

Monetary Variables in Macmod

**A note concerning the introduction of
monetary variables in the Tanzanian
macro economic model: Macmod**

Per Granberg

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Summary

This paper discusses the relationship between money supply and production in Tanzania, with special reference to Macmod, the macroeconomic model for Tanzania.

The relationship between money supply and production is seen as being neither direct nor simple in nature: the paper argues that the money supply does not impact production directly, but via inflation. Other things being equal, one may consequently expect money supply to influence inflation, and inflation to affect production.

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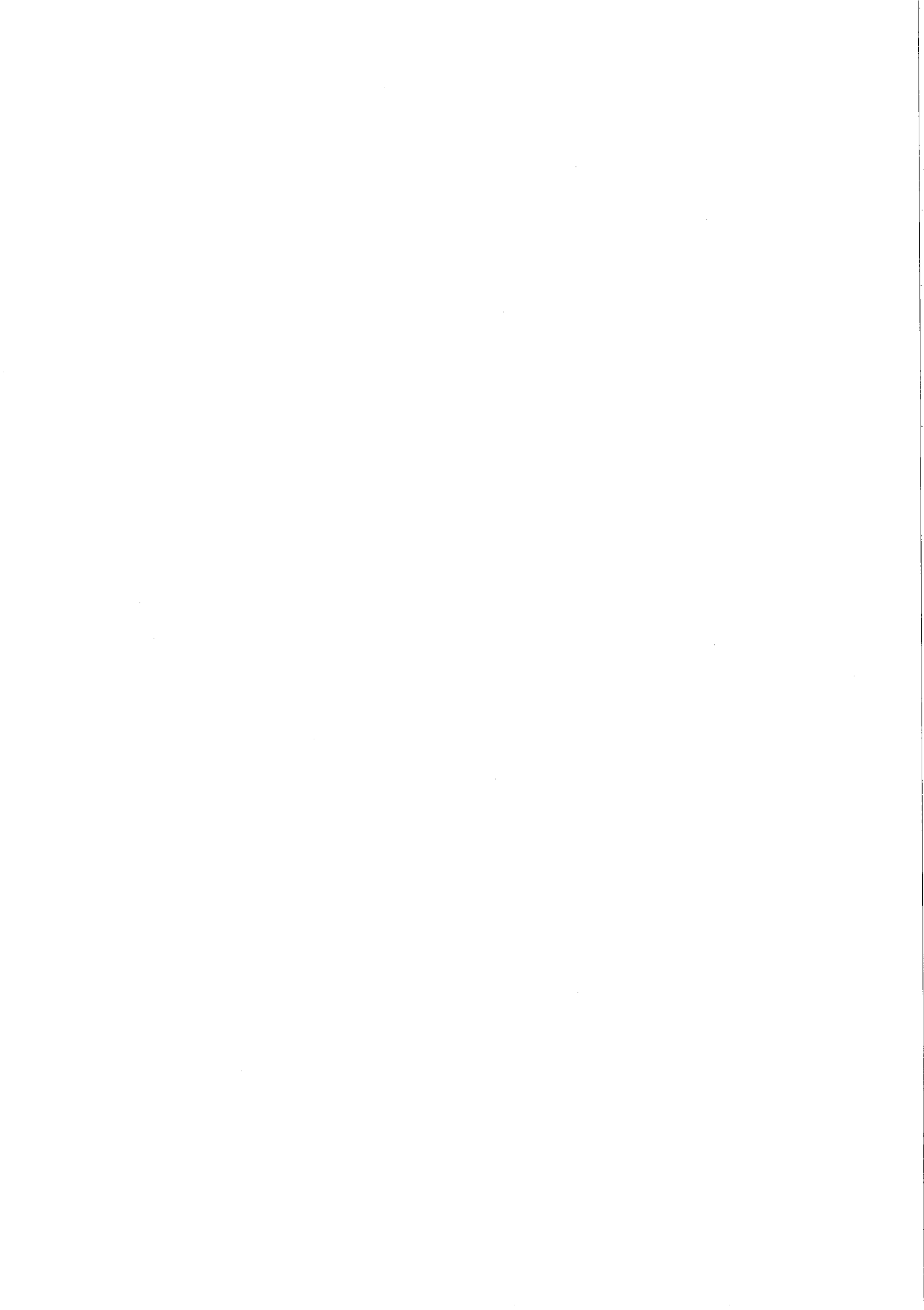
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Macmod

Tanzania

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I : Introduction

This paper reports on some observations and reflections made about the relationship between the aggregate supply of money on the one hand, and the total volume of production on the other. The reflections refer to the Tanzanian setting, and were made in connection with the ongoing revision of Macmod, the macroeconomic model for Tanzania constructed with technical assistance from the Chr. Michelsen Institute.

