THE GRANGER-CAUSALITY BETWEEN MONEY GROWTH, INFLATION, CURRENCY DEVALUATION AND ECONOMIC GROWTH IN INDONESIA: 1954-2002

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Abstract

This paper uses annual data for the period 1954-2002 to investigate the causal relationship between money growth, inflation, currency devaluation and economic growth in Indonesia. Three testable hypotheses are investigated: (1) does the money supply growth Granger-cause inflation? (2) does currency devaluation Granger-cause inflation? (3) does inflation affect economic growth? The empirical results suggest that there existed a short-run bi-directional causality between money supply growth and inflation and between currency devaluation and inflation. For the complete sample period, the causality running from inflation to narrow money supply growth was stronger than that from narrow money supply growth to inflation. This result is consistent with the view that in a high-or hyperinflationary economy, inflation does have a feedback effect on money supply growth and this generates a self-sustaining inflationary process. The short-run bi-directional causality between currency devaluation and inflation was, however, weak or not so robust for the complete or any shorter sample period. On the relationship between inflation and economic growth, the results suggest that there was no short-run causality from inflation to economic growth for the complete or any sub-sample period.

JEL classification: C50, C52

Key words: Inflation, Money Growth, Budget Deficits, Devaluation, Economic Growth, Granger-Causality, Indonesia

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1. Introduction

Indonesia is considered an inflation-prone country largely because of its inflation history in the 1950s and early 1960s when it was on the verge of 'hyperinflation' and economic collapse (Arndt, 1971; Hill, 1996; Thomas and Drysdale, 1964; Sundrum, 1973). Indonesia's high inflation during the 1950s and early 1960s had fiscal-monetary roots (Aghevli and Khan, 1977; Arndt, 1971; Corden and Mackie, 1962; Hicks, 1966; Mackie, 1967). The political change in 1966 and subsequent stabilization and economic reforms in this country brought its inflation rate down to a single digit level within a short period of time.

Since the late-1960s to the late-1990s Indonesia experienced moderately high inflation on average within the range of about 10-12 percent per annum, except during three supply/external shocks. The first was the OPEC oil shock during 1973-1974 when Indonesia's inflation rose to about 35 percent per annum. The second was the OPEC oil shock during 1979-1980 when Indonesia's inflation was about 20 percent per annum. The third was the Asian currency crisis during 1997-1999 that hit the Indonesian economy, and later its society and polity, the most. During the peak of the crisis in 1998, Indonesia's inflation rose to about 60 percent. This was a transitory phenomenon, and it did not lead to hyperinflation as many feared presumably because a set of IMF-supported stabilization policies were already in place.

Although monetary targeting of one form or the other was the preferred strategy of monetary policy in Indonesia since the late 1960s to 2003, to what extent inflation in this country originated from an excess money supply under different exchange rate regimes remains unknown. In a related paper for Indonesia (Hossain, 2005a), it is found that the consumer price index (CPI), the stock of narrow (M1) or broad money (M2) and real permanent income form a (weakly) cointegral relationship for the sample period 1952-2002. This relationship has been found broadly stable for several sub-samples, especially when the model is estimated with a narrow definition of money. One theoretical implication of cointegration is

that if two variables, say, consumer price index and the nominal money stock, are integrated of order one and cointegrated, there must be a Granger-causality (Granger, 1969) between inflation and money supply growth in at least one direction as one variable can help determine the other.

This paper provides an overview of the sources of inflation and investigates the causal linkage between money supply growth, inflation, currency devaluation and economic growth in Indonesia for the period 1954-2002.[1] The rest of the paper is organized as follows. Section 2 provides an overview of the sources of inflation in Indonesia since the 1950s. Section 3 specifies the Granger-causality test models. Section 4 reports the test results between money supply growth and inflation. Section 5 reports the test results between devaluation and inflation. Section 6 reports the test results between inflation and economic growth. Section 7 summarizes the findings and draws conclusion.

2. Sources of Inflation in Indonesia

The Soekarno-Era: 1950-1965

There is consensus that high inflation in Indonesia during the Soekarno regime originated from the monetization of sustained budget deficits, especially since the late 1950s. Therefore, it does not make much difference whether one postulates that Indonesia's high inflation during this period was a fiscal or a monetary phenomenon. In general, the money growth rate and inflation are highly correlated and in most high inflationary countries, there exists a bi-directional *causality* between money supply growth and inflation. In a high-inflationary situation, inflation affects budget deficits, which, when financed by money creation, fuel the inflationary process. Thus, budget deficits become intertwined with both money supply growth and inflation. This was the story behind Indonesia's high inflation in the 1950s and early 1960s.

