Chapter 5

EMPIRICAL RESULTS

5.1 Introduction

In this chapter the system of equations in section 4.3.1 will be estimated using the data from the sources in section 4.3.3. The method of estimation will be explained in section 5.2. Section 5.3 talks briefly about the problem of serial correlation in time series data. Section 5.4 presents the results of the estimation.

5.2 Estimation method

The method of Ordinary Least Squares (OLS) can be used to estimate a system of equations only when there is no contemporaneous correlation or the independent variables are exactly the same for all equations in the system. This is not the case for the system of equations in this study. The methods that are widely used to estimate a system of equations that are suggested in the literature are Two Stage Least Squares (2SLS) and Three Stage Least Squares (3SLS). 2SLS instead of 3SLS is used in this study because it is a single equation method in the context of a simultaneous system and therefore it is less sensitive to the specification error of some part of the model. This means that those parts of system that are correctly specified should not be affected by error specifications in another part (Gujarati 1988, p. 595).

It is widely acknowledged that applying the OLS method to estimate a simultaneous model with different sets of independent variables and/or with contemporaneous correlation will result in biased and inconsistent estimates. This is because the error terms are correlated with the explanatory endogenous variables. Furthermore, tests of hypotheses on parameters will not be valid (Ramanathan 1989, p. 491). The idea behind the 2SLS method is, therefore, to make the explanatory

endogenous variables uncorrelated with the error terms (Chang, S. 1984, p. 125). The general procedure of 2SLS estimation is, firstly, to estimate each of the explanatory endogenous variables as functions of all predetermined variables in the whole model using the OLS method. The second stage of the 2SLS method is to estimate by using the OLS method the original equations by replacing observations of explanatory endogenous variables with predicted values of the same variables which are obtained from the first stage of estimation.

The 2SLS estimator is derived as follows. Let the statistical model for the i^{th} equation be written as:

$$\begin{aligned} y_i &= Y_i\gamma_i + X_i\beta_i + \varepsilon_i \\ &= Z_i\delta_i + \varepsilon_i \end{aligned}$$

where,

$$Z_i = [Y_i : X_i],$$

$$\delta_i = \begin{bmatrix} \gamma_i \\ \beta_i \end{bmatrix}$$

y_i is a (Nx1) vector of observations of the left-hand side dependent variable. Y_i is a (Nx(m_i-1)) matrix of jointly endogenous variables on the right hand side of the i^{th} equation. m_i is the total number of endogenous variables in the i^{th} equation so (m_i-1) is the number of right-hand side endogenous variables in the i^{th} equation. X_i is a (NK_i) matrix of exogenous variables in the i^{th} equation. K_i is the number of right-hand side exogenous variables in the i^{th} equation. ε_i is a (Nx1) vector of disturbances. The total number of unknown parameters in δ_i , is p_i=m_i+K_i-1.

The 2SLS estimator is defined as:

$$\hat{\delta_i} = \left[Z'_i\, X(X'X)^{-1}X'Z_i\right]^{-1} Z'_i\, X(X'X)^{-1}X'y_i$$

the covariance matrix is:

$$\hat{\text{cov}}(\hat{\delta_i}) = \left[Z'_i\, X(X'X)^{-1}X'Z_i\right]^{-1}$$

and the estimator for σ^2 is:

$$\hat{\sigma}^2 = \frac{[y_i - Z_i\hat{\delta}_i]'[y_i - Z_i\hat{\delta}_i]}{N}$$

5.3 Serial correlation in a simultaneous model

Because the variables in the model in this study are time series variables, the reliability of the model will depend on whether or not autocorrelation is present. If autocorrelation occurs in some or all of the equations in a simultaneous model, applying 2SLS to the model is questionable and a modified procedure may be required (Ramanathan 1989, p. 498).

The most widely accepted way of testing whether or not the residuals of a regression model exhibit a serious level of autocorrelation is to use the Durbin-Watson (D-W) statistic to test the hypothesis H_0 : no autocorrelation against H_1 : there is autocorrelation.

5.4 Estimation results

Table 5.1 below summarises the 2SLS estimates of the model which consists of eight equations. The table also reports *t*-statistics and *D-W* statistics. *t*-statistics are used at the 5 per cent and 10 per cent significant levels of coefficient estimates. The *D-W* statistic is used to see if autocorrelation presents.

Foreign Reserves (equation 4.5)

All coefficient estimates have the expected signs that is the growth of the natural log of real foreign reserves, $\Delta\ln(R/P)_t$, is positively related to the natural log of domestic real output $\ln(Y_t)$, negatively related to the natural log of the previous real money stock $\ln(M/P)_{t-1}$, negatively related to the growth of the natural log of real domestic credit $\Delta\ln(D/P)_t$, and positively related to the growth of the natural log of real net other items $\Delta\ln(NOI/P)_t$. Looking at the t-statistics, the only coefficient which is not significantly different from zero, even at the significance level of 10 per cent, is the real domestic interest rate *(rd)*. Therefore, it is evident that changes in the foreign reserves are related to the excess demand for money which is only captured by the domestic real output and the net other items which are not met by changes in the domestic credit as the MABP suggests. The D-W statistic suggests no autocorrelation in this equation.

Table 5.1: Estimated Model, 1971-1992

(1) Foreign Reserves (equation 4.5):

$$\Delta \ln(R \hat{/} P)_t = \underset{(-1.624)}{-50.110} + \underset{(1.823)}{9.4842}^{**} \ln Y_t + \underset{(1.227)}{8.8275}(rd)_t - \underset{(-3.269)}{5.9333} * \ln(M/P)_{t-1} - \underset{(3.926)}{10.012} * \Delta \ln(D/P)_t + \underset{(-1.867)}{5.4755}^{**} \Delta \ln(NOI/P)_t$$

$D-W = 2.0792$

(2) Exchange Rate (equation 4.10):

$$\Delta \ln \hat{e}_t = \underset{(7.638)}{3.6758}^{*} + \underset{(2.858)}{.11441} \ln^{*}(R/D)_{t-1} + \underset{(2.545)}{.045798} * \ln(R/NOI) - \underset{(-3.560)}{.80940}^{*} (\Pi - \Pi_f)_t - \underset{(-7.017)}{.53091} * \ln e_{t-1}$$