The concrete background for focusing on this particular model and topic is set out in the following documents:

- “Macroeconomic and budgetary modelling for medium term planning (Phase II)” (undated document in respect of the Macmod-model, written by H. K. Nordås, CMI), where the chapter: The Money Market reads as follows:

As explained in the MACMOD documentation, it appears that monetary policy in the past has been the most effective policy instrument in controlling aggregate demand. The transmission mechanisms have, however, not been the traditional Keynesian via the interest rate and investment demand. In order to improve the money market block of the MACMOD, we suggest an assessment of recent developments of the financial sector and the instruments used by the Bank of Tanzania. The objective of this assessment is to incorporate in the most realistic manner the transmission mechanisms of monetary policy in the economy. In accordance with the recommendations from the recent technical session it will be explored whether using M3 as the monetary aggregate improves the model projections.

- “Macmod, a macroeconomic model for the Tanzanian economy” (Hildegunn Kyvik Nordås with Arild angelsen. CMI Report R1998:5), where a section of chapter 3.3 reads as follows:

Before closing this section, it is useful to look at how monetary and fiscal policy have influenced aggregate demand in the past. To get a very rough idea, we have computed the correlation coefficients between various components of total expenditure and money supply and government final consumption respectively for the period 1987-1996. The results are presented in table 3.3.

Table 3.3 Correlation between money supply and GDP and its expenditure categories

	M2
GDPmp	0.92
Private consumption	0.93
Investment	-0.1

As can be seen from this table, the correlation coefficients between money supply and GDP and consumption are exceptionally high. The correlation between money supply and investment is, however, negligible and, if anything, slightly negative. This suggests that the transmission mechanism for monetary policy in the not been the traditional Keynesian transmission via the interest rates and investment. It appears that money supply has rather had a direct effect on private consumption and GDP through net wealth effects. This is probably because a large share of the money demand has been for working capital in parastatals and cooperatives and for credit to government, which in turn has increased the purchasing power in the economy. In future, however, the Keynesian transmission mechanism should be expected to be more prominent as capital markets are deregulated, and government monetize the budget deficit to a much lesser extent.

Summing up, the assignment drawn up in the two documents cited above is consequently:

- to look at the financial instruments used by the Bank of Tanzania,
- in order to identify the way in which monetary variables impact production,
- for the ultimate purpose of introducing relevant model structures into Macmod.

II : Monetary matters

Monetary policy objectives and instruments

The Bank of Tanzania (BOT) operates a web site (www.bot-tz.org) containing a lot of valuable information about monetary matters etc in Tanzania. According to the statements made in that web site:

- *The primary objective of the Bank of Tanzania is price stability. The Bank therefore has the responsibility of ensuring that it establishes monetary conditions that are consistent with low and stable inflation.*
- *However, inflation control is not an end in itself, but rather, the means by which monetary policy contributes to solid economic performance.*
- *Low inflation allows the economy to function more effectively, thereby contributing to better economic performance over time.*
- *Inflation control by the Central Bank is done by controlling money supply. The Bank of Tanzania targets extended broad money, M3, which is defined as total deposit liabilities held by commercial banks, including foreign currency deposits, because it is the monetary aggregate estimated to have closest relationship with the rate of inflation.*
- *To influence the chosen monetary aggregate, i.e. M3, the Central Bank normally controls the base money (reserve money, or central bank money) which is directly related to money supply.*

The above statements, (together with other statements in the BOT web site), make it abundantly clear that the monetary policy of Tanzania has *one* primary objective: to maintain low and stable inflation. The importance attached to this target is indicated by the fact that this is also stated (in the web site) as *the primary* objective of the Bank itself, and of all its activities.

The focus on inflation does not, however, imply that price stability is seen as an end in itself. Rather it is seen as the way in which monetary policy may contribute to economic development. Stable and low inflation is seen as an essential *precondition* for sustainable economic growth.

The control of the money supply is the main policy instrument used by the Bank in controlling inflation. In so doing, BOT uses its direct control over base money (reserve money, or central bank money) to influence the extended broad money aggregate (M3). BOT targets M3 because it sees it as the monetary aggregate with the closest relationship to the rate of inflation.

