrate the negative effect of trade controls on Indonesian competitiveness; the final graph summarises the impact on the RER of the policies implemented by the government.

[26] Simulations have been carried out using TSP386 and the parameters' estimates from Model 7. RER behaviour in the absence of oil price shocks has been simulated using Model 9 estimated parameters.

Graph 5.3.4.1. Aid's Contribution to RER Behaviour.

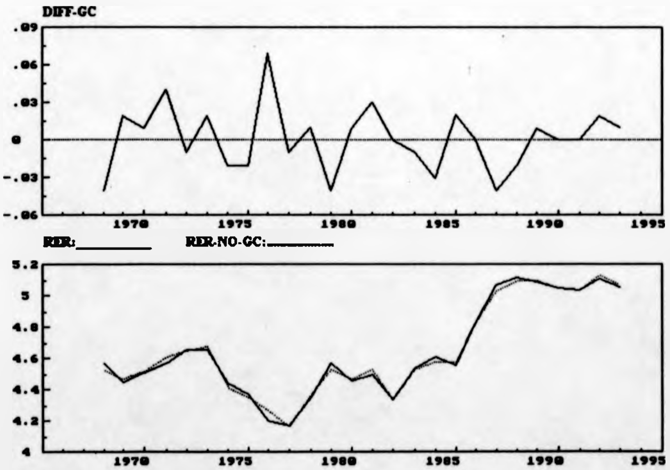
Percentage Difference (DIFF-AID) Between the RER Simulated Without Aid (RER-NO-AID) and the Simulated Base RER (RER).



RER and RER-NO-AID in logarithms.

Graph 5.3.4.2. Government Consumption's Contribution to RER Behaviour.

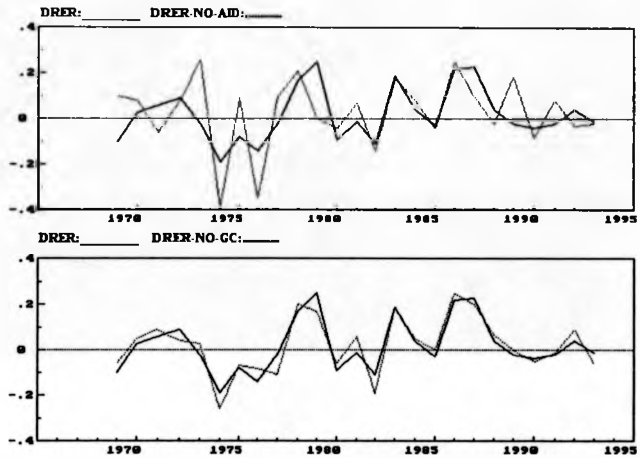
Percentage Difference (DIFF-GC) Between the RER Simulated Without Government Consumption (RER-NO-GC) and the Simulated Base RER (RER).



RER and RER-NO-GC in logarithms.

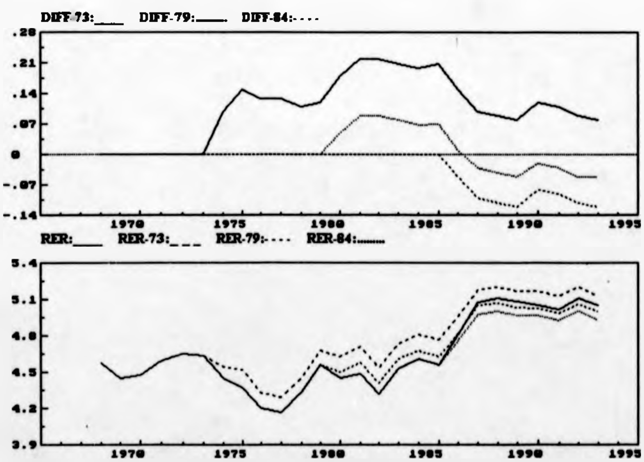
Graph 5.3.4.3. RER Variability With and Without Aid and Government Consumption.

Annual Percentage Changes of Simulated Base RER (DRER), the RER Simulated Without Aid (DRER-NO-AID) and the RER Simulated Without Government Consumption (DRER-NO-GC).



Graph 5.3.4.4. The Oil Price Shocks' Contribution to RER Behaviour.

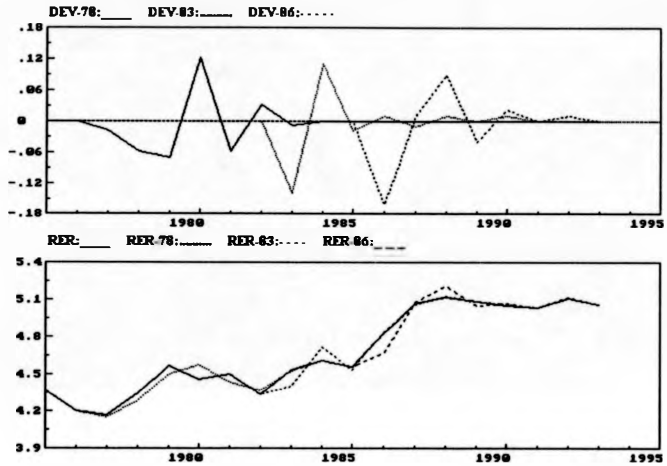
Percentage Difference (DIFF-73, DIFF-79, DIFF-84) Between the RER Simulated Without the 1973, 1979 and 1982/84 Oil Price Shocks (RER-73, RER-79, RER-84, respectively) and the Simulated Base RER (RER).