$D-W = 1.6683$

(3) Wholesale Prices (equation 4.11):

$$\Delta \ln(\hat{P}w)_t = \underset{(1.377)}{.061211} + \underset{(3.301)}{.58433} * \Delta \ln(Pm)_t + \underset{(.6906)}{.13654} \Delta \ln(Px)_t$$

$D-W = 1.9556$

(4) Consumer Prices (equation 4.13):

$$\Delta \ln \hat{P}_t = \underset{(2.370)}{6.1110}^{*} - \underset{(-1.485)}{.084613} \ln(M/P)_{t-1} - \underset{(-1.870)}{.50722}^{**} \ln(Y)_t - \underset{(-2.126)}{.88577}^{*} (rd)_t - \underset{(-2.272)}{.00003426} * \ln(Y/Ytr)_t + \underset{(.5849)}{.10419} \ln(Pw)_t$$

$D\text{-}W = 2.3532$

(5) Real Output (equation 4.17):

$$\ln \hat{Y}_t = \underset{(15.98)}{7.1014}^{*} + \underset{(2.334)}{.13539} * \ln Y_t^{*} + \underset{(5.588)}{.51073} * \ln(e.P^{*}/P)_t - \underset{(-.9560)}{.11612} \ln(Cps/P)_t$$

$D-W = 1.2239$

(6) Net Credit to Government (equation 4.21):

$$\ln(Cg \hat{/} P)_t = \underset{(1.690)}{4.4507} + \underset{(.2436)}{.62278} [\ln(GDE) - \ln(GDR)]_t - \underset{(-2.354)}{2.9712}^{*} [\ln(GFR) - \ln(GFE)]_t + \underset{(8.576)}{.90310} * \ln(Cg/P)_{t-1}$$

$D\text{-}W = 2.1987$

(7) Government Foreign Borrowing (equation 4.23):

$$\ln(\hat{GFB})_t = \underset{(2.361)}{1.1078}^{*} + \underset{(21.79)}{.93421} * \ln(GDI)_t + \underset{(1.535)}{.065794} \ln(GFB)_{t-1} - \underset{(-4.249)}{.25263} * \ln(GS)_t$$

D-W = 1.4446

(8) Domestic Government Revenue (equation 4.24):

$$\ln(\hat{GDR})_t = \underset{(1.534)}{.038122} + \underset{(63.35)}{.71497} * \ln(Y)_t$$

D-W=1.9987

Notes: *(1) Numbers in brackets are t-values. (2) * and ** signify that the estimated coefficient is significantly different from zero at the 5 per cent and 10 per cent significance levels respectively. (3) D-W = Durbin Watson statistic.*

Exchange Rate (equation 4.10)

All the coefficient estimates have the expected signs. All t-statistics calculated are high meaning all coefficient estimates are significantly different from zero at the significance level of 5 per cent. The D-W statistic is in an inconclusive region so that it is difficult to judge whether or not autocorrelation between the error terms exists.

It is evident that the natural log of foreign reserves relative to domestic credit, $\ln(R/D)_t$, positively influences the growth of the natural log of the nominal exchange rate, $\Delta \ln e_t$.. Since the nominal exchange rate is defined as the price of one unit foreign currency in terms of the domestic currency, an increase in the level of foreign assets relative to domestic credit would depreciate the domestic currency. Recalling the foreign reserves determination above, therefore, foreign reserves have been used as a device both to meet the excess demand for money and to depreciate the domestic currency. At the same time, a significant coefficient estimate of the inflation differential *(*Π-Πf*)* suggests that the monetary authority considers changes in relative prices in managing the nominal exchange rate. As the coefficient estimate of the inflation differential has a negative sign, it suggests that the inflation differential tends to appreciate the domestic currency.

A test of the hypothesis $H_0:(\Pi - \Pi_f) = 1$ against $H_1:(\Pi - \Pi_f) \neq 1$ has been conducted to see if under H_0 there is one to one relationship between the inflation differential $(\Pi - \Pi_f)$ and the growth of the natural log of the nominal exchange rate, $\Delta \ln e_t$.. The test gives a value of -1.8094 which rejects the null hypothesis $H_0:(\Pi - \Pi_f) = 1$ at the significance level of 5 per cent. It is evident, therefore, that there is no perfect one to one relationship between those two variables. However, it is significant, as mentioned above, that the coefficient estimate of the inflation differential (Π-Πf) is closer to one, while the coefficient estimate of the level of foreign reserves relative to domestic credit *(R/D)* has a small magnitude. This means that purchasing power parity still has a dominant influence on the nominal exchange rate. For this reason, in the long run, changes in the nominal exchange rate would be well predicted by the inflation differential keeping the real exchange rate constant. It follows that the monetary authority would take a reactive action in the sense that the authority takes actions dictated by the difference of price changes. In this regard, an effort to influence the nominal exchange rate by the monetary authority should be considered as preventing the nominal exchange rate from appreciating as the external factor captured by the foreign inflation Π_f has a dominant influence. In a case when the inflation

differential is constant or the domestic inflation rate is larger than the foreign inflation rate, the authority can depreciate (devaluate) the nominal exchange rate in order to increase external competitiveness *(e.P*/P)*.

The implication of this is that choosing an inflation rate that differs from the world inflation rates to maintain competitiveness requires the monetary authority to have a powerful control over the domestic money supply. The reason is that domestic inflation will be determined by the world inflation and that the monetary authority can only influence the domestic inflation rate by controlling the domestic money supply. To give more controllability over the money supply and prices, then, it is required to use a more flexible exchange rate system because this system allows the domestic money supply to be relatively unaffected by developments in the balance of payments. If the monetary authority does not have full power to influence the money supply, as this study suggests, fiscal policy through the government budget may have a significant role in helping the monetary authority control the money supply through domestic credit creation even in the managed float regime.

Wholesale Prices (equation 4.11)

The coefficient estimates have the expected signs. The only significant coefficient estimate is the growth of the natural log of import prices, $\Delta \ln(Pm)_t$, which positively influences the growth of the natural log of the wholesale prices, $\Delta \ln(Pw)_t$. This means that the openness of the economy and the role of exchange rates in the transmission of world inflation rates are mostly captured by import activities. The D-W statistic is in the safe area indicating no autocorrelation in the error terms.