Base money control is not the only weapon in BOT's arsenal. The Bank also makes use of a number of additional monetary instruments in the fight to ensure price stability. Thus, according to the BOT web site, the Bank engages in Open Market Operations, through which it sells and buys government securities (e.g. Treasury bills) in the

open market. Other BOT instruments include the discount and Lombard rate, the statutory reserve requirements, moral inducement and gentlemen's agreements. The characteristics of the various instruments are described in considerable detail in the said web site (to which the interested reader is referred).

The interest rate

The interest rate is of specific concern to the present paper, given that it is a central variable in the Keynesian transmission mechanism referred to earlier. The interest rate (or rather: the average or typical interest rate) of Tanzania is market oriented; it reflects the prevailing conditions in the financial market (i.e. the relative shortage or surplus of liquidity etc.) Even so, BOT plays a crucial role in "setting" the interest rate; it is a major "force" behind the said market conditions. Thus, BOT determines the "leading" (or "signal") interest-rates "underpinning" the financial market, it control the supply of base money etc.

The "signal" rates¹ are policy instruments in their own right. BOT describes them as independent variables that it may use to *control* the supply of money (as defined in terms of M3), not as dependent variable *controlled* by it. This, however, does not imply that BOT can impose them on the rest of the economy in the sense that it can set them entirely at will and expect the market to "follow suite". In setting these rates BOT has to take due account of other relevant factors and conditions, and of the overall policy objective of controlling inflation.

This may possibly have been different in earlier years. The financial sector was then under heavy government control, and credit allocated largely by administrative means (rather than through the market). BOT was consequently in command of the financial market. The government, in its turn, was in command of BOT. At the same time, government budget discipline was weak, and government "borrowing in the central bank" the order of the day. BOT was consequently relied on to provide government with a steady supply of credits.

This scenario may possibly serve to throw some light upon a point raised in the earlier cited CMI Report (R1998:5). It is recalled that the correlation coefficient between money supply and investments was found to be negative (-0.1), apparently to the surprise of the authors of the report. Instead, they appear to have expected a positive correlation coefficient on the assumption that:

- an increase in the money supply will tend to lower the interest rate,
- which will reduce the "cost of borrowing",
- which will increase the demand for investment products (because investments tend to be credit financed).

A correlation coefficient of -0.1 repudiates this hypothesis. It corresponds to a coefficient of determination of almost zero, indicating the absence of a causal relationship of any kind between money supply and investments.² This situation may possibly arise because the first part of the above hypothesis is incorrect. In other words:

¹ The "signal" rates in question are the discount rate, which is used when BOT buys financial securities from the banks, and the Lombard rate, which is used when BOT gives loans to the private banks.

² See Appendix I for a note about the interpretation of the coefficient of determination, correlation coefficient etc.

changes in money supply did *not* impact the interest rate, because both were set administratively and independently.³

Monetary survey

Table II,1 portrays the various elements of money supply in (mainland) Tanzania for the period 1985-98. The rapid growth in the variables concerned is readily seen in the upper section of the table. Thus, narrow money (M1) grew by a factor of 22, from 25 billion shillings in 1985 to 546 billion in 1998. Broad money (M2) also grew by a factor of 22, from 39 to 845 billion, while extended broad money (M3) grew by a factor of 26, from 39 to 1,027 billion. The additional growth in M3 is due to the spectacular growth in foreign currency deposits, which has grown from virtually zero in the 1980s, to 182 billion shillings in 1998.

Table II,1 Monetary Survey for mainland Tanzania (TZS'Billion)

Year	Currency in circulation	Plus: Demand deposits	Equals: Narrow money (M1)	Plus: Time & savings deposits	Equals: Broad money (M2)	Plus: Foreign currency deposits	Equals: Extended broad money (M3)
1985 ^{*)}	12,7	12,6	25,3	13,7	38,9	0,2	39,0
1986	18,3	17,5	35,8	14,4	50,2	0,1	50,4
...
1997	287,9	206,0	493,9	266,5	760,4	166,7	927,1
1998	307,8	237,7	545,5	299,4	844,9	182,1	1 027,0
Annual averages for selected periods:							
1985-88	21,8	21,6	43,4	17,8	61,2	0,3	61,4
1989-93	76,0	76,4	152,5	74,7	227,2	16,3	243,4
1994-98	254,8	194,5	449,3	228,8	678,1	140,9	819,0

cont.