RER, RER-73, RER-79 and RER-84 in logarithms.

Graph 5.3.4.5. Nominal Devaluations' Contribution to RER Behaviour.

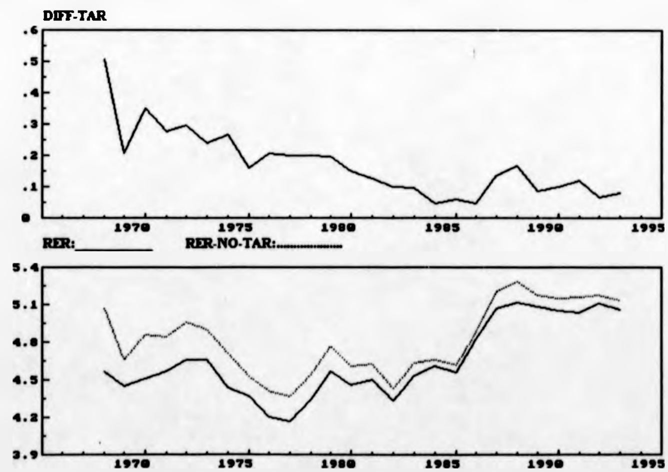
Percentage Difference (DEV-78, DEV-83, DEV-86) Between the RER Simulated Without the 1978, 1983 and 1986 Nominal Devaluations (RER-78, RER-83, RER-86, respectively) and the Simulated Base RER (RER).



RER, RER-78, RER-83 and RER-86 in logarithms.

Graph 5.3.4.6. Tariffs' Contribution to RER Behaviour.

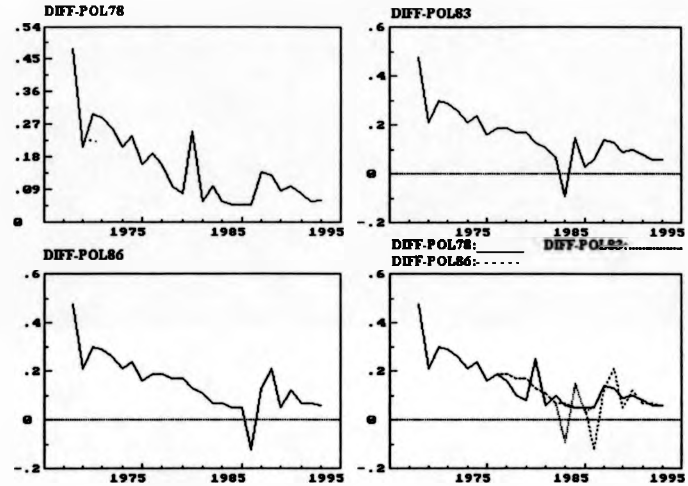
Percentage Difference (DIFF-TAR) Between the RER Simulated Without the Tariffs (RER-NO-TAR) and the Simulated Base RER (RER).

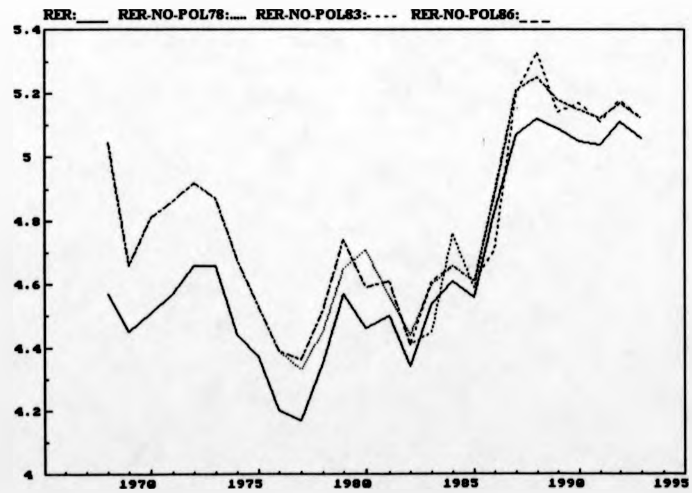


RER and RER-NO-TAR in logarithms.

Graph 5.3.4.7. Policy Impact on RER Behaviour.

Percentage Difference (DIFF-POL78, DIFF-POL83, DIFF-POL86) Between the RER Simulated Without Government Consumption, Tariffs and Nominal Devaluations in 1978, 1983 and 1986 (RER-NO-POL78, RER-NO-POL83 and RER-NO-POL86, respectively) and the Simulated Base RER (RER).





RER, RER-NO-POL78, RER-NO-POL83 and RER-NO-POL86 in logarithms.

Note that in all graphs percentage differences between the RER simulated without some of the fundamentals, or policy measures, and the simulated base RER denote real depreciation if positive, while negative values denote real appreciation. These differences can be interpreted in two ways. On the one hand, they show the real devaluation or appreciation that the RER would have undergone in the absence of external shocks or policy intervention. On the other hand, the contribution of such events is singled out and reflected in the differences.