However, the debate remains whether large budget deficits during the Soekarno era were due to the government's over-ambitious programs of economic development once the country gained formal

independence from the Dutch in 1949 and/or were the outcome of exogenous economic shocks and political developments. Thomas and Drysdale (1964:p.548) have suggested that Indonesia's large budget deficits in the 1950s and early 1960s originated not from any drive for economic development but due to political reasons:

> It is our view that Indonesian experience throws no light, one way or the other, on the pros and cons of inflationary financing for development. Inflation in Indonesia was the result, not of a drive for economic development, but of a continued, though inconclusive, struggle for power (at least until 1959), the consolidation of territorial claims, a system of civil service "patronage", and defence spending, financed primarily through government deficits. The existence of the Five-year Plan 1956-60 is no evidence to the contrary. The plan represented a compilation of data submitted by the various government departments, data which economic policy at no stage served to co-ordinate.

Glassburner (1971:p.71) has given a similar interpretation of the government's expansionary economic policies during 1950-1957:

> … from the point of view of economic policy, the years 1950 to 1957 in Indonesia are best understood as years of a hopeless losing battle on the part of a very small group of pragmatically conservative political leaders against an increasingly powerful political coalition of generally radical orientation.

Mackie (1967:p.3) has extended this view for the early 1960s:

> The underlying cause of the inflation, in my opinion, has been Indonesia's unresolved political crisis of the last ten years; the outward political stability of 1960-64 was misleading, for it was largely contingent upon budget deficits which represented a failure to resolve fundamental problems.

He has, however, emphasized that there were institutional constraints that prevented the Soekarno government from

undertaking an overtly expansionary fiscal policy during the early 1950s and that might have kept inflation under control until the late 1950s:

> Until the end of 1956, Indonesian governments were restrained in their use of deficit financing as a way to cope with their budget problems because of several political considerations which ceased to apply during 1957. The Bank Indonesia Act of 1953 imposed a statutory requirement that the Bank must retain gold and foreign exchange reserves to the value of 20% of its advances. This meant, virtually, that the government's indebtedness to the central bank could not exceed five times the nation's current gold and foreign exchange holdings without resorting to the emergency provisions of the Act which required the approval of Parliament. Hence there was a significant legal and political limit to the extent to which the supply of money could be inflated… [However]… both these restraints were swept away by the political crisis brought on by the regional revolts of early 1957 (Mackie, 1967:p.22).

Thus the impression one gets from the early writings on this issue is that Indonesia's high-inflationary episode in the late 1950s and early 1960s was due to some exogenous factors and was not the outcome of any populist economic policy paradigm of the Soekarno regime, *a la macroeconomic populism* of Latin America. This is reflected in the fact that instead of increasing government expenditures, the sharp rise in budget deficits since the late 1950s was due to a sharp decline in government revenues. For example, the government revenue as a proportion of GDP fell sharply from a relatively high level of 13 percent in 1960 and 1961 to an average of only 4.6 percent during 1962-1966; the expenditure as a proportion of GDP declined but to a relatively smaller extent and remained at an average level of 9.8 percent during this period. The result was a sharp increase in budget deficits to the level of 5.1 percent of GDP during 1958-1966 (Table 1). Therefore, it appears that, after remaining within the range of about 20-25 percent throughout the 1950s, the inflation rate started to accelerate in 1957 when budget deficits, financed

mostly by money creation (Table 2), increased from 1.1 percent to 3.2 percent and increased further during the next few years.

Table 1. Budget Deficits and Money Growth in Indonesia: 1952-1972

Year/ Period Average	Growth Rate of Narrow Money Supply (%)	Government Expenditure-Income Ratio (%)	Government Revenue-Income Ratio (%)	Budget Deficits (% of GDP)
1	2	3	4	5 = 4-3
1952	13.6	17.4	14.3	-3.1
1953	19.8	18.4	15.9	-2.5
1954	26.0	17.0	12.9	-4.1
1955	24.6	13.3	11.6	-1.7
1956	9.3	14.7	13.6	-1.1
1957	21.6	15.6	12.4	-3.2
1952-57	19.2	16.1	13.5	-2.6
1958	39.3	13.5	9.1	-4.4
1959	30.6	15.6	8.2	-7.4
1960	24.4	14.9	12.8	-2.1
1961	33.3	18.7	13.2	-5.5
1962	52.0	9.1	5.5	-3.6
1963	68.2	10.3	5.0	-5.3
1964	80.4	9.5	4.1	-5.4
1965	113.5	10.6	3.9	-6.7
1966	174.7	9.3	4.1	-5.2
1958-66	68.5	12.4	7.3	-5.1
1967	149.9	10.3	7.1	-3.2
1968	81.9	8.9	7.6	-1.3
1969	63.5	10.1	8.7	-1.4
1970	39.2	13.0	9.6	-3.4
1971	28.0	13.9	10.3	-3.6
1972	32.0	14.7	10.1	-4.6
1967-72	65.8	11.8	8.9	-2.9

Source: Author's compilation based on Aghevli and Khan (1977).