Year	Extended broad money (M3)	of which:			
		Net foreign assets	Net claims on government	Lending to private & parastatals	Other items, net
1985 ^{*)}	39,0	-10,8	32,3	17,4	-6,9
1986	50,4	-12,9	32,6	27,6	3,1
...
1997	927,1	398,9	239,5	183,0	105,7
1998	1 027,0	458,0	276,6	248,3	44,1
Annual averages for selected periods:					
1985-88	61,4	-16,7	38,0	43,4	-5,0
1989-93	243,4	15,9	82,2	177,1	-31,7
1994-98	819,0	285,9	254,4	220,1	58,5

^{*)}The 1985 entries do not balance.

Source: Table A1 of Annex II.

³ Investment demand will of course also depend on a number of other factors, besides the money supply and the interest rate. Thus, it will depend on the "general investment climate", i.e. on such factors as the situation with respect to "red tape", the secure supply of required production inputs, the expectations about the future etc. Factors of this nature have probably been of considerable importance, especially in the past, given that the Tanzanian economy has suffered significant inefficiencies, inequilibria, bottlenecks etc.

Looking at the lower section of table II,1 we find that M3 was mainly associated with lending to the private and parastatal sector, as well as with net claims on government, during the 1980s, and early 1990s. The prominence of these factors has weakened considerably during the later 1990s, with foreign assets becoming the major M3 item in recent years.

The rapid growth in the various money supply components is illustrated in table II,2. The table shows that the foreign currency deposits increased at an average rate of 88 % pa during the period 1985-98, while extended broad money (M3) grew at an average rate of 29 % pa. The corresponding figure for M1 and M2 is 27 % pa (in both cases). Breaking the 1985-98 period down into two sub-periods (1985-91 and 1992-98) we find that the average growth rates were decidedly higher in the first sub-period than in the second. This is the case for all the three money aggregates, and also for their various sub-components, with the exception of foreign currency deposits.

*Table II,2 Average growth rates for selected periods (geometric, % pa) *)*

Period	Currency in circulation	Demand deposits	Narrow money (M1)	Time & savings deposits	Broad money (M2)	Foreign currency deposits	Ext. broad money (M3)
1985-88	36 %	39 %	37 %	21 %	32 %	24 %	32 %
1989-93	24 %	25 %	25 %	30 %	26 %	105 %	29 %
1994-98	20 %	14 %	17 %	20 %	18 %	28 %	20 %

cont.

Period	Extended broad money (M3)	of which:			
		Net foreign assets	Net claims on government	Lending to private & parastatals	Other items, net
1985-88	32 %	29 %	17 %	62 %	20 %
1989-93	29 %	-204 %	25 %	18 %	5 %
1994-98	20 %	76 %	8 %	0 %	-204 %

*) Based on the data of table A1.

Decomposing the overall growth rate

Table II,3 shows the annual (year on year) growth rates for M1, M2 and M3 during each year of the period 1986-98. The growth rates are, as expected, seen to vary with respect to both years and variables. On the whole, however, the picture is one of fairly substantial variations between years, and relatively modest variations within year. The variation between years is particularly striking when comparing the rates of the last few years to the rates of earlier years. In comparison, the variation between the three variables (M1, M2 and M3) within each year is relatively small. With some exceptions, the three aggregates seem to have moved fairly well in step over the years.

It is recalled that the question of whether to use M2 or M3 for the modelling effort was raised in the Macmod report "Macroeconomic and budgetary modelling for medium term planning (Phase II)". The above observation may possibly serve to suggest that the choice between the two is not all that important.⁴

⁴ Note, however, that the above finding refers to annual data. A proper analysis of the question ought preferable to employ monthly data. According to present plans, this will be done in another paper. We will therefore not venture further along this road here.

Table II,3 Annual growth rates for M1, M2 and M3 (% pa)

Year	Narrow money (M1)	Broad money (M2)	Ext. broad money (M3)
1986	42 %	29 %	29 %
1987	32 %	32 %	32 %
1988	39 %	35 %	35 %
1989	26 %	29 %	29 %
1990	35 %	42 %	43 %
1991	22 %	26 %	27 %
1992	37 %	38 %	43 %
1993	33 %	29 %	39 %
1994	33 %	33 %	35 %
1995	30 %	26 %	32 %
1996	5 %	12 %	9 %
1997	10 %	11 %	13 %
1998	10 %	11 %	11 %
Annual (geometric) averages, selected periods:			
1985-88	37 %	32 %	32 %
1989-93	25 %	26 %	29 %
1994-98	17 %	18 %	20 %

Table II,3 refers to the aggregate M1, M2 and M3 levels. It may be of some interest to analyse how the various components of these aggregates have contributed to the overall growth in money supply. Table II,4 breaks the annual growth in the M3 aggregate down into its various components.