Consumer Prices (equation 4.13)

All coefficient estimates, except the natural log of the lagged real money supply, $\ln(M / P)_{t-1}$, and the real interest rate, (*rd*), have the expected signs. All coefficient estimates, except the natural log of the wholesale price index, $\ln(Pw)_t$, and the natural log the lagged real money supply, $\ln(M/P)_{t-1}$, are significantly different from zero at the 5 per cent significance level. Judging the model empirically, changes in the consumer price index, which is the domestic inflation rate, are entirely determined by domestic components. For example, changes in consumer prices are negatively related to the natural log of domestic real output, $\ln(Y_t)$. As another example, the natural log of the ratio of real domestic output to its trend, $\ln(Y/Y_{tr})$ has a negative impact on the natural log of lagged consumer prices. This indicates that the

demand and the supply conditions for non traded goods are important determinants of consumer prices. The D-W statistic suggests there is no autocorrelation in the error terms.

Real Output (equation 4.17)

All coefficient estimates have the expected signs. All coefficients, except the natural log of real net credit to the private sector, $\ln(Cps/P)_t$, are significantly different from zero at the 5 per cent significance level. The model suggests that the natural log of real output, $\ln(Yt)$, is positively influenced by the natural log of world real output, $\ln Y_t^*$, showing that the domestic economy is open. The natural log of external competitiveness, $\ln(e.P^*/P)_t$, also has a positive influence on the natural log of real domestic output, suggesting no conflict between the domestic inflation rate (actually P) and the exchange rate e. On the other hand, the natural log real net credit to the private sector does not affect the natural log of real domestic output meaning that there is no positive relationship between net credit to private sector and real output. Like other developing countries, Indonesia imports a lot of capital goods. This will be reflected in higher cost components captured in import prices offsetting the real domestic credit given to the private sector. The D-W statistic is in inconclusive area so it is difficult to see whether or not autocorrelation between the error terms is present.

The Net Credit to Government (equation 4.21)

All coefficient estimates have the expected signs. All coefficient estimates, except the domestic budget deficit, $\ln(GDE)$-$\ln(GDR)$, are significantly different from zero at the significance level of 5 per cent. It is empirically suggested that the foreign component of the government budget has been successfully covering the domestic component of the government budget deficit. Specifically, the government has been successfully raising foreign borrowing, captured by $\ln GFR$, to avoid printing domestic money to finance its domestic budget deficit. The D-W statistic suggests no autocorrelation in the error terms.

The Government Foreign Borrowing (equation 4.23)

All coefficient estimates have the expected signs. All coefficient estimates, except the natural log of lagged of the government foreign borrowing, $\ln(GFB)_{t-1}$, are significantly different from zero at the significance level of 5 per cent. The equation

suggests that the natural log of government foreign borrowing, $\ln(GFB)_t$, is positively related to the natural log of government domestic investment, $\ln(GDI)_t$, and negatively related to the natural log of government saving, $\ln(GS)_t$. This means that an increase in government domestic investment needs more foreign borrowing if the government is not capable of raising its saving. As long as the government plays a dominant role in the development processes compared to the private sector, dependency on foreign borrowing remains if the government can not raise its saving. Since deregulation is still in the early stage, there is no indication that foreign borrowing will be reduced. The D-W statistic is in inconclusive area so it is difficult to see whether or not autocorrelation between the error terms exists.

The Domestic Government Revenue (equation 4.24)

The coefficient estimates have the expected signs. All coefficient estimates, except for the intercept, are significantly different from zero at the significance level of 5 per cent. Therefore, the natural log of government domestic revenue, $\ln(GDR)_t$ is positively related to domestic real output, $\ln(Y)_t$. This means that an increase in domestic real output will increase government domestic revenue. Although the government is still not able to cover its budget deficit, this equation indicates that in the government has been successfully imposing the value added taxes introduced in 1973. The D-W statistic suggests no autocorrelation between the error terms.

5.5 Summary

In general, the behavioural relationships are well estimated. It follows that the monetary approach to the balance of payments (MABP) via this the model is capable of explaining the Indonesian economy for the period 1971-1992. It is apparent that, under the managed float exchange rate, the monetary authority has been successful in managing the monetary sector (equations 4.5 and 4.6) with the support of a tight fiscal budget (equations 4.24, 4.23 and 4.21). This tight fiscal budget is evidently achieved by raising foreign borrowing since domestic revenue is not capable of covering the domestic budget deficit (equation 4.23 and 4.21). The fiscal action (equation 4.21) has given the monetary authority an easy way to control the money supply (4.5). The controllability of the money supply affects the reliability of monetary policy as the managed exchange rate (equation 4.5) influences external competitiveness and real domestic output (equation 4.17). Since real domestic output is part of the demand for

money (equation 4.5) and the government budget is a part domestic credit creation (equation 4.21 and 4.5), the model is simultaneously determined.

Chapter 6

CONCLUSIONS

6.1 Summary

The objective of this study was to assess empirically the causal links and transmission processes between key macro economic variables described by a simple open monetary model, particularly, to explain the movements of foreign reserves, exchange rates, prices, real output and government revenue and expenditure from 1971 to 1992. These aims are quite important to the Indonesian economy for almost three decades after 1966, the monetary environment in Indonesia has been mostly characterised by prudent policies aimed at raising foreign reserves, depreciating exchange rates and keeping low inflation rates to support economic growth. In terms of monetary policy, therefore, these policies could not be separated in the context of the controllability and reliability of money.

Inflation rates were on average of 8.6 percent during last 15 years, a great success compared to the inflation rate of 600 per cent in 1965 inherited from the old regime. The current account deficit has been kept between 1.5 to 3.5 percent of GDP by devaluations, depreciations, and foreign exchange reserves have frequently been at approximately five months import needs. From 1970 to 1993, the average annual growth of real gross domestic product was 6.5 per cent, with the highest rate of 7.2 per cent achieved in the 1970s when oil prices were high and the lowest of 5.6 per cent when oil prices fell in the 1980s. Since then, growth accelerated to an average of 6.8 per cent per year. With regard to the stabilisation program in Indonesia, however, doubts have recently surfaced about the controllability and reliability of the money supply under the current managed float regime particularly about conflicting targets and the inability to conduct sterilisation. In November 1978, for example, the rupiah was devalued by 50.6 per cent to maintain a stable price and international

competitiveness. More recently, the rupiah was also devalued in March 1983 and September 1986. According to Fane (1994, p. 8), a continual depreciation strategy has been a likely contributor to the increase in price levels in the late 1980s and the early 1990s, therefore reducing competitiveness.