The sharp decline in government revenues was due to fall in foreign trade taxes. Between 1960 and 1966 the value of recorded exports declined from US$841 million to US$679 million, partly due to adverse trends in the world prices of rubber and other exportable products of Indonesia and partly because of the declining exportable surpluses and the diversion of exports into unrecorded trade. Also, the sharp appreciation of the real exchange rate, under a fixed exchange rate system, encouraged smuggling and both under-invoicing of exports and over-invoicing of imports. Further, the government's capacity to tax decreased with the breakdown of tax administration because of the erosion of the purchasing power of salaries of government employees (Sundram, 1973). Corden and Mackie (1962:pp.39-40) have elaborated the balance-of-payments problems and their implications on budget deficits and inflation:

There has been severe and practically continuous price inflation since 1953… The cause of the inflation has been government budget deficits financed by credit creation. … The effect of the inflation has been to place continuous pressure on the balance of payments… As a result the inflation has made inevitable the progressive devaluation of the rupiah, twice a formal devaluation of the official exchange rate, and at other times *de facto* devaluation by the use of various indirect devices.

The export or repatriation of capital from Indonesia has in general been prohibited. Furthermore, other than for the petroleum companies, there have been increasing delays in the granting of approval to repatriate profits. At the same time there has certainly been a strong desire to send money abroad, partly due to the lack of confidence of foreign enterprises in their prospects in Indonesia, whether due to inflation or to political reasons, partly due to the exclusion of Chinese businessmen from village retailing and a large range of importing, and partly due to expectations of further devaluation of the rupiah.

One result is that traders have attempted to understate the foreign currency values of exports and overstate the values of

imports in order to build up balances abroad. Another result has been the actual smuggling of exports out of the country. The aim of exporting capital has provided one reason for the attempts to evade currency regulations. The other motive has been to evade payments of trade taxes, by avoiding the spread between the rupiah proceeds of exporters and the rupiah payments of importers. These two motives have presented the Indonesian exchange control authorities with the continuous problem of ensuring that the flow of currency payments passes through official channels and that, when it does, exports and imports are valued correctly.

Table 2 shows that the major contributors to changes in the narrow money supply growth since the mid-1950s to mid-1960s were borrowings by both the government and public enterprises. As pointed out earlier, the money supply growth rate was moderately high in the 1950s on a sustained basis but not excessive until 1960 given that there was rapid monetization of Indonesia's economy in the 1950s with an estimated income elasticity of demand for narrow money at about two (Hossain, 2005a). This helped to keep the inflation rate within control. This phenomenon is reflected in the 'puzzling' sharp decline in the velocity of money in the midst of double-digit inflation until there was the obvious sharp rise in income velocity of money during hyperinflation. Thomas and Drysdale (1964:p.547) have given a political interpretation of the decline in income velocity of money prior to hyperinflation:

> … in conditions of persistent inflation, the public would sooner or later have moved from money into goods, implying a decline in the demand for money or a rise in the velocity of circulation. In developing economies, monetization of the subsistence sector usually leads to a secular decline in velocity. But this could not possibly account for the magnitude of the decline in velocity in Indonesia during the 1950s. The real explanation would appear to be a widespread and increasing tendency to hoard cash, induced primarily by increasing political uncertainty. This interpretation derives

some support from the fact that the decline in velocity seems to have accelerated in the year after 1957. If this explanation is correct, it implies that until about 1960 a growing precautionary demand for money (hedging against political uncertainty) prevailed over any tendency towards a flight into goods (hedging against inflation). Money illusion remained strong enough to preclude any development of hyper-inflation. This hoarding had a stabilizing effect on the monetary situation: it dampened the effects of a rapidly rising money supply on the price level and money income.

Table 2. Changes in the Money Supply in Indonesia: 1955-1966

Year	Narrow Money Supply Growth	Government	Public Enterprises	Private Enterprises	Foreign	Others	Change in Narrow Money supply	
	(%)	Percentage distribution of change in the narrow money supply					Percent	Rp (new) Million
1955	9.9	145.5	18.2	-118.2	90.9	-36.4	100	1.1
1956	9.8	208.3	-16.7	83.3	-150.0	-25.0	100	1.2
1957	41.0	103.6	1.8	39.3	-17.9	-26.8	100	5.5
1958	55.6	91.3	12.5	-8.7	5.8	-1.0	100	10.5
1959	18.7	60.7	94.6	19.6	250.0	-325.0	100	5.5
1960	37.2	-6.2	25.4	-9.2	34.6	55.4	100	13.0
1961	41.1	118.2	15.7	35.9	-34.3	-35.4	100	19.8
1962	101.0	78.6	18.8	7.5	-13.8	8.9	100	68.3
1963	93.8	96.3	18.5	7.8	-8.6	-14.0	100	127.5
1964	156.3	83.9	19.9	7.9	-2.5	-9.2	100	411.7
1965	282.5	74.4	20.7	12.4	-0.2	-7.4	100	1906.9
Mar-1966	116.6	42.9	20.8	6.6	0.2	29.4	100	3011.4

Source: Author's compilation based on Arndt (1971: p.368).