In commenting the results from Models 1 to 9, we discussed the sign and size of the impact of fundamentals and non-fundamental disturbances on RER behaviour. The historical perspective which is offered by the simulation exercise can enrich the above discussion.

From the econometric estimations we found that aid and government consumption influence the RER in differences and not in levels. In particular, an acceleration in aid inflows leads to real depreciation, while expansive public spending causes real appreciation. Inspection of graph 5.3.4.1 and 5.3.4.3 shows that aid has reduced RER variability especially during the oil boom and in the late 1980's and early 1990's. Moreover, the marked increase in aid inflows during the years 1986-88 (namely, 25% in 1986, 61% in 1987 and 16% in 1988) prevented a real appreciation of almost 20%. The point we made in paragraph 5.2.3 of aid signalling the business community restored creditworthiness, government's ability of using effectively additional resources and good economic prospects is reinforced here by an additional perspective. The upper part of graph 5.3.4.3 clearly shows that in the absence of aid, or with constant aid inflows, the RER would have more volatile, or, conversely, aid provides a financial cushion to reduce RER variability. A volatile

RER fosters business uncertainty: on the internal side, domestic investment suffers from the lack of confidence and stability; while on the external side, foreign investment and private capital are not attracted by a situation of instability. Therefore, given the link of the RER with uncertainty, aid may play an important role in promoting stability and business confidence, thus boosting investment prospects and opportunities. Latest development appear to confirm this finding. By the end of October 1997 Indonesia obtained from the IMF a package of aid worth 23 billion dollars aimed at restoring economic agents' confidence in the Indonesian economy and at stabilising financial markets on the wake of the recent turmoil in East Asian financial markets[27].

Similar considerations can be made of public spending, although the scale of its impact is smaller (see graphs 5.3.4.2 and 5.3.4.3). The mean value of DIFF-NO-AID is 2.8% as opposed to a mean value of 2.1% of DIFF-NO-GC. Moreover, while DIFF-AID ranged between -19% and 17%, DIFF-GC ranged between -4% and 7% and. Note that these extremes correspond to a 16% drop government consumption growth in 1987 and to a 23% increase in 1975, respectively.

While aid can be negotiated but not controlled by the Indonesian government, public spending can play an active role in determining RER behaviour. Fiscal policy is thus confirmed to be important with respect to competitiveness.

Turning to the oil shocks' contribution to RER behaviour, from graph 5.3.4.4 we can observe a strong negative link. According to our simulations, the 1973 oil price shock has determined a massive real appreciation of 15% in 1975, which would have risen to a maximum 22% in 1981 in the hypothetical case of the absence of the

[27] Source: *Corriere della Sera*, November the 1st 1997.

1973 shock and the occurrence of the 1979 shock. The effect on the RER of the second oil shock was smaller and reached 9% in 1981. Finally, the drop in real oil prices in 1982/84 has contributed to a real depreciation of more than 10% in the late 1980's.

The interesting feature of the simulations without the 1978, 1983 and 1986 nominal devaluations is the relatively long persistence period of their effects (see graph 5.3.4.5). The 50% devaluation in 1978 affected the RER until 1981, with a peak in its effectiveness in 1980, when the RER depreciated by 12% in the simulation, that is other things given. Had the 37% devaluation not taken place in 1983, then the RER would have suffered, ceteris paribus, an immediate appreciation of 14%, a figure close to the effect of the 1986 50% devaluation (16%). From the simulations we also find that, on average, the effects of the three nominal devaluation episodes lasted six years.

The theoretical argument that trade controls lead to real appreciation is strongly supported by graph 5.3.4.6. Without tariffs, the RER would have been largely devalued, especially until the 1980's, when trade liberalization became more effective. It is thus important to monitor trade controls as they appear to impede competitiveness and represent a powerful policy instrument to promote competitiveness.

Finally, graph 5.3.4.7 presents combined simulations of policy tools influence on the RER. Government consumption, tariffs and nominal devaluation appear to influence markedly RER behaviour. The strong real appreciation they seem to have caused is mainly driven by the influence of trade controls. However, policy matters and can play a role not only in contrasting excessive appreciation, but also in stabilising the RER.

Looking ahead, the Indonesian government faces a period of exchange rate instability after the decision, in 1997, to opt for a flexible exchange rate and given the recent instability in East Asian financial markets. Fiscal policy and trade liberalisation should be closely monitored to influence RER behaviour. In addition, given aid's role in stabilising the RER, the negotiation of aid deals may take advantage of this positive side effect of aid.

5.5. Conclusions.

This chapter has presented an analysis of the Indonesian RER based on Edwards' approach and on its extension in terms of an ECM model. We have emphasised misalignment and short run disequilibrium issues. The Indonesian RER appears to have suffered from misalignment during the period under investigation (1968-1993), especially during the oil boom era and until the early 1990's. The results from the empirical estimation of RER behaviour show, among other things, that aid and the real price of oil do matter. Both act as fundamental determinants of RER behaviour and most importantly contribute to RER stability and the simulation exercise confirms this finding. Also, we find that a worsening in the terms of trade lead to real depreciation, a result which is in line with most empirical studies. Unsurprisingly, we find trade controls to hamper competitiveness. Domestic investment, on the contrary, appear to restore competitiveness. We do not find empirical evidence of a Bela-Balassa effect on the RER, that is technological progress linked to real appreciation, although this may be due to the use of real growth as a proxy to technological progress. Finally, our finding show that nominal devaluations have a relatively long-lasting effect on the RER in contrast to the view that nominal devaluation do not influence RER behaviour.