The basic framework of the study developed in chapter three followed the monetary approach to the balance of payments (MABP) for several reasons. Firstly, Indonesia is a small open economy where developments in the balance of payments affects the domestic economy. A study by Leod (1993, p. 106) indicated that besides the government budget, the balance of payments has been one of the dominant causes of changes in the money base. Secondly, unlike many developing countries, Indonesia has been a most open economy in terms of capital movements (Thorbecke 1992, p. 93) in which the domestic interest rates are adjusted to world interest rates. These two features provide a basic justification for using the MABP. Thirdly, on empirical grounds, studies by Park (1985) of South Korea and Sa-Ngarmangkang (1986) of Thailand were that the MABP provided a very useful theoretical and empirical framework to explain the economic performance of those countries for 1970-83 and 1965-85 respectively. A few monetary variables included in the model made the analysis simple and feasible, especially in light of the economic structure and data available in developing countries such as Indonesia. Fourthly, the monetary approach also provided useful policy implications. In terms of policy, the MABP suggests that the monetary authority has some degree of control over the level of international reserves through the management of the composition of the monetary base, international reserves and domestic credit. To some extent the monetary authority can sterilise the impacts of flows in the balance of payments. In the extreme case, the MABP also suggests that the use of a free floating exchange rate will give the monetary authority the ability to control the money supply.

It has been mentioned in chapter three that under a fixed exchange rate regime, a lack of liquidity in the domestic financial system would cause accumulation of foreign assets to eliminate the domestic excess demand for money as long as there was no significant increase in domestic credit. The accumulation of foreign reserves was translated into an increase in the money supply as the central bank should buy foreign reserves interpreted as a money stock adjustment. This reduces the excess demand for money and would restore equilibrium. A careful attention to section 3.2.2 would yield the conclusion that, *during the period of money stock adjustment*, foreign assets or reserve accumulation and therefore a balance of payment surplus were accompanied by an increase in the money supply. The exchange rate should depreciate until the desired

(fixed) exchange rate target was achieved. The determination of the exchange rate became clear under a freely flexible regime where the central bank does not intervene in the foreign exchange market so that the money supply is independent of the balance of payments. It might enable the central bank to have complete power to control the domestic part of the money supply. Disequilibrium in the money market was eliminated through changes in prices and the nominal exchange rate. An increase in the growth rate of domestic credit causing an excess supply of money resulted in an equiproportionate depreciation of the home currency (Connolly 1978, p. 9).

The framework has been extended to capture the managed float regime by letting foreign reserves, nominal exchange rates and price levels to be endogenously demand determined implying that, unlike the fixed exchange rates, the effect of disequilibrium in money market would be felt by both the balance of payments and exchange rates or prices. With fixed exchange rates, the nominal money supply adjusted to the demand for money via payments imbalances, while with flexible exchange rates the demand for money adjusted to the nominal money supply via changes in the exchange rate. In the managed float system both the demand and the supply of money adjusted to achieve equilibrium (Connolly 1978, p. 9). It was worth concluding that if the monetary authority conducted nonsterilised intervention, an excess supply of money would depreciate the home currency and cause a loss of foreign reserves, while an excess demand for money, keeping domestic credit constant, would result in an increase in foreign reserves and an appreciation of the home currency. The scenario mentioned above assumed money market equilibrium. Analysing disequilibrium in the money market would suggest a slight different result in that appreciation of the home currency would not necessarily occur when there was an excess demand for money because stock adjustment of the money supply could prevent the home currency from appreciating. Based on equation (3.34), if there were an excess demand for money, the public would adjust its holdings by adding to its balances so that the money stock increases. As the stock of money increases the home currency tends to depreciate. An important conclusion based on equation (3.34) was, therefore, that an excess demand for money, keeping the domestic credit constant, would result in foreign reserves accumulation and, to some extent, might depreciate the home currency. This became the starting point for specifying the open monetary model Indonesia discussed in chapter four.

In chapter four, a formal model was developed to see the real situation in Indonesia from year 1971 to 1992 based on the MABP. In Indonesia, a persistent balanced budget applied since 1966 may have been reduced the monetary impact of

domestic credit creation to curb domestic inflation. This policy would provide a way for the monetary authority to target external balances such as raising foreign reserves and depreciating exchange rates, even with a more flexible regime under the current managed float. Because of this, fiscal variables have been included in the model to capture the monetary impact of the government budget through domestic credit creation. The model has provided a framework to show that monetary policy conducted to increase net foreign assets and to depreciate the nominal exchange rate would be a success if the government through its budget were capable of raising revenues both from domestic and foreign sources. The model consists of eight equations and three identities with 30 variables of which 11 were endogenous and 19 were exogenous and lagged. .

The model postulated that foreign reserve accumulation occurred as long as the demand for money was not satisfied by increases net domestic credit (equation 4.5). Excess demand for money could arise from the financing the budget deficit by a combination of raising domestic and foreign sources therefore reducing money creation through domestic credit (equation 4.21 and identity 4.18). Therefore, this would stimulate reserve accumulation (equation 4.5).

Reserve accumulation reflects an increase in the money supply, and therefore would cause the exchange rate to depreciate or prevent it from appreciating (equation 4.10). This effect would reinforce the direct influence of rising foreign prices on traded-goods prices (equation 4.11), which would in turn increase domestic consumer prices at a faster pace if they were rising, or decrease them at a lower rate if they were falling (equation 4.13). As long as there was not a conflict with the inflation rate, a depreciation of the nominal exchange rate would guarantee external competitiveness and improved growth performance (equation 4.17). A higher real output level, in turn, would increase the demand for money and reduce the pressure on domestic prices (4.13). Thus the direct impact of exchange rate changes on these prices would be counteracted by the influence of output, and the net impact would depend on the relative size of the relevant coefficients. Increases in real output increase government revenue (equation 4.24).