The Soekarno-Era and Thereafter: 1966-2002

The failed 'military coup' in October 1965 gradually and effectively brought Soeharto's 'New Order' government in power in 1966. The new government introduced a wide range of IMF-World Bank-supported stabilization and reform measures, including the removal of restrictions on trade and capital flows. These measures opened the economy for foreign investment, increased aid flows and moved the economy to a higher growth path within two years. By 1970 the

inflation rate was brought down to a single digit level. Thee Kian Wie (2003:p.23) suggests that the main policy instrument for price stability was the introduction of a balanced-budget strategy:

> Upon assuming power in 1966, Soeharto asked his economic team to draw up a Programme for Stabilization and Rehabilitation. The main objective of the Programme was the stabilization of the economy by stopping the runaway inflation. The main policy instrument was a balanced budget, based on the principle that the government should not resort to the printing of money to finance budget deficits. To make this policy more feasible, the estimated revenues in the balanced budget would also include revenues from foreign aid…. The new government's reliance on foreign aid as a source of financial support for the budget was a far cry from the anti-Western "go to hell with your aid" attitude of President Sukarno.

Hill (1996) suggested inflation control of the new government as a major achievement. He commented on it generously: 'The Soeharto government tackled inflation surprisingly quickly and effectively. Indeed, one of the hallmarks of the regime since 1966 has been its commitment to control inflation' (Hill, 1966:p.30). However, in reality, the Soeharto government's commitment to control inflation was at best half-hearted, given that the government maintained a high-growth development strategy during the next three decades when price stability became subordinate to economic growth.

This follows the fact that the goals of monetary policy in Indonesia since the beginning of the Soeharto government until the currency crisis in July 1997 were designed to achieve multiple objectives, including price and exchange rate stability and economic growth. The monetary policy was conducted through controlling monetary aggregates — narrow money (M1) and broad money (M2) — under a fixed/pegged or a 'managed floating' exchange rate arrangement. This strategy of monetary policy was apparently in the lines of monetary targeting where the (broad) monetary aggregate was used as an intermediate target, and open-market operations were

conducted to bring changes in the operational target — the monetary base.[2]

Monetary policy conducted through a 'soft-form' of monetary targeting was not successful in maintaining the monetary growth rate at its target level and thereby achieving one of its goals: price stability, meaning low and stable inflation. To begin with, as Indonesia maintained an open capital account since the late-1960s, it did not have a high degree of monetary policy independence under a fixed or pegged exchange rate system.[3] External developments contributed to most changes in the money supply and the open-market operations were not effective in maintaining the desired growth rate of the money supply, as yields were set administratively at low levels, not market determined (McLeod, 1993). Therefore the money supply in the medium to long-term became an endogenous, rather than an exogenous policy, variable. Moreover, given the ambiguities of monetary targeting under a fixed or pegged exchange rate system, Bank Indonesia did not gain monetary policy credibility for achieving price stability. In fact, it was not the money supply growth rate *per se* but the exchange rate that acted as the nominal anchor to inflation.[4] The resulting inflationary outcome was not satisfactory. Although Indonesia has a high degree of economic openness, its non-tradable goods sector remains large. Therefore the actual inflation rate, which is the weighted average of the inflation rates in the tradable and non-tradable sectors, diverged significantly from that of the pegged currency country (US) and also exhibited a high degree of volatility.[5]

Thus, in brief, the inflation-and monetary history of Indonesia does not suggest that a simple monetary model of inflation under a flexible exchange rate system would be appropriate for this country for the sample period of this study. The key issue is whether a monetary model of inflation is appropriate under a fixed or a pegged exchange rate system when the money supply becomes endogenous. Also, the issue is to what extent any excess money supply in an economy operating under a fixed/pegged or managed floating exchange rate system is adjusted through the price level, rather than through changes in foreign reserves. Such theoretical issues are

beyond the scope of this paper. However, to complement the results in Hossain (2005a), this paper investigates some testable hypotheses within the Granger-causality framework.

3. Specification of the Granger-Causality Models

The Bivariate Granger-Causality Model

Given that there exists a cointegral relationship between money, prices and output, a bivariate Granger-causality model of the following form can be specified for testing causality between money supply growth ($\Delta \ln Mj$) and inflation ($\Delta \ln CPI_t$) (Enders, 1995; Roca, 2000):

$$\Delta \ln CPI_t = \text{constant} + \rho 1\, EC_{t-1} + \Sigma \alpha i\, \Delta \ln Mj_{t-i} + \Sigma \delta i\, \Delta \ln CPI_{t-i} + \text{error term}$$

$$\Delta \ln Mj_t = \text{constant} + \rho 2\, EC_{t-1} + \Sigma \beta i\, \Delta \ln CPI_{t-i} + \Sigma \gamma i\, \Delta \ln Mj_{t-i} + \text{error term}$$

where EC_{t-1} is one period lagged error-correction term in the cointegral relationship, Mj(j = 1,2) is the narrow (M1) or broad (M2) money stock, CPI is the consumer price index, and as per the Granger representation theorem at least one of $\rho 1$ and $\rho 2$ is nonzero.