The components of table II,4 are additive within years, i.e. they add up to the M3-total when summed row-wise. Section A presents the percentage shares of the annual (year on year) growth in the value of M3. Section B gives the same shares, but this time expressed in terms of the annual M3 (% pa) growth rate. Figures in bold (in section A) are "local maxima" while the underlined figures are the corresponding minima.

Inspecting the table (section A) it is seen that currency in circulation, and lending to the private and parastatal sector, were the main M3 components in the 1980s and early 1990s. The picture, however, is not entirely "one-sided". Thus, in 1988 the demand deposits contributed much more to the overall growth in M3 than did the currency in circulation.

Later years have seen considerable variations in this "pattern". All kinds of deposits, including foreign currency deposits, have become important contributors to the growth of M3, as have net foreign assets. No single variable among them is however able to dominate the picture in the way as currency in circulation and lending to the private and parastatal sector dominated the picture in the early years.

All in all the picture presented by table II,4 is therefore one of significant change during the 1990s, from an initial situation rather heavily dominated by the two factors: currency in circulation and lending to the private and parastatal sector, to a situation which is much more balanced in the sense that more factors have come into play.

Table II,4 Components of growth in M3⁵

Section A: Percentage shares of the annual (year on year) growth in M3 value

Year	Cur- rency in circula- tion	Demand deposits	Narrow money (M1)	Time & savings deposits	Broad money (M2)	Foreign currency deposits	Extend. broad money (M3)	of which:			
								Net for- eign assets	Net claims on gov.	Lend- ing to priv.etc	Other items, net
1986	49 %	43 %	93 %	7 %	99 %	-1 %	100 %	-18 %	2 %	89 %	88 %
1987	39 %	31 %	70 %	28 %	99 %	1 %	100 %	-44 %	19 %	170 %	-45 %
1988	31 %	48 %	78 %	21 %	100 %	1 %	100 %	-14 %	69 %	79 %	-34 %
1989	35 %	29 %	64 %	32 %	96 %	4 %	100 %	5 %	32 %	126 %	-62 %
1990	33 %	24 %	57 %	39 %	96 %	4 %	100 %	57 %	-12 %	77 %	-22 %
1991	13 %	43 %	55 %	40 %	95 %	5 %	100 %	30 %	-32 %	117 %	-16 %
1992	35 %	20 %	55 %	32 %	88 %	12 %	100 %	31 %	37 %	-10 %	42 %
1993	23 %	29 %	52 %	18 %	69 %	31 %	100 %	-18 %	94 %	48 %	-24 %
1994	36 %	19 %	55 %	25 %	80 %	20 %	100 %	60 %	-2 %	23 %	19 %
1995	37 %	17 %	54 %	16 %	69 %	31 %	100 %	27 %	54 %	-18 %	37 %
1996	20 %	12 %	32 %	77 %	109 %	-9 %	100 %	191 %	25 %	-163 %	47 %
1997	28 %	13 %	41 %	28 %	69 %	31 %	100 %	100 %	-52 %	38 %	14 %
1998	20 %	32 %	52 %	33 %	85 %	15 %	100 %	59 %	37 %	65 %	-62 %
Annual (geometric) averages for selected periods:											
1985-88	37 %	42 %	79 %	20 %	99 %	0 %	100 %	-25 %	38 %	110 %	-10 %
1989-93	27 %	28 %	55 %	29 %	84 %	16 %	100 %	15 %	40 %	52 %	-7 %
1994-98	31 %	19 %	49 %	30 %	79 %	21 %	100 %	71 %	15 %	0 %	13 %