Government domestic revenue and government foreign revenue grow inversely with net credit to the government (equation 4.21) and reduce domestic credit creation (identity 4.18), and therefore increase net foreign assets (equation 4.5). In line with the development in net foreign assets, however, the net monetary impact of government budgetary operations through government foreign expenditure and government

domestic expenditure should be minimal. It is also clear that increases in government foreign borrowing and government oil revenue (the government foreign revenue (identity 4.20)) play an important role in reducing the need for domestic money creation (equation 4.21) and therefore foreign assets would accumulate (equation 4.5).

In chapter five, 2SLS, instead of 3SLS, are used for estimation because it is a single equation method in the context of a simultaneous system and therefore is less sensitive to specification error in some part of the model. This means that those parts of system that are correctly specified should not be affected by error specifications in another part (Gujarati 1988, p. 595). Table 5.1 summarised the 2SLS estimates of the model which consists of eight equations. The table also reported *t*-statistics and *D-W* statistics. The *t*-statistics were used to see the 5 per cent and 10 per cent significance levels of coefficient estimates. The *D-W* statistic was used to see if autocorrelation was present. Based on the t-statistics and the D-W statistics, the behavioural relationships have been well estimated. It was evident that the monetary approach to the balance of payments (MABP) was capable of explaining the Indonesian economy from 1971 to 1992. More specific, it was apparent that, under the managed float regime, the monetary authority has been successful in managing the monetary sector (equations 4.5 and 4.10) with the support of fiscal action through a tight budget (equations 4.24, 4.23 and 4.21).

Foreign reserves accumulation has been achieved due to an excess demand for money which partly originated from domestic real output and partly from a tight domestic credit policy. The later was supported by financing the budget deficit through foreign borrowing. Net other items (import deposits) played a role in reducing domestic liquidity creating an excess demand for money and therefore positively influenced foreign reserves (equation 4.5).

Accumulation of foreign reserves influences the home currency to depreciate. Its impact, however, was relatively smaller than that of the inflation differential meaning that purchasing power parity (PPP) has a greater influence than the monetary authority's intervention (equation 4.10). In the long run, changes in the nominal exchange rate would be well predicted by the inflation differentials.

Depreciation of the nominal exchange rate has caused the import price index to increase which led to an increase in the wholesale price index (equation 4.11). However, the wholesale price index did not influence the domestic inflation rate. Therefore, there was no conflict between depreciation of the home currency and the

domestic inflation rate (equation 4.13) which was the contrary to Fane's comments (1994). As the findings suggested, the domestic inflation rate was influenced by the domestic economy indicating the interaction between the demand and supply of nontradable goods.

The absence of conflict between nominal exchange rate depreciation and domestic inflation led to an increase in external competitiveness and an increase in real domestic output (equation 4.17). Real domestic output also has been influenced by real foreign output. On the other hand, the level of net credit to the private sector did not affect the level of real domestic output meaning there was no positive relationship between net credit to private sector and domestic productivity. Like other developing countries, Indonesia imported a lot of capital goods for production. This is reflected in higher cost components captured in import prices offsetting real domestic credit to the private sector.

Increases in real domestic output increase government domestic revenue (equation 4.24). Government domestic revenue, however, did not eliminate the domestic government budget deficit (4.21) and therefore domestic government revenue did not play a key role in reducing the need for domestic credit creation, whereas the foreign borrowing did (4.23). Foreign borrowing will still be needed as long as government savings cannot cover government domestic investment.

6. 2 Policy Implications

Our empirical work indicates that a short run monetary approach to the balance of payments (MABP) model under a managed float is well suited to the Indonesian economy for 1971-1992. In general, the results suggest, firstly, that monetary policy conducted to increase foreign reserves will be a success if the fiscal authority finances its budget in a contractionary manner. Since the foreign reserves equation (equation 4.5) represents the interaction between the demand and supply of money, it is evident that under a managed float exchange rate, the monetary cannot fully control the money supply. The money supply becomes endogenously demand determined. A contractionary budget plays an important in creating excess demand for money. This, however, will put pressure on the fiscal authority to increase foreign borrowing since domestic sources are not capable of financing the budget deficit. In a situation where the fiscal authority plays a dominant role in the economy, reducing government expenditure to have a contractionary budget would not be a popular action since reducing government expenditure probably means reducing employment. It follows that foreign borrowing will have two effects which are financing the deficit and

stimulating economic activity. Therefore, by borrowing abroad, low inflation may be in line with high output and employment. Supply side policies affecting the labor and goods market would be required to stabilise price expectations, increase productivity and improve external competitiveness.

The second important implication is that both foreign reserve accumulation and the inflation differential affect nominal exchange rate depreciation. However, the inflation differential has a larger impact than foreign reserves. In the long run, the nominal exchange rate determination follows purchasing power parity and changes in the nominal exchange rate in order to keep the real exchange rate constant are well predicted by the inflation differential. If the later is used as an indicator of external competitiveness, maintaining the inflation differential to keep external competitiveness requires the monetary authority being able to control the domestic money supply and thereby influence the domestic inflation rate. This suggests that flexible exchange rates would be more appropriate since under this system changes in foreign reserves are zero, and the money supply is exogenously determined by the monetary authority. A decrease in foreign borrowing would reduce the ability of the fiscal authority through its budget to help the monetary authority in managing the domestic inflation rate. Managing the domestic inflation rate in the face of decreased foreign borrowing should be undertaken mostly by the monetary authority and would require a more flexible exchange rate system. Financial deregulation, therefore, should accompany these developments.

6.3 Suggestions for Further Study

We have studied money and exchange rates along with the monetary approach to the balance of payments through a model borrowed from Otani and Sassanpour. The model was estimated for 1971-1992. Annual data have been used since the quarterly data are not available.

The model was estimated using the 2SLS method. This method has the advantage of avoiding model misspecification in the sense that any mistake in one equation would not affect the others in the system. In terms of efficiency, however, it is suggested to apply 3SLS method since the later will include cross equation restrictions. If one finds a large sample of observations, it is also suggested to conduct simulation and prediction since these may improve reliability of the model as the coefficients of determination are not well defined in the 2SLS method.