A negative and significant coefficient $\rho 1$ or $\rho 2$ would indicate the presence of a long-run causal relationship between money growth and inflation. If, for example, only $\rho 1$ is significant, this would suggest a unidirectional causality from money to prices, implying that money drives prices toward long-run equilibrium but not the other way around. If both $\rho 1$ and $\rho 2$ are significant, they would suggest a bi-directional causality between money growth and inflation. This interpretation of Granger causality in a cointegrated system has been emphasized by Enders (1995). According to him, in a cointegrated system, $\{z_t\}$ does not Granger cause $\{y_t\}$ if lagged values Δz_{t-i} do not enter the Δy_t equation and if y_t does not respond to the deviation from long-run equilibrium', which is represented by the error-correction term in the short-run model. In the above specification, the lagged terms of $\Delta \ln CPI_t$ and $\Delta \ln Mj_t$ appear as

explanatory variables, indicating the short-run cause and effect relationship between these two series. Thus if the lagged coefficients of $\Delta \ln Mj_t$ are significant in the regression of $\Delta \ln CPI_t$, this means that money growth causes inflation in the short run.

The Trivariate Granger-Causality Model

Although the above specification is considered adequate, for the present study the Granger-causality model is specified in an expanded form for testing causality between money supply growth and inflation and between inflation and economic growth:

$$\Delta \ln CPI_t = \text{constant} + \rho 1\, EC_{t-1} + \Sigma \alpha i\, \Delta \ln Mj_{t-i} + \Sigma \delta i\, \Delta \ln CPI_{t-i} + \Sigma \eta i\, \Delta \ln y^p_{t-i} + \text{error term}$$

$$\Delta \ln Mj_t = \text{constant} + \rho 2\, EC_{t-1} + \Sigma \beta i\, \Delta \ln CPI_{t-i} + \Sigma \gamma i\, \Delta \ln Mj_{t-i} + \Sigma \nu i\, \Delta \ln y^p_{t-i} + \text{error term}$$

$$\Delta \ln y^p_t = \text{constant} + \rho 3\, EC_{t-1} + \Sigma \varepsilon i\, \Delta \ln CPI_{t-i} + \Sigma \iota i\, \Delta \ln Mj_{t-i} + \Sigma \vartheta i\, \Delta \ln y^p_{t-i} + \text{error term}$$

where y^p is a measure of permanent income and other variables have been defined earlier.

This expanded model is appropriate to examine the short-run causal relationship between money supply growth and inflation conditional on the growth of real permanent income. Any causality between currency devaluation and inflation can also be tested within this framework. The third equation in the above specification is used for testing the effect of inflation on economic growth.

In the specification, i can take an infinite value, but in practice, it takes a finite value. The definition of Granger-causality in the limited sense, or 'precedence' *à la* (Leamer, 1985), implies that the money supply growth is causing inflation provided that in the regression of inflation on lagged inflation, lagged money growth and lagged output growth rates, the sum of the coefficients of money growth rates, that is, $\Sigma \alpha i$, i = 0,2…, is not statistically zero. Similarly, inflation is causing money supply growth provided that in the regression of money supply growth on lagged money growth, lagged inflation and

lagged output growth rates, the sum of the coefficients of inflation, that is, $\Sigma\beta i$, i = 0, 1,2…, is not statistically zero. If both of these events occur, this would indicate a feedback relationship between inflation and money supply growth. Again, as per the third equation in the specification, inflation is causing output growth provided that in the regression of output growth on lagged output growth, lagged inflation and lagged money growth rates, the sum of the coefficients of inflation, that is, $\Sigma\varepsilon i$, i = 0, 1,2…, is not statistically zero.

In applying the test for Indonesia, the lag length is sequentially set at 1, 2 and 3 years because causal inference is usually sensitive to the choice of lag length. Given the relatively small sample size, the maximum lag length of 3 years is considered long enough for the explanatory variables to have their impact realized on the dependent variable. In general, a premature truncation of the lag length may ignore the significant connection that exists in the relationship.

4. The Granger-Causality Between Money Growth and Inflation

Table 4 reports the short-run causality test results in a summary form. The results suggest that there is a strong causality running from inflation to narrow money supply growth for the complete sample period. This result remains robust with the narrow definition of money in the regression model.[6] This finding is consistent with the idea that high inflation generally has a pronounced impact on money supply growth. When inflation rate is high, the government attempts to extract resources from the private sector by printing money (and spending it) at a faster rate than the rate of inflation to cover rapid loss of real revenues. This gives a strong bi-directional relationship between money supply growth and inflation. When the inflation rate is low, the impact of inflation on fiscal deficits is not pronounced; hence, any causality running from inflation to money supply growth may not be strong enough to be detected by a statistical test. As the rate of inflation in Indonesia remained moderately high throughout the sample period, the impact of inflation on money supply growth was statistically significant. However, the causality running from money supply growth to inflation is weak and remains sensitive to

the lag length. This indicates that the money supply growth, under a fixed/pegged exchange rate system, was more an endogenous, rather than an exogenous policy, variable, determined by factors in the money demand function, such as inflation, interest rates, exchange rates and real output.