Exogenous shocks such as oil price sharp movements or aid inflows influence competitiveness but can hardly be influenced by policy makers. However, the Indonesian government can use fiscal policy, trade measures and investment incentives as a tool to influence and stabilise the RER. Correct RER alignment and stability have positive effects on competitiveness, on the domestic and foreign business community and on the overall economic prospects.

These results cannot be generalised and further research is necessary to compare the Indonesian case with other experiences in order to possibly draw a general lesson. In particular, the relationship between aid and the RER has not been widely studied. The widespread concern has been on the Dutch disease effect of aid or other external shocks. Our analysis has not be focused on this, but rather on more aggregated economic features of the Indonesian economy.

Appendix 12. Unit Root Tests for Regressors.

Table A.12.1. Unit Root Tests Full Sample: 1960-93.

	τ_τ	$\tau_{\beta\tau}$	$\tau_{\alpha\tau}$	Φ_3	Φ_2	τ_μ	$\tau_{\alpha\mu}$	Φ_1	τ
log AIDY	-2.65	-0.76	1.45	3.58	2.39	-2.58	1.59	3.33	-1.99
log INVY[a]	-1.31	0.94	1.74	1.36	3.20	-1.36	1.86	4.39	0.99
log TOT	-0.95	0.22	1.15	0.76	0.61	-1.23	1.30	0.91	0.40
log P_{OIL}	-0.80	-0.01	1.13	0.74	0.63	-1.24	1.33	0.97	0.42
NOMDEV	-3.61	-2.05	2.51	6.58	4.39	-2.85	1.50	4.06	-2.38
DEH	-4.06	2.13	-2.54	8.26	5.51	-3.28	-1.40	5.37	-2.92
GROWTH	-4.34	1.21	2.30	9.43	6.28	-4.14	3.69	8.57	-1.59
log TAR[b]	-3.41	-2.31	2.96	5.81	3.97	-2.34	1.88	2.86	-1.42
log GCY	-4.10	2.32	3.93	8.60	5.74	-3.22	3.19	5.19	-0.39
Critical values:		n=50	n=50	n=50	n=50		n=50	n=50	
5%	-3.55	2.81	3.14	6.73	5.13	-2.95	2.56	4.86	-1.95
2.5%		3.18	3.47	7.81	5.94		2.89	5.80	
1%	-4.26	3.60	3.87	9.31	7.02	-3.64	3.28	7.06	-2.63

Note: all tests are ADF(0) tests except where indicated. For a formal explanation of the tests and of the statistics reported in the table refer to chapter 4, paragraph 4.4.1.
a: ADF(2) for log INVY.
b: ADF(1) for log TAR.

Table A.12.2. Unit Root Tests. Sub-Sample: 1967-93.

	τ_τ	$\tau_{\beta\tau}$	$\tau_{\alpha\tau}$	Φ_3	Φ_2	τ_μ	$\tau_{\alpha\mu}$	Φ_1	τ
log AIDY[a]	-1.54	-0.38	0.53	0.95	0.68	-1.72	0.57	1.90	-1.89
log INVY	-3.20	2.60	3.66	7.00	7.17	-2.40	2.60	5.86	1.98
log TOT	-0.82	-0.38	1.24	1.18	0.92	-1.51	1.58	1.36	0.45
log P_{OIL}	-0.76	-0.68	1.47	1.54	1.24	-1.63	1.74	1.66	0.51
NOMDEV	-10.69	0.05	0.71	69.24	49.60	-12.01	2.37	77.49	-11.27
DEH[b]	-34.98	3.61	-5.01	712.86	502.83	-28.44	-3.34	479.75	-25,82
GROWTH	-5.23	-0.96	4.06	13.84	9.26	-5.18	4.93	13.48	-1.18
log TAR[c]	-3.42	-2.98	3.16	5.86	4.20	-1.47	0.98	1.40	0.18
log GCY	-2.68	1.07	2.69	3.62	2.43	-2.46	2.46	3.05	0.95
Critical values:		n=25	n=25	n=25	n=25		n=25	n=25	
5%	-3.59	2.85	3.20	7.24	5.68	-2.97	2.61	5.18	-1.95
2.5%		3.25	3.59	8.65	6.75		2.97	6.30	
1%	-4.34	3.74	4.05	10.61	8.21	-3.70	3.41	7.88	-2.65

Note: all tests are ADF(0) tests except where indicated. For a formal explanation of the tests and of the statistics reported in the table refer to chapter 4, paragraph 4.4.1.
a: ADF(1) for log AIDY.
b: ADF(1) for DEH.
c: ADF(1) for log TAR.

Table A.12.3. Unit Root Tests for Differenced Variables.