If one has a large sample of observations and they are stationary, vector autoregression model (VAR) may be appropriate. The Granger causality test may be worth conducting to test for exogeneity of variables before one goes on to estimate an a priori and more restrictive model like ours. As most time series data are nonstationary, instead of a VAR model, one might use a cointegration model since the latter is useful for finding long run equilibrium relationships in nonstationary data.

Appendix 1

Indonesia's Macro Economic Variables, 1966-1992

year	(M1) & Demand Deposits (billion of rupiahs)	(QM) Quasi Money (billion of rupiahs)	(M2) Broad Money (M1+QM) (billion of rupiahs)	(R) Net Foreign Assets (billion of rupiahs)	(D) Domestic Credit (billion of rupiahs)	(NOI) Net Other Items (billion of rupiahs)	(Cps) Claims on Private Sector (billion of rupiahs)	(Cg) Net Claims on Government (billion of rupiahs)	(e) Nominal Exchange Rates (Rupiah per US Dollar)	(gdpDefl.) GDP defla-tor (1987=100)
1966	22.21	0.34	22.55	-5.18	26.35	1.38	7.08	19.27	85	
1967	51.42	2.25	53.67	-9.57	66.36	3.12	31.72	34.64	235	2.5889
1968	116.2	12.2	128.4	32.1	169.3	73	89.1	80.2	326	5.7518
1969	183.4	49.9	233.3	27.6	287.4	81.7	173	114.4	326	7.0238
1970	250.2	80.1	330.3	23.3	426.9	119.9	316.3	110.6	378	8.0395
1971	319.2	148.5	467.7	13.5	556.7	102.5	421.5	134.8	415	8.2618
1972	474	231.4	705.4	220.9	720.5	236	618.8	103.7	415	9.6607
1973	671	340.9	1011.9	295.3	1089.5	372.9	973.2	116.3	415	13.1546
1974	942.4	545.8	1488.2	661	1477.4	650.2	1402.9	74.5	415	19.3714
1975	1274.3	765.1	2039.4	-343.4	2873.1	490.3	2675	198.1	415	21.7786
1976	1601	1060	2661	-50	3397	686	3515	-118	415	24.9218
1977	2007	1155	3162	500	3608	946	3844	-236	415	28.1421
1978	2489	1435	3924	1061	4986	2123	5273	-287	625	31.22
1979	3317	1978	5295	2943	5206	2854	6309	-1103	627	42.081
1980	5013	3056	8069	6031	5054	3016	7589	-2535	626.8	55.5251
1981	6474	3231	9705	6838	5759	2892	6192	-433	644	61.7353
1982	7120	3954	11074	5613	8434	2973	8750	-316	692.5	66.4325
1983	7576	7093	14669	8419	11069	4819	11325	-256	994	75.6498
1984	8581	9356	17937	11942	11978	5983	15292	-3314	1074	82.0287
1985	10124	13054	23178	14106	14799	5727	18873	-4074	1125	86.2355
1986	11631	15984	27615	15919	20329	8633	23766	-3437	1641	86.2856
1987	12705	21200	33905	16206	28739	11040	30803	-2064	1650	100
1988	14392	27681	42073	13751	40835	12513	41652	-817	1731	107.6043
1989	20559	37967	58526	12568	60564	14606	60945	-381	1797	117.9178
1990	23819	60811	84630	10659	95896	21925	100213	-4317	1901	129.8127
1991	26693	72717	99410	17283	114002	31875	117007	-3005	1992	140.7516
1992	28801	90274	119075	27987	123164	32076	127164	-4000	2062	149.4106

Indonesia's Macro Economic Variables, 1966-1992 (continued)

year	(P(cpi)) Consumer Price Index (1987=100)	(Pw) Wholesale Price Index (1987=100)	(Pm) Import Price Index (1987=100)	(Px) Export Price Index (1987=100)	(rd) Deposit Rate	(GDP) at Current Market Prices (billion of rupiahs)	(GDP) at Constant GDP Deflator (1987=100)	(Y) GDP at Constant CPI (1987=100)	(GRE) Government Routine (operating) Expenditure (billion of rupiahs)
1966									
1967	3.7405		25.6145	14.4828		894.632	34556.4526	23917.4442	
1968	8.5599		28.5786	13.4906		2212.5216	38466.5944	25847.5166	
1969	9.8884		27.3566	12.5988		2868.4593	40839.1375	29008.3263	
1970	11.3054		31.4444	14.6637		3524.71	43842.4031	31177.225	216.54
1971	11.7982	7.5212088	32.0377	15.6725	21	3874.84	46900.6754	32842.637	288.17
1972	12.5665	8.5426075	35.5565	14.6784	17.5	4816.11	49852.5987	38324.991	349.1
1973	16.4669	11.811083	45.7754	21.6228	12.85	7126.039	54171.4609	43274.9273	438.1
1974	23.1529	17.475204	60.8633	60.0731	12	11299.5	58330.8382	48803.8216	713.3
1975	27.5646	18.570886	63.6714	55.5117	12	13341.4	61259.2178	48400.4847	1016.11
1976	33.0387	20.427975	61.6714	62.2076	12	16321.4	65490.4541	49400.8541	1332.57
1977	36.685	22.712193	64.1673	69.8977	9.1	20084.39	71367.7728	54748.235	1629.76
1978	39.6599	24.829274	73.8339	70.5556	6	24002.49	76881.7745	60520.8031	2148.9
1979	46.1088	36.26894	85.3314	101.038	6	34344.71	81615.7173	74486.2369	2743.67
1980	54.4162	47.225763	102.2913	146.1988	6	48913.5	88092.5924	89887.754	4061.77
1981	61.0792	51.901113	102.946	155.5263	6	58421.3	94631.9205	95648.4368	5800
1982	66.8704	56.293109	97.811	142.4415	6	62646.49	94300.9671	93683.4384	6978
1983	74.7525	67.391164	94.2921	129.9415	6	77622.99	102608.322	103839.992	6996
1984	82.5679	80.802005	92.0724	128.1725	16	89884.99	109577.489	108861.906	8412
1985	86.4738	78.308532	90.4972	121.5059	18	96997	112479.199	112169.235	9429
1986	91.6077	84.964757	83.1629	82.8509	15.39	102683	119003.634	112089.923	11952
1987	100	99.999996	100	100	16.78	124817	124817	124817	13559
1988	108.0438	107.83085	109.5847	109.5176	17.72	142105	132062.566	131525.363	17481
1989	114.9781	116.20986	119.3924	116.3947	18.63	167158	141758.072	145382.468	20739
1990	123.5494	122.47454	122.942	122.96	17.3	196920	151695.481	159385.638	24331
1991	134.9717	129.82302	110.692	112.118	23.27	227136	161373.654	168284.166	29998
1992	145.103	142.19295			20.37	255089	170730.189	175798.571	30228