Table 3. The Short-Run Granger-Causality Between Money Supply Growth and Inflation

A. Regression Model $\Delta \ln CPI_t$ = constant + $\rho 1\ EC_{t-1}$ + $\Sigma \alpha i\ \Delta \ln Mj_{t-i}$ + $\Sigma \delta i\ \Delta \ln CPI_{t-i}$ + $\Sigma \eta i\ \Delta \ln y^p_{t-i}$ + error term		
With Narrow Money Supply Growth (Δln M1)		
Lag-Adjusted Sample Period	Lag Length	F(degrees of freedom)[a]
1954-2002	1	F(1,44) = 5.05*
1955-2002	2	F(2,40) = 0.19
1956-2002	3	F(3,36) = 1.29
1954-1965	1	F(1,7) = 2.19
1955-1965	2	F(2,3) = 0.14
1954-1969	1	F(1,11) = 0.54
1955-1969	2	F(2,7) = 0.24
1971-2002	1	F(1,27) = 1.63
1971-2002	2	F(2,24) = 2.47
1971-2002	3	F(3,21) = 2.13
With Broad Money Supply Growth (Δln M2)		
1971-2002	1	F(1,27) = 0.20
1971-2002	2	F(2,24) = 0.40
1971-2002	3	F(3,21) = 0.14
B. Regression Model $\Delta \ln Mj_t$ = constant + $\rho 2\ EC_{t-1}$ + $\Sigma \beta i\ \Delta \ln CPI_{t-i}$ + $\Sigma \gamma i\ \Delta \ln Mj_{t-i}$ + $\Sigma \nu i\ \Delta \ln y^p_{t-i}$ + error term		
With Narrow Money Supply Growth (Δln M1)		
1954-2002	1	F(1,44) = 20.69**
1955-2002	2	F(2,40) = 13.78**
1956-2002	3	F(3,36) = 12.70**

1954-1965	1	F(1,7) = 0.83
1955-1965	2	F(2,3) = 1.00
1954-1969	1	F(1,11) = 3.76
1955-1969	2	F(2,7) = 1.69
1971-2002	1	F(1,27) = 0.21
1971-2002	2	F(2,24) = 0.07
1971-2002	3	F(3,21) = 4.47*
With Broad Money Supply Growth (Δln M2)		
1971-2002	1	F(1,27) = 0.13
1971-2002	2	F(2,24) = 0.58
1991-2002	3	F(3,21) = 0.21

Notes:

a The F-statistic value is obtained by the variable deletion test. The figures in parentheses are the degrees of freedom

***** significant at the 5 percent level, implying a *causality* running from money supply growth (inflation) to inflation (money supply growth).

** significant at the 1 percent level, implying a *causality* running from money supply growth (inflation) to inflation (money supply growth).

5.The Granger-Causality between Currency Devaluation and Inflation

If the money growth rate is not the main source of inflation, currency devaluation may be considered a supplementary, if not an independent, source of inflation. The procedure generally adopted for examining whether devaluation is an independent source of inflation has three main parts, arranged in a sequential manner (Hossain, 2002). The first part involves testing for a cointegral relationship between the consumer price index (CPI), the narrow (M1) or the broad (M2) money stock, and permanent income (y^p). The presence of a cointegral relationship among these variables is interpreted as a long-term price-level relationship, derived from an equilibrium condition in the money market. The second part of the procedure involves investigation of the short-term effect of devaluation on

inflation. This can be done by estimating an error-correction model of inflation in which devaluation, a stationary variable, is included with the contention that it may have a short-term effect on inflation. The third part of the procedure involves investigation of the feedback effects between inflation and devaluation. Given that the first and second parts of the procedure have been conducted in Hossain (2005b), the third part of the procedure involves the conduct of the Granger causality test between devaluation and inflation within the error-correction modeling framework specified above.

Table 4 reports the test results. They suggest that there is only a weak bi-directional causal relationship between inflation and devaluation and that the results are sensitive to the lag-length. This indicates that devaluation was not a major or an important source of inflation in Indonesia.