Section B: Same as above, but expressed in terms of the % pa M3 growth rates

Year	Cur- rency in circula- tion	Demand deposits	Narrow money (M1)	Time & savings deposits	Broad money (M2)	Foreign currency deposits	Extend. broad money (M3)	of which:			
								Net for- eign assets	Net claims on gov.	Lend- ing to priv.etc	Other items, net
1986	14 %	13 %	27 %	2 %	29 %	0 %	29 %	-5 %	1 %	26 %	26 %
1987	12 %	10 %	22 %	9 %	32 %	0 %	32 %	-14 %	6 %	54 %	-14 %
1988	11 %	17 %	27 %	7 %	35 %	0 %	35 %	-5 %	24 %	28 %	-12 %
1989	10 %	8 %	19 %	9 %	28 %	1 %	29 %	1 %	9 %	37 %	-18 %
1990	14 %	10 %	25 %	17 %	42 %	2 %	43 %	24 %	-5 %	33 %	-9 %
1991	3 %	11 %	15 %	11 %	26 %	1 %	27 %	8 %	-9 %	32 %	-4 %
1992	15 %	9 %	24 %	14 %	37 %	5 %	43 %	13 %	16 %	-4 %	18 %
1993	9 %	11 %	20 %	7 %	27 %	12 %	39 %	-7 %	37 %	19 %	-9 %
1994	13 %	7 %	20 %	9 %	28 %	7 %	35 %	21 %	-1 %	8 %	7 %
1995	12 %	5 %	17 %	5 %	22 %	10 %	32 %	9 %	17 %	-6 %	12 %
1996	2 %	1 %	3 %	7 %	9 %	-1 %	9 %	17 %	2 %	-14 %	4 %
1997	4 %	2 %	5 %	4 %	9 %	4 %	13 %	13 %	-7 %	5 %	2 %
1998	2 %	3 %	6 %	4 %	9 %	2 %	11 %	6 %	4 %	7 %	-7 %
Annual (geometric) averages for selected periods:											
1985-88	36 %	39 %	37 %	21 %	32 %	24 %	32 %	29 %	17 %	62 %	20 %
1989-93	24 %	25 %	25 %	30 %	26 %	105 %	29 %	-204 %	25 %	18 %	5 %
1994-98	20 %	14 %	17 %	20 %	18 %	28 %	20 %	76 %	8 %	0 %	-204 %

⁵ Note that the various components are directly additive. Thus, for each year they add up to the M3 growth rate.

III : Transmission mechanisms

Implicit assumptions

The assignment drawn up in the introduction may at first glance seem clear enough. On closer consideration, however, the picture becomes less lucid. This is because the assignment implicitly builds upon certain underlying presumption about the nature of the Tanzanian economy. These presumptions are of fundamental importance to the question put before us, and they seem far from self-evident to the present author. We shall therefore take a closer look at them.

The texts cited in chapter I seem to have accepted without much qualm that monetary policy has so far been “most effective” in influencing local demand, and hence local production. Splitting this argument into its separate components, we get the following two statements:

- Typically speaking, the economy of Tanzania is (or, rather: has been) demand-driven (as opposed to supply-driven).
- The use of monetary variables is (or, rather: has been) the most effective way of controlling aggregate demand.

The first of these statements implies that demand is the critical factor determining the volume of activity attained by the country’s producers. Supply, on the other hand, is assumed merely to “follow” demand. Producers are consequently presumed able, willing and compelled to meet any variations in demand for their products. Given such a structure, slow economic growth may be seen as caused by weak aggregate demand, not by supply-side constraints or similar. In order to achieve higher economic growth one must therefore try to increase demand, rather than production capacity.

Assumptions of this nature is often adopted in the case of rich, industrialised countries, especially for the short-term perspective, or when faced with an economic downturn or depression.⁶ The assumption seems more doubtful in the case of a poor, agricultural country like Tanzania, where significant supply constraints in all probability are the order of the day.

Expressing this differently we may note that the fundamental problem of countries like Tanzania is poverty. The predicament is therefore not one of insufficient demand as such, in the sense that consumers etc are “holding back” and have to be stimulated so as to spend more. Rather, it is one of insufficient income and purchasing power, allowing them to satisfy their many unsatisfied needs. The insufficient income, in its turn, reflects insufficient means of production, insufficient labour productivity etc., i.e. insufficient capacity to produce and supply.

The second of the above statements (about total demand being governed mainly by the money supply) also seems a bit doubtful. In order to discuss this statement we draw on the macro budget identity which equates total demand to total supply, and

⁶ I.e. when affected by a slow or otherwise unsatisfactory economic performance, despite spare production capacity.

breaks both down into their various components. Thus: Total Supply, which is equal to: GDP + Imports, must be equal to Total Demand, which is equal to: Private and Government Consumption + Private and Government Capital Formation + Exports + Changes in Inventories.

It is readily seen that one of the above demand variables (exports) represents foreigners' procurement of Tanzanian products. Such demand seems likely to depend on conditions abroad, and equally unlikely to depend on the monetary situation in Tanzania.⁷

Among the local demand components private consumption accounts for the lion's share of all demand. Thus, as seen from table III,1 it accounts for around 6/10 of total demand, some 3-4 times the share of the next largest demand components (government consumption and private investments).

