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Macro-Economic Policy: An Analytical Framework

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Introduction

Macro-economics refers to that branch of economics which deals with broad aggregates. Its subject matter includes such major problem as unemployment, inflation, economic growth, and international payment deficits, among others. Macro-economic problems are not new. They have, in fact, occupied a central place in the development of economic thought. Interest in macro-economics arose from the publication of Keynes