Table 4. The Granger-Causality Between Devaluation and Inflation

Effect of Devaluation on Inflation (With Narrow Money Supply Growth, Δln M1) Regression Model $\Delta \ln CPI_t$ = constant+ $\rho 4\ EC_{t-1}$+ $\Sigma\beta i\ \Delta \ln CPI_{t-i}$ +$\Sigma\gamma i\Delta \ln M1_{t-i}$ +$\Sigma\nu i\ \Delta \ln y^p_{t-i}$ + $\Sigma ki\ \Delta \ln ER_{t-i}$ + error term		
Lag-Adjusted Sample Period	Lag Length	F(degrees of freedom)[a]
1967-2002	1	F(1,30) = 2.67
1968-2002	2	F(2,25) = 0.57
1968-2002	3	F(3,20) = 0.59
Effect of Devaluation on Inflation (With Broad Money Supply Growth, Δln M2) Regression Model $\Delta \ln CPI_t$ =constant + $\rho 5\ EC_{t-1}$ +$\Sigma\beta i\ \Delta \ln CPI_{t-i}$ +$\Sigma\gamma i\Delta \ln M2_{t-i}$ +$\Sigma\nu i\ \Delta \ln y^p_{t-i}$ + $\Sigma ki\ \Delta \ln ER_{t-i}$ + error term		
Lag-Adjusted Sample Period	Lag Length	F(degrees of freedom)[a]
1967-2002	1	F(1,30) = 3.37
1968-2002	2	F(2,25) = 0.77
1968-2002	3	F(3,20) = 0.54

Effect of Inflation on Devaluation (With Narrow Money Supply Growth, Δln M1) Regression Model $\Delta \ln ER_t$ =constant+ $\rho 6\ EC_{t-1}$+ $\Sigma \varepsilon i\ \Delta \ln CPI_{t-i}$ +$\Sigma \iota i \Delta \ln M1_{t-i}$ +$\Sigma \vartheta i\ \Delta \ln y^p_{t-i}$ + $\Sigma \varsigma i\ \Delta \ln ER_{t-i}$ + error term		
Lag-Adjusted Sample Period	Lag Length	F(degrees of freedom)[a]
1967-2002	1	F(1,30) = 2.65
1968-2002	2	F(2,25) = 0.31
1968-2002	3	F(3,20) = 0.61
Effect of Inflation on Devaluation (With Broad Money Supply Growth, Δln M2) Regression Model $\Delta \ln ER_t$ =constant+ $\rho 7\ EC_{t-1}$+ $\Sigma \varepsilon i\ \Delta \ln CPI_{t-i}$ +$\Sigma \iota i \Delta \ln M2_{t-i}$ +$\Sigma \vartheta i\ \Delta \ln y^p_{t-i}$ + $\Sigma \varsigma i\ \Delta \ln ER_{t-i}$ + error term		
Lag-Adjusted Sample Period	Lag Length	F(degrees of freedom)[a]
1967-2002	1	F(1,30) = 2.02
1968-2002	2	F(2,25) = 0.45
1968-2002	3	F(3,21) = 1.05

a The F-statistic value is obtained by the variable deletion test. The figures in parentheses are the degrees of freedom

6. The Granger-Causality Between Inflation and Economic Growth

Friedman (1977) argues that inflation leads to inflation uncertainty and that inflation uncertainty adversely affects economic activity. Thus, in his view, there is no long-run trade-off between inflation and unemployment (the Phillips curve); instead, there could be a positive relationship between inflation and unemployment given that inflation and inflation uncertainty may adversely affect economic growth and raise unemployment. Ball (1992) later derived Friedman's views formally in an asymmetric repeated information game where the public faces uncertainty about the monetary authority.

Most empirical studies, such as Fischer (1993), De Gregorio (1993) and Bruno and Easterly (1995), suggest that high or hyper-inflation retard economic growth, although there could be a positive relationship between inflation and economic growth when the inflation rate is low. The debate remains on the cut-off point at which inflation retards economic growth. Bruno and Easterly (1998) suggest that the annual inflation rate above 40 percent is likely to lead to a growth crisis. Fischer, Sahay and Vegh (1996) find that, in the case of transition economies, this cut-off point occurs when the annual inflation rate is about 50 percent. Sarel (1996) locates the break-point at which annual inflation rate affects economic growth is 8 percent. For inflation rates greater than 8 percent, the effect is negative, statistically significant and strong. Below that rate, inflation does not have a significant effect on growth or it may even exhibit a slightly positive effect. Ghosh and Phillips (1998), using a large sample than Sarel's, find a substantially lower threshold effect at 2.5 percent annual inflation rate. They find that inflation is an important statistical determinant of growth. Cristofferson and Doyle (1998) argue that the negative relationship between inflation and growth, typically found in cross-country regressions, exists only in high-frequency data and with extreme inflation observations. They find no cross-sectional correlation between long-run averages of growth and inflation in the full-sample, but detect a negative effect of inflation and growth for inflation rates higher than 40 percent. Khan and Senhadji (2000) examine this relationship separately for industrial and developing countries and suggest that "the threshold level of inflation above which inflation significantly slows growth is estimated at 1-3 percent for industrial countries and 7-11 percent for developing countries".

Indonesia experienced rapid economic growth and transformation since the late 1960s. Indonesia also experienced moderately high and volatile inflation for most of the period since the 1950s. Such volatility originated from both policy reasons and supply/external shocks to an increasingly open economy. It remains an issue whether inflation had any impact on economic growth in Indonesia.