	1962-1993		1968-1993	
	Constant τ_μ	**No Constant** τ	**Constant** τ_μ	**No Constant** τ
Δ log AIDY	-7.12	-7.24	-8.06	-8.30
Δ log INVY	-7.03[a]	-6.31[a]	-8.37[a]	-6.45
Δ log LTOT	-4.81	-4.85	-4.32	-4.35
Δ log P_{OIL}	-4.51	-4.55	-4.12	-4.12
Δ NOMDEV	-6.88	-6.98	-10.28	-9.86
Δ log DEH	-7.51	-7.63	-9.54	-8.82
Δ log TAR	-3.83	-3.83	-7.86	-4.73
Δ log GCY	-10.93	-11.09	-9.63	-9.77
Critical values:				
5%	-2.96	-1.95	-2.97	-1.95
1%	-3.65	-2.64	-3.70	-2.65

Note: all tests are ADF(0) tests except where indicated. For a formal explanation of the tests and of the statistics reported in the table refer to chapter 4, paragraph 4.4.1.
a: ADF(1) for Δ log INVY.

Appendix 13. Edwards' Model: Full Sample OLS Estimates.

Table A.13.1. Edwards' Model OLS Estimates. Sample: 1961-1993.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
	Coeff (t-value)	Coeff (t-value)	Coeff (t-value)	Coeff (t-value)
log RER_{-1}	0.74 (23.26***)	0.75 (29.56***)	0.73 (22.91***)	0.75 (31.15***)
CONSTANT	0.87 (2.53**)	0.80 (4.42***)	0.94 (2.88***)	0.72 (4.58***)
log INVY	0.26 (5.37***)	0.28 (7.59***)	0.26 (5.62***)	0.29 (8.47***)
log TOT	-0.13 (-3.51***)	-0.13 (-4.20***)		
log P_{OIL}			-0.12 (-4.03***)	-0.12 (-4.95***)
Δ log AIDY	0.15 (3.33***)	0.08 (2.23*)	0.13 (2.99***)	0.06 (1.83°)
Δ log GCY	-0.26 (-2.55**)		-0.24 (-2.51**)	
GROWTH	0.006 (1.27)		0.005 (1.16)	
log TAR	-0.013 (-0.37)		-0.028 (-0.83)	
NOMDEV	0.36 (3.89***)	0.51 (7.86***)	0.37 (4.26***)	0.52 (8.64***)
DEH	0.08 (2.51**)	0.12 (4.90***)	0.08 (2.84***)	0.13 (5.30***)
Dummy 1965	-0.54 (-5.25***)	-0.66 (-6.84***)	-0.61 (-5.97***)	-0.70 (-7.73***)

°, * , **, *** denote significance at 10%, 5%, 2,5% and 1%, respectively.

Diagnostic Tests

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
R^2	0.986	0.981	0.987	0.984
F-test on Regressors	153.6 (0.00)	184.3 (0.00)	171.5 (0.00)	214.6 (0.00)
σ	0.051	0.056	0.049	0.052
Durbin Watson	1.65	1.53	1.69	1.58
RSS	0.058	0.078	0.052	0.067
AR 2 F	0.47 (0.63)	1.38 (0.27)	0.31 (0.74)	0.78 (0.47)
ARCH 1 F	2.04 (0.17)	0.24 (0.63)	3.07 (0.09)	1.31 (0.26)
Normality χ^2	0.27 (0.87)	2.44 (0.29)	0.25 (0.88)	3.46 (0.18)
RESET F	1.95 (0.18)	3.06 (0.09)	1.30 (0.27)	2.43 (0.13)
X_i^2 F		1.86 (0.16)		1.14 (0.42)

Significance levels in parentheses.

Table A.13.2. Edwards' Model OLS Estimates. Sample: 1961-1993. Long-run Solutions: Solved Static Long-Run Equations.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
CONSTANT	3.37 (0.99**)	3.24 (0.48**)	3.41 (0.86**)	2.86 (0.41**)
log INVY	1.02 (0.25**)	1.12 (0.18**)	0.95 (0.22**)	1.13 (0.16**)
log TOT	-0.51 (0.12**)	-0.55 (0.13**)		
log P_{OIL}			-0.46 (0.09**)	-0.48 (0.09**)
Δ log AIDY	0.60 (0.18**)	0.31 (0.14**)	0.48 (0.16**)	0.24 (0.13*)
Δ log GCY	-0.99 (0.36**)		-0.86 (0.32**)	
GROWTH	0.023 (0.02)		0.019 (0.02)	
log TAR	-0.05 (0.13)		-0.10 (0.12)	
NOMDEV	1.40 (0.45**)	2.08 (0.34**)	1.36 (0.40**)	2.07 (0.30**)
DEH	0.29 (0.13**)	0.51 (0.11**)	0.30 (0.11**)	0.50 (0.10**)
Dummy 1965	-2.10 (0.47**)	-2.68 (0.50**)	-2.22 (0.42**)	-2.76 (0.45**)

Standard errors in parentheses. * and ** denote 10% and 5% significance level, respectively.

Diagnostic Tests.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Wald Test χ^2	102.7 (0.00)	77.6 (0.00)	129.0 (0.00)	96.0 (0.00)
Unit Root t-test	-8.11***	-9.61***	-8.66***	-10.55***

For Unit Root t-test * and *** denote respectively 5% and 1% significance level.

Appendix 14. Edwards' Model Instrumental Variable Estimates.