Table III,1: The macro budget⁸

Year	Supply components		Total supply (& demand)	Demand components					Errors and omissions	
	GDP at market price	Imports		Private consumption	Gov. consumption	Private investments	Gov. investments	Exports		Change in stocks
A : Absolute values, at constant 1992 prices, TZS' billion										
1987	1 154	481	1 635	952	229	302	23	120	3	6
1988	1 201	477	1 678	987	250	230	21	131	3	56
...
1996	1 525	561	2 086	1 278	169	264	10	329	4	32
1997	1 578	403	1 981	1 310	135	252	23	247	4	10
B : Percentage distribution										
1987	71 %	29 %	100 %	58 %	14 %	18 %	1 %	7 %	0 %	0 %
1988	72 %	28 %	100 %	59 %	15 %	14 %	1 %	8 %	0 %	3 %
...
1996	73 %	27 %	100 %	61 %	8 %	13 %	0 %	16 %	0 %	2 %
1997	80 %	20 %	100 %	66 %	7 %	13 %	1 %	12 %	0 %	0 %

Private consumption may possibly be affected by monetary variables, for instance via the credit market, via the inflation rate or similar. On the whole, however, these impacts are likely to be indirect and marginal in nature. This is especially so given the fact that a large part of private consumption is non-monetary in nature. Thus, as table A3 of Annex II demonstrates, a large part of Tanzania's GDP is of the non-monetary kind. Almost all of this ends up as private consumption.⁹

What then, is the decisive factor behind private consumption demand? The obvious answer to this question is that consumer demand is "driven" by consumer income.

⁷ Note that this statement concerns the *demand* side of exports. It does not rule out the possibility that the *supply* of exports may be influenced by local monetary variables, either in terms of volume or price.

⁸ From table A5 of Annex II.

⁹ A minor part of non-monetary GDP is usually ascribed to private investments (hut construction etc).

Consumption incurs expenditure, which the consumer has to cover. The necessary "consumer purchasing power" is largely acquired through "incomes earned" (as modified by assets held, taxes paid, savings (positive or negative) made, gifts/transfers given or received etc).

The incomes in question are primarily those earned as labour rewards (inclusive of incomes-in-kind, incomes from self-employment, "incomes" in non-monetary activity etc.), but capital returns in small and medium scale activities are probably also of relevance. Given that returns to labour and capital are the major components of GDP, "incomes earned" are therefore closely associated with the latter, which may serve as a "shadow variable" for the former.

The case of private investments provides more scope for the monetary dimension, at least in principle. Like consumption, investments have to be financed. This will often be from the investors' own assets or incomes, but credit finance is also common (provided that the country in question has the required credit facilities). The average private investment project may therefore be dependent upon the credit market, which in its turn presumably reflect monetary and credit policies. Investment decisions, however, reflect many and complex factors, not merely the "ease or squeeze" in the credit market. Investments may therefore be low even though credit conditions seem favourable (and *vice versa*), denying the effective role of money and credit also for this variable.¹⁰

Government demand (consumption and investments) ought in principle to be financed by government incomes (tax revenues, grants etc.), by drawing on existing assets, or by borrowing from the non-government sector. In other words, the resources used by government ought to be "balanced" against a parallel reduction in the "disposable resources" of the rest of the economy.

However, governments are often inclined to spend "beyond their means", "borrowing in the central bank" to cover the extra expenditures. In most cases this is a euphemism for "printing money", i.e. for injecting additional money into the economy. So also in Tanzania, where poor budget discipline and extensive deficit spending used to be a common occurrence in government organisations. In this particular sense, therefore, money supply and government demand went hand in hand.

This, however, was no receipt for economic development. The result of such monetary expansion was all too often found to be demand pressure and inflation, rather than real-term economic growth.¹¹ In recognition of this fact, the Tanzanian authorities have curtailed the use of such deficit financing in recent years. The close relationship between money supply and government demand described above is therefore unlikely to persist today.

Summing up, there consequently seems quite limited scope for a *direct* monetary impact on economic demand categories. This, however, is not to deny the possibility that

¹⁰ Thus, it is recalled from the earlier quoted CMI Report (R1998:5) that the investments were found to be negatively correlated to the money supply.

¹¹ Note, however, that a certain degree of monetary expansion, reflecting (and "servicing") the growth of the (monetary) economy, may nevertheless be required as part of proper macro-economic management.

demand may be *indirectly* linked to money supply via production, i.e. via the supply variable: GDP. Thus, it is recalled that private consumption, which constitutes the lion's share of demand, is closely associated with GDP. In the following chapter we shall look at the relationship between production and money supply.

Aggregate money and production

It is recalled from CMI Report R1998:5) that the Tanzanian correlation coefficient for money supply and production was found to be "exceptionally high", suggesting a strong bond between these two variables. However, as explained in Annex I, the correlation coefficient in itself is but a measure of statistical association; it does not imply any form of causality between the variables concerned.