Table 5 reports the Granger-causality test results. They suggest that there was no significant causal effect from inflation on economic growth for the complete or any sub-sample period. Mackie (1967) pointed out that the Indonesian economy was somehow immune from the adverse consequences of inflation even during the phase of high inflation in the 1950s and early 1960s. One possible reason for it could be the subsistence nature of the economy during that period. That the Indonesian economy did not suffer much from even moderately high or volatile inflation since the early 1970s is reassuring but needs further investigation.[7]

Table 5. Effect of Inflation on Economic Growth

Regression Model $\Delta \ln y^p_t$ = constant + $\rho 3\ EC_{t-1} + \Sigma \beta i\ \Delta \ln CPI_{t-i} + \Sigma \gamma i\ \Delta \ln M_{j\,t-i} + \Sigma \nu i\ \Delta \ln y^p_{t-i}$ + error term (With Narrow Money Supply Growth, $\Delta \ln M1$)		
Lag-Adjusted Sample Period	Lag Length	F(degrees of freedom)[a]
1954-2002	1	F(1,44) = 0.05
1955-2002	2	F(2,40) = 0.24
1956-2002	3	F(3,36) = 0.36
1971-2002	1	F(1,27) = 0.06
1971-2002	2	F(2,24) = 0.46
1971-2002	3	F(3,21) = 0.30
Regression Model $\Delta \ln y^p_t$ = constant + $\rho 4\ EC_{t-1} + \Sigma \beta i\ \Delta \ln CPI_{t-i} + \Sigma \gamma i\ \Delta \ln M_{j\,t-i} + \Sigma \nu i\ \Delta \ln y^p_{t-i}$ + error term (With broad Money Supply Growth, $\Delta \ln M2$)		
Lag-Adjusted Sample Period	Lag Length	F(degrees of freedom)[a]
1962-2002	1	F(1,36) = 0.09
1963-2002	2	F(2,32) = 0.60
1964-2002	3	F(3,28) = 0.83

Note: a The F-statistic value is obtained by the variable deletion test. The figures in parentheses are the degrees of freedom

7. Summary and Conclusion

This paper has used annual data for the period 1954-2002 to investigate the causal relationship between money growth, inflation, currency devaluation and economic growth in Indonesia. Three testable hypotheses have been investigated: (1) does the money supply growth Granger-cause inflation? (2) does currency devaluation Granger-cause inflation? (3) does inflation affect economic growth? The empirical results suggest that there existed a short-run bi-directional causality between money supply growth and inflation and between currency devaluation and inflation. For the complete sample period, the causality running from inflation to narrow money supply growth was stronger than that from narrow money supply growth to inflation. This result is consistent with the view that in a high-or hyperinflationary economy, inflation does have a feedback effect on money supply growth and this generates a self-sustaining inflationary process. The short-run bi-directional causality between currency devaluation and inflation was, however, weak or not so robust for the complete or any shorter sample period. On the relationship between inflation and economic growth, the results suggest that there was no short-run causality from inflation to economic growth for the complete or any sub-sample period.

Notes

1.This paper uses the data set in Hossain (2005b), which contains the definition of variables, data sources and a summary of the time series properties of variables used in the regression analysis. However, the detailed unit root test results are not reported in the paper but would be available from the author upon request.

2.For the conduct of open-market operations, Bank Indonesia certificates and some money market securities, rather than the government-issued debt instruments were used. At the operational level, the monetary authorities' main task was to keep the monetary aggregate at a level that was considered adequate for a pre-determined target rate of economic growth and to avoid creating internal-and external imbalances (Arndt, 1979; Grenville, 1981; Alamsyah, Joseph, Agung and Zulverdy, 2001).

3.Under a fixed or pegged exchange rate system the domestic interest rate (i^d) is expected to move in tandem with the foreign interest rate (i^f) if there is freely mobile capital. This follows the interest rate parity condition: $i^d = i^f + \delta$, where δ is the expected rate of depreciation of domestic currency against the anchor currency and should be zero under a credible fixed or pegged exchange rate system.

4.This follows the purchasing power parity proposition: $P_T = NER \bullet P_T^*$ where P_T is the price of tradables in domestic currency, NER is the fixed/pegged exchange rate and P_T^* is the price of tradables in foreign currency.

5.Nevertheless, Hill (1966:p.30) has somewhat generously praised the Soeharto government's efforts for inflation control:

> Until recently monetary policy instruments have been blunt and underdeveloped. But the regime has established a credible reputation for basically sound macroeconomic management: each burst of inflation has been followed by corrective intervention. Unquestionably, one of the positive legacies of the bitter experience of the 1960s has been an aversion to high inflation. Indeed, as soon as inflation has approached the threshold of double-digit levels, alarm bells have sounded in the central bank and the Department of Finance and the response has generally been prompt.

6.The results with the broad definition of money suggest no such relationship.

7.The issue is under investigation by the author within the ARCH-GARCH modeling framework.

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