Table A.14.1. Edwards' Model Instrumental Variable Estimates. Sample: 1967-1993.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
	Coeff (t-value)	Coeff (t-value)	Coeff (t-value)	Coeff (t-value)
log RER_{-1}	0.65 (8.90***)	0.75 (15.17***)	0.64 (7.67***)	0.75 (14.25***)
CONSTANT	1.98 (2.99***)	1.03 (3.87***)	1.77 (2.60**)	0.85 (3.37***)
log INVY	0.22 (3.62***)	0.25 (4.32***)	0.22 (3.21***)	0.26 (4.05***)
log TOT	-0.23 (-3.99***)	-0.16 (-4.47***)		
log P_{OIL}			-0.18 (-3.48***)	-0.12 (-3.97***)
Δ log AIDY	0.28 (3.60***)	0.20 (3.02***)	0.24 (2.68**)	0.17 (2.23*)
Δ log GCY	-0.24 (-2.23*)		-0.25 (-2.01*)	
GROWTH	0.01 (1.81°)		0.011 (1.65)	
log TAR	-0.12 (-1.69°)		-0.12 (-1.58)	
NOMDEV	0.15 (0.96)	0.36 (3.25***)	0.15 (0.82)	0.36 (2.78***)
DEH	0.08 (0.77)	0.19 (2.22*)	0.02 (0.19)	0.15 (1.72°)

°, * , **, *** denote significance at 10%, 5%, 2,5% and 1%, respectively.
Additional Instruments used: $LTOTWB_{-1}$, $DLAY_{-1}$, $NOMDEVXM_{-1}$.

Diagnostic Tests

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
IV χ^2	4.58 (0.10)	4.64 (0.10)	2.17 (0.34)	3.30 (0.19)
IV β=0	1276.3 (0.00)	967.7 (0.00)	995.5 (0.00)	873.0 (0.00)
σ	0.042	0.047	0.047	0.049
RF σ	0.045	0.066	0.055	0.074
Durbin Watson	2.08	1.96	2.19	1.97
RSS	0.029	0.044	0.037	0.049
AR 2 χ^2	1.21 (0.55)	0.18 (0.91)	0.82 (0.66)	0.29 (0.86)
ARCH 1 F	1.01 (0.33)	0.10 (0.76)	0.12 (0.73)	0.16 (0.70)
Normality χ^2	1.08 (0.58)	0.36 (0.83)	0.51 (0.77)	0.53 (0.77)
X_i^2 F		0.51 (0.85)		0.74 (0.69)

Significance levels in parentheses.

Table A.14.2. Edwards' Model Instrumental Variable Estimates. Sample: 1967-1993. Long-run Solutions: Solved Static Long-Run Equations.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
CONSTANT	5.65 (0.98**)	4.13 (0.70**)	4.90 (1.00**)	3.38 (0.67**)
log INVY	0.62 (0.22**)	1.02 (0.20**)	0.61 (0.24**)	1.01 (0.21**)
log TOT	-0.66 (0.10**)	-0.65 (0.13**)		
log P_{OIL}			-0.49 (0.09**)	-0.48 (0.11**)
Δ log AIDY	0.81 (0.18**)	0.81 (0.28**)	0.66 (0.22**)	0.66 (0.32**)
Δ log GCY	-0.69 (0.25**)		-0.69 (0.29**)	
GROWTH	0.028 (0.01**)		0.03 (0.02)	
log TAR	-0.33 (0.15**)		-0.34 (0.16**)	
NOMDEV	0.44 (0.53)	1.45 (0.59**)	0.42 (0.59)	1.43 (0.64**)
DEH	0.22 (0.30)	0.75 (0.39*)	0.06 (0.34)	0.60 (0.39)

Standard errors in parentheses. * and ** denote 10% and 5% significance level, respectively.

Diagnostic Tests.

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Wald Test χ^2	147.8 (0.00)	57.8 (0.00)	123.2 (0.00)	54.2 (0.00)
Unit Root t-test	-4.79*	-5.03*	-4.33	-4.82*

For Unit Root t-test * and *** denote respectively 5% and 1% significance level.

Appendix 15. Abbreviations for Diagnostic Tests.

R^2	Coefficient of determination of the regression
F-test on Regressors	F-test on the joint significance of all explanatory variables except the constant
RSS	Residual sum of squares
σ	Standard error of the regression
RF σ	Reduced Form σ (Instrumental variables estimation)
Durbin Watson	Durbin Watson test for first order autocorrelation
IV χ^2	χ^2 test for the validity of the choice of the instrumental variables used
IV β=0	χ^2 test on the joint significance of reduced form explanatory variables except the constant
AR 2 F, AR 2 χ^2	Breusch-Godfrey Lagrange Multiplier (LM) test for serial correlation up to the second lag (F- and χ^2 forms).
ARCH 1 F	LM F-test for autoregressive conditional heteroscedasticity up to the first lag
N χ^2	Doornik and Hansen χ^2 test for univariate normality of the residuals
X_i^2 F	White's F-test for heteroscedasticity using squares
RESET F	Ramsey's general F-test of misspecification
VIT	Variance instability test
JIT	Joint instability test for all the parameters in the model
Wald χ^2	Wald χ^2 test on the joint significance of long-run coefficients (except the constant)
Unit Root t-test	Pc-Give unit root test: if significant, it indicates cointegration

These tests are the standard output of the econometric package used, PcGive 8.0 and PcFiml 8.0. Full references and explanations for each test are available in most standard econometric textbooks, as well as in PcGive and PcFiml manuals.