Indonesia's Macro Economic Variables, 1966-1992 (continued)

Year	(GFE) Government Foreign Expenditure (billion of rupiahs)	(GDI) Government Domestic Investment (billion of rupiahs)	(GDE) Government Domestic Expenditure (billion of rupiahs)	(GS) Government Saving (billion of rupiahs)	(GFB) Governmen t Foreign Borrowing (billion of rupiahs)	(GOR) Government Oil Revenue (billion of rupiahs)	(GDR) Government Domestic Revenue (billion of rupiahs)	(GFR) Government Foreign Revenue (billion of rupiahs)
1966								
1987					24.689	7.46	52.826	32.149
1968					35.537	33.25	124.242	68.787
1969					73.78725	53.32	161.736	127.10725
1970		118.13	334.67	27.16	116.782	88.88	265.87675	205.662
1971	34.7	169.66	423.13	56.43	120.4	68.8	275.8	189.2
1972	53.6	195.9	491.4	78.92	135.5	112.5	315.5	248
1973	63.6	298.22	672.72	152.51	157.8	198.9	391.7	356.7
1974	81.7	450.96	1082.56	254.39	203	344.6	623.1	547.6
1975	93.9	961.82	1884.03	737.55	232	973.1	780.6	1205.1
1976	106.2	1397.73	2624.1	909.28	491.6	1249.1	992.8	1740.7
1977	198.2	2054.48	3486.04	1276.23	783.8	1619.4	1286.6	2403.2
1978	253.9	2156.8	4051.8	1386.5	773.4	1948.7	1586.7	2722.1
1979	570.4	2555.65	4728.92	1522.41	1035.5	2308.7	1957.4	3344.2
1980	706.1	4014	7369.67	2635.04	1381.1	4259.6	2437.2	5640.7
1981	820.8	5916.13	10895.33	4427.02	1493.9	7019.6	3207.4	8513.5
1982	989.6	6940	12928.4	5235	1709	8627.8	3584.8	10336.8
1983	1284.2	7360	13071.8	5422	1940	8170.4	4247.9	10110.4
1984	2188.9	9899	16122.1	6021	3882.4	9520.2	4912.5	13402.6
1985	2858	9952	16523	6476	3478	10430	5475	13908
1986	3443	10873	19382	7301	3572	11144	8109	14716
1987	5691	8332	16200	2582	5752	6338	9803	12090
1988	8385	9477	18573	3322	6158	10047	10756	16205
1989	11112	12251	21878	2265	9991	9527	13477	19518
1990	12094	13834	26071	4409	9429	11252	17488	20681
1991	3503	19452	45947	9548	9905	17712	21834	27617
1992	13547	21764	38445	11357	10409	15039	26546	25448

Indonesia's Macro Economic Variables, 1966-1992 (continued)

Year	GRR Government Routine Revenue (billion of rupiahs)	Total Government Expenditure TGE (billion of rupiahs)	(P*) US's Consumer Price Index (1987=100) P*(cpi)US	(Y*) US's GDP (billion of US Dollars) Y*(US)
1966		0	28.5624	142425
1967	60.286	0	29.3552	113341
1968	157.492	0	30.5933	123143
1969	215.056	0	32.2498	119651
1970	243.7	334.67	34.151	147852
1971	344.6	457.83	35.6045	198870
1972	428.02	545	36.7814	291850
1973	590.61	736.32	39.0693	502926
1974	967.69	1164.26	43.3807	1580282
1975	1753.66	1977.93	47.3421	1865470
1976	2241.85	2730.3	50.0581	2451965
1977	2905.99	3684.24	53.3051	3011430
1978	3535.4	4305.7	57.3816	2962247
1979	4266.08	5299.32	63.8463	3170694
1980	6696.81	8075.77	72.4715	4303344
1981	10227.02	11716.13	79.9474	4083823
1982	12213	13918	84.8726	3546007
1983	12418	14356	87.5991	4266658
1984	14433	18311	91.3809	4504693
1985	15905	19381	94.6351	4040169
1986	19253	22825	96.3944	2901460
1987	16141	21891	100	3348717
1988	20803	26958	104.0097	3073721
1989	23004	32990	109.0301	3473361
1990	28740	38165	114.9154	3364588
1991	39546	49450	119.7816	3508502
1992	41585	51992	123.4099	4419105

Sources: 1) International Monetary Fund (IMF), International Financial Statistics; various issues
2) World Bank, World Tables, various issues
3) Biro Pusat Statistik (BPS), Indikator Ekonomi, various issues

REFERENCES

Boediono (1985), 'Demand for Money in Indonesia, 1975-1984', *Bulletin of Indonesian Economic Studies*, XXI(2): pp. 74-94.

Cawley, Peter Mc. (1982), *Ekonomi Orde Baru*, LP3ES, Jakarta.

Central Bureau of Statistics (Biro Pusat Statistik), various issues

Chang, Semoon (1984), *Practitioners' Guide to Econometrics*, University Press of America, New York.

Chrystal, K. Alec and Price, Simon (1994), *Controversies in Macroeconomics*, Harvester Wheatsheap, New York.

Coghlan, Richard (1980), *The Theory of Money and Finance*, Macmillan, London.

Connolly, Michael (1978), *The Monetary Approach to An Open Economy: The Fundamental Theory*, in Bluford H. Putnam and D. Sykes Wilford (eds.), The Monetary Approach to International Adjustment, Praeger Publisher, New York.