Rectifying this "deficiency", by formulating a feasible hypothesis of causality, however, may seem a fairly straightforward matter in the present case. Thus, we may for instance put forward the hypothesis implied in the said CMI Report, i.e. that production is a function of the money supply. Spelling this out in further detail, we hypothesise that the level of total GDP (as measured in real terms, i.e. constant prices) in any given year may be treated as a linear function of the corresponding (nominal) level of the monetary aggregate M2 in the same year.

Putting this hypothesis to the test, by running the available data through a simple regression analysis, we get a coefficient of determination of 0.85, implying that 85% of the variation in the dependent variable (GDP) is caused by the variation in the independent variable (M2). This may at first glance appear to constitute conclusive evidence of causality. After all, how could such a high coefficient of determination possibly mirror anything *but* a fairly clear and strong causal link between these variables?

To answer this question we simply need to take note of the obvious. The problem of creating economic growth would be easily overcome if mere increases in the money supply were capable of inducing the kind of production responses suggested above. If this had been the case, why bother with other economic growth factors than the money supply, and why not use it more expansionary, in the safe knowledge that the result is stronger economic growth? The answer, of course, is that experience has shown that monetary variables can produce little economic growth in and by themselves; flushing the economy with money is likely to result in inflation rather than in real term economic growth.

The idea that the authorities can use the money supply to "drive" the economic growth process on a simple "pro-rata" basis is consequently untenable. And yet that is what our regression results seem to imply. This suggests that the relationship between these variables is spurious, despite the high coefficient of determination. This problem may for instance have arisen because the relationship is incorrectly specified in respect of the problem studied.

To investigate this possibility we take a closer look at the data yielding the 0.85 coefficient of determination. Table III,3 contains the data in question, as well as their implied % pa growth rates. It is noted that the 0.85 coefficient refers to the specific "total dimension" of the variables analysed (see Section A of the table), and that this is not the only "dimension" possible (see, for instance, Section B of the table).

We consequently need to ask ourselves if our use of the “total dimension” represents an appropriate choice. In other words: should the presumed relationship between money and production variables really be defined in terms of the absolute GDP- and M2-*levels*? Isn't it more appropriate to define it as a relationship between the *changes* in these levels?

Table: III,3: Aggregate Money and Production, 1986-97 ¹²

Year	Section A Absolute values (TZS' billion)		Section B Annual increases (% pa)	
	Aggregate Money (M2)	Production (Total GDP)	Aggregate Money (M2)	Production (Total GDP)
1986	50	1 001	NA	NA
1987	66	1 072	31.7 %	7.0 %
1988	89	1 119	35.1 %	4.4 %
1989	115	1 148	28.5 %	2.6 %
1990	163	1 219	42.1 %	6.2 %
1991	206	1 253	26.1 %	2.8 %
1992	285	1 276	38.5 %	1.8 %
1993	367	1 281	28.8 %	0.4 %
1994	486	1 299	32.5 %	1.4 %
1995	614	1 345	26.1 %	3.6 %
1996	685	1 402	11.6 %	4.2 %
1997	760	1 448	11.0 %	3.3 %

In suggesting the existence of a causal link between M2 and GDP, we undoubtedly mean to imply that the absolute aggregate GDP-values somehow reflect the corresponding aggregate M2-values. But that does not tell the whole story; in addition, we mean to imply that this correlation at the aggregate level has arisen because given *changes* in M2 give rise to corresponding *changes* in GDP.

We may “test” the validity of the latter postulate by reformulating our regression hypothesis in terms of the annual changes in the two variables in question. Table III,4 summarises the result of alternative postulates. Section A of the table confirms that the coefficient of determination between the absolute levels is 0.85 (for the variables TotGDP and M2). Section B shows that a reformulation of the hypothesis in terms of the *absolute* annual changes of the variables (i.e. in terms of dTotGDP and dM2) yields a coefficient of determination of no more than 0.07. Finally, section C shows that a reformulation of the hypothesis in terms of the *relative* annual changes of the variables (i.e. in terms of d%TotGDP and d%M2) yields a coefficient of determination as low as -0.10 (which we may interpret as 0.00).

In both of the latter cases, therefore, the coefficient of determination implies that the variables involved grew independently of one another, even though they appear to have followed each other fairly closely at the “accumulated” level. The table also shows that this apparent paradox is not unique to the specific variables here discussed

¹² The monetary aggregate in question is: M2, and the GDP aggregate: total GDP at factor cost, in constant 1992 prices.