CONCLUSIONS

This thesis has investigated theoretical and empirical issues related to aid effectiveness and the Indonesian economy. In various occasions, we have also emphasised the need for a careful methodological discussion. We have modelled and tested empirically the impact of aid on government behaviour. The statistical properties of the Indonesian real exchange rate (RER) have then been investigated and a model of RER determination has been discussed and tested econometrically. As mentioned in the introduction, the logical link between the fiscal response model and the analysis of RER behaviour is given by the emphasis on the macroeconomic effectiveness of aid. The methodological issues raised throughout the thesis are instrumental to pointing out the need for a more rigorous treatment of data, definitions and empirical specification of otherwise well defined theoretical models. This concluding chapter presents the main results from the individual approaches, i.e. fiscal response model and RER behaviour, and attempts to draw a summarising lesson.

Fiscal Response Model

The general lesson we draw from our analysis is threefold. On the aid issue, we conclude with a positive assessment of aid giving, provided it is given in loans. The burden of repayments prevents the misuse of external finances and stimulates a commitment to a 'virtuous' fiscal behaviour. Loans are found to encourage tax collection, public and private investment and consumption so that the whole economy benefits. On the contrary, total combined aid, grants, multilateral and bilateral aid negatively affect all fiscal variable as well as income and consumption. However, they reduce public consumption more than investment, thus exhibiting a pro-investment bias.

The second consideration is one of rethinking the modelling approach. The lack of consensus on aid effectiveness which emerges from the existing fiscal response literature is an indicator that this modelling approach presents some weaknesses. Further research should move towards a more realistic extension of the model which includes the monetary sector in the theoretical framework, in order to take into account interest rates, inflation and monetary policy issues. Another important theoretical contribution would be the introduction of an asymmetric objective function for the government consistent with utility maximisation when targets are met. Further investigation is also needed to explain the nature of the budget constraint, that is whether it is linear or kinked, single or dual.

We have stressed the importance of static feedback effects and of dynamic linkages. It is our contention that their role is a crucial one in understanding aid effectiveness and must not be underestimated. For instance, if an investment project is financed by foreign aid, the effects of this inflow will necessarily distributed over time and will have also feedback effects on the economy via the Keynesian multiplier.

Finally, the disaggregation of aid into grant and loan and into bilateral and multilateral aid has shown different impact of each aggregate, when compared to total combined official aid. It is thus important to take into account the forms and the nature in which aid is given. There is a variety of alternative aid disaggregations. One of the most significant ones refers to the distinction between tied versus untied aid and is related to the issue of the conditions attached to aid inflows the receiver has to fulfil. This has interesting policy and political implications, especially in terms of international relationships.

The final consideration focuses on methodological aspects. In implementing empirically the fiscal response model, we have used various specifications dependent on the choice of aid's disaggregation procedure. We have also used two different datasets for aid and government data, given the differences between the official international and national data. The fact that our results change across the models and depending on the dataset used is likely to be an indicator that they are not too robust. The issue of the choice of data is shown to be a source of potential misinterpretation of results. At the same time, the estimation method is also important. The poor performance of our model when estimated simultaneously, with 3SLS estimation techniques, is probably due to the lack of degrees of freedom. What is cause for concern is the poor discussion of both issues in the existing literature. It is worth stressing how results heavily depend on the datasets used and on the estimation techniques employed. Moreover, results are comparable only if similar data conventions are adopted.

The investigation on RER behaviour and determination has been carried out at two distinct but complementary levels. First, we have presented an overview of the main problems related to the definition and measurement of the real exchange rate. We have then modelled RER behaviour and studied the impact of its fundamental and non-fundamental determinants.

A set of real effective exchange rate (REER) indexes for the Indonesian rupiah has been computed and their statistical properties analysed. Unit root testing has been extensively used to test for stationarity. The issue of RER stationarity is closely related to the purchasing power parity (PPP) debate. In the PPP context, if the RER shows no tendency to return to its mean or trend, long run PPP cannot be confirmed. On the contrary, a tendency of the RER to return to its mean value is regarded as a necessary condition for PPP to hold.

We have started with simple ADF tests, followed by rolling, recursive and sequential ADF tests. The possibility of breaks has been tested using Perron's methodology, which we have slightly extended to include a break in the mean and in the trend at different years. As a conclusion, we have consistently rejected the hypothesis of REER stationarity except in those cases in which the full sample series have been used and/or two breaks have been allowed. In those cases results show stationarity, but we should treat them more as indicative than as definitive. A much longer time series would be most appropriate, and results from a test based on a much larger sample size would be less suspicious.

Further research could bring a comparative perspective in order to determine whether the behaviour of the Indonesian REER matches other countries REERs.

The analysis of the determination of the Indonesian RER is based on Edwards' (1989) approach and on its extension in terms of an ECM model. Central to the analysis is the role economic fundamentals, and in particular aid inflows and the price of oil, have in determining RER behaviour. Exchange rate management has played a significant role in Indonesia as an instrument to ensure competitiveness during and after the oil boom.