Cuthberson, K. (1979), *Macroeconomic Policy: The New Cambridge, Keynesian and Monetarist Controversies*, Macmillan, London.

Dernburg, Thomas F. (1989), *Global Macroeconomics*, Harper & Row, New York.

Dornbusch, Rudiger and Fischer, Stanley (1990), *Macroeconomics*, McGraw-Hill, Singapore.

Fane, George (1994), 'Survey of Recent Development', *Bulletin of Indonesian Economic Studies*, 30(1): pp. 3-38.

Gärtner, Manfred (1993), *Macroeconomics Under Flexible Exchange Rates*, Harvester/Wheatsheaf, New York.

Garnaut, Ross (1979), 'Survey of Recent Developments', *Bulletin of Indonesian Economic Studies*, XV(3): pp. 1-42.

Ghatak, Subrata (1981), *Monetary Economics in Developing Countries*, Macmillan, London.

Gujarati, Damodar N. (1988), *Basic Econometrics*, McGraw-Hill, Singapore.

International Monetary Fund, *International Financial Statistics (various issues)*.

Johnson, H. G. (1977), *The Monetary Theory of Balance of Payments*, in Jacob A. Frenkel and Harry G. Johnson (eds.), The Monetary Approach to the Balance of Payments, George Allen & Unwin Ltd., Surrey.

Krugman, Paul R. and Obstfeld, Maurice (1987), *International Economics: Theory and Policy*, Scott, Foresman and Company, Chicago.

Lane, Christopher E., Cole, David C. and Slade, Betty F. (1993), *Indonesia, 1974-90*, in Sheila Page (ed.), Monetary Policy in Developing Countries, Routledge, New York.

Leod, Ross H. (1993), 'Analysis and Management of Indonesian Money Supply Growth', *Bulletin of Indonesian Economic Studies*, 29(2): pp. 97-128.

Levačić, Rosalind and Rebmann, Alexander (1990), *Macroeconomics: An Introduction to Keynesian-Neoclassical Controversies*, Macmillan, London.

Moore, Lyell, Crane, and Crowley (1992), *Financial Institutions & Markets*, Surendip Publications, Wamberal Australia

Mundell, Robert A. (1976), *The International Distribution of Money in a Growing World Economy*, in Jacob A. Frenkel and Harry G. Johnson (eds.), The Monetary Approach to the Balance of Payments, George Allen & Unwin Ltd., Surrey.

Nasution, Anwar (1983), *Financial Institutions and Policies in Indonesia*, Institute of Southeast Asian Studies, Singapore.

_____ (1990), *Tinjauan Ekonomi Atas Dampak Paket Deregulasi Tahun 1988 pada Sistem Keuangan Indonesia*, PT Gramedia, Jakarta.

Newlyn, W. T. and Bootle, R. P. (1978), *The Theory of Money*, Clarendon Press, Oxford.

Otani, Ichiro and Sassanpour, Cyrus (1991), *Financial, Exchange Rate, and Wage Policies in Singapore, 1979-1986*, in Mohsin S. Khan, Peter J. Montiel, and Nadeem U. Haque (eds.), Macroeconomic Models for Adjustment in Developing Countries, International Monetary Fund, Washington, D. C.

Pangestu, Mari and Azis, Iwan Jaya (1994), 'Survey of Recent Developments' *Bulletin of Indonesian Economic Studies*, 30(2): pp. 3-47.

Parikh, A., Booth, A. and Sundrum, R.M. (1985), 'An Econometric Model of the Monetary Sector in Indonesia', *The Journal of Development Studies*, 21(3): pp. 406-422.

Park, Kil Ho (1985), 'Monetary Policy and Economic Stabilisation: A Case Study of Korea' M.Ec. Dissertation, University of New England, Armidale.

Ramanathan, Ramu (1989), *Introductory Econometrics: With Applications*, Harcourt Brace Jovanovich, New York.

Sa-Ngarmangkang, Suthilux (1986), 'The Monetary Approach to the Balance of Payments: An Empirical Study of Thailand' M.Ec. Dissertation, University of New England, Armidale.

Sassanpour, Cyrus (1984), 'An Empirical Analysis of the Effects of Monetary Disequilibria in Open Economies', *Journal of Monetary Economics*, 13: pp. 127-163.

Siegel, Barry N. (1982), *Money, Banking and the Economy: A Monetarist View*, Academic Press, New York.

Sumardi, M. (1984), 'Exchange Rate Strategy in Indonesia: An Analysis of 1978 Devaluation' M.Ec. Dissertation, University of New England, Armidale.

Sundararajan, V. and Molho, Lazaros (1988), *Financial Reform and Monetary Control in Indonesia*, in Hang-Sheng Cheng (ed.), Monetary Policy in Pacific Basin Countries, Kluwer Academic Publishers, United States of America.

Sundrum, R. M (1986), 'Indonesia's Rapid Economic Growth: 1968-81' *Bulletin of Indonesian Economic Studies*, 22(3): pp. 40-69.

Swoboda, A.K. (1972), 'Equilibrium , Quasy-Equilibrium, and Macroeconomic Policy under Fixed Exchange Rates', *Quarterly Journal of Economics*, 86: pp. 162-171.

The Minister of Trade (1994), *Overview of Economic Developments in Indonesia*, paper presented to Indonesia Update 1994, The Australian National University, Canberra.

Thomas, R.L. (1989), *Using Mathematics in Economics*, Longman, London & New York.

Thorbecke, Erik (1992), *Adjustment and Equity in Indonesia*, in Christian Morrisson (ed.), Adjustment and Equity in Developing Countries, OECD, Paris.

Treadgold, M. L. (1990), 'Macroeconomic Management in Asian-Pacific Developing Countries' *Asian-Pacific Economic Literature*, 4(1): pp. 3-40.

Turner, Paul (1993), *Modern Macroeconomic Analysis*, McGraw-Hill, London.

Vane, Howard R. and Thompson, John L. (1979), *Monetarism: Theory, Evidence and Policy*, Martin Robertson, Oxford.

World Bank (1992), *Trends in Developing Economies*, Baltimore and London

_____ (1994), *World Tables 1994*, Baltimore and London