We have tested the two models, i.e. Edwards' model and the ECM extension, and emphasised misalignment and short run disequilibrium issues. As in the fiscal response case, simulation exercises have been carried out to study the influence of external shocks and policy options on the RER.

Recent discussion among development economists has emphasised the role of correct real exchange alignment, that is a sustainable level of the RER which reflects the economic fundamentals of the country. Edwards has also developed the concept of an equilibrium RER which reflects internal and external equilibrium and which is allowed to vary in response to changes in the fundamentals. Real overvaluation is particularly harmful to competitiveness and may hamper the development of the export oriented sector, thus preventing an export-led growth process. In addition, RER stability is important to reduce uncertainty and contribute to business confidence in investing in the country.

The Indonesian RER appears to have suffered from misalignment during the period under investigation (1968-1993), especially during the oil boom era and until the early 1990's. The results from the empirical estimation of RER behaviour show, among other things, that aid and the real price of oil do matter. Both act as fundamental determinants of RER behaviour and most importantly contribute to RER stability and the simulation exercise confirms this finding. An interesting feature of aid's impact is that aid inflows appear to influence RER in differences and not in levels. This implies that a constant flow of aid monies does not appear to modify the RER, while accelerating aid inflows lead to real depreciation. Similarly, government consumption influences the RER in differences and not in levels, although the sign of its impact is negative. Ever growing public consumption causes real appreciation. This result indicates the importance of cautious fiscal management and of monitoring public consumption for the RER. Also, we find that a worsening in the terms of trade leads to real depreciation, a result which is in line with most empirical studies. Unsurprisingly, we find trade controls to hamper competitiveness. Domestic investment, on the contrary, appears to restore competitiveness. We do not find empirical evidence of a Bela-Balassa effect on the RER, that is technological progress linked to real appreciation, although this may be due to the use of real growth as a proxy to technological progress. Finally, our findings show that nominal devaluations have a relatively long-lasting effect on the RER in contrast to the view that nominal devaluation does not influence RER behaviour.

Exogenous shocks such as oil price sharp movements or aid inflows influence competitiveness but can hardly be influenced by policy makers. However, the

Indonesian government can use fiscal policy, trade measures and investment incentives as a tool to influence and stabilise the RER. Correct RER alignment and stability have positive effects on competitiveness, on the domestic and foreign business community and on the overall economic prospects. The floating of the rupiah in August 1997 adds a new challenge to the Indonesian government. Nominal devaluation cannot be relied upon anymore to influence competitiveness. Therefore, it is on the fundamentals that policy makers should rely in order to attain competitiveness, RER stability and thus credibility on the international markets. The positive side-effects of the financial turmoil of recent months is thus the growing emphasis on the real economy.

These results cannot be generalised and further research is necessary to compare the Indonesian case with other experiences in order to possibly draw a general lesson. In particular, the relationship between aid and the RER has not been widely studied. The widespread concern has been on the Dutch disease effect of aid or other external shocks. Our analysis has not be focused on this, but rather on more aggregated economic features of the Indonesian economy.

A Summing Up

Indonesia faces medium to long run prospects of growth and development, provided stable macroeconomic foundations ensure increases in efficiency and productivity. The development strategy of the government for the medium run is focused on reducing regional differences through decentralisation of development planning at a regional level; increasing the role for the private sector through further deregulation; continuing the globalisation policies of the 1990's to boost foreign investment further; improving health and education and investing in human capital; and following a sustainable resource management, which protects the environment. Growth is projected at an average 7.1% per annum by the end of Repelita VI (1999). Main sources of growth are expected to be high domestic demand on the expenditure side, while on the production side the main contribution will come from the manufacturing and infrastructure related sectors, notably telecommunications and power generation on the production side.

Foreign direct investment is projected to continue the rising trend of the past few years; consequently, capital inflows should remain high and mainly destined to finance activities in the private sector. Therefore, the issue of RER management and stability is crucial in order to increase certainty and business confidence on Indonesian prospects.

As world economic growth recovers, Indonesian non-oil exports are expected to increase, in response also to persistent government efforts towards trade liberalisation, restored competitiveness and expanded domestic capacity.

After the floating of the rupiah in August 1997, a challenge for the Indonesian government is represented by dealing with the impact of the new regime on the rupiah through sound macroeconomic policies. The early stages of a floating exchange rate system are generally characterised by substantial fluctuations and speculation.

The main lesson from this thesis is that aid may be fruitfully used to support both private and public investment: we found that aid exhibits a pro-investment bias and that it contributes to RER stability. In this respect, the results from the fiscal response study complement the findings from the RER analysis in pointing out a role not only for aid but also for government intervention. Aid is found to affect both fiscal behaviour and RER movements. Therefore, policy makers need to take into account the implications of fiscal policies and aid management.

The new developments in the East Asian markets point out the need to focus more on the economic fundamentals in order to prevent speculative disruption. As for Indonesia, after the floating of the rupiah in August 1997, the role of government policies - and also of its political conduct - becomes even more important not only for internal purposes, but also with respect to international competitiveness and credibility. Aid can help not only in the development process, but also in providing financial 'cushion resources' to stabilise the RER. In this respect, further research should investigate the relationship between government behaviour and exchange rate management in the presence of aid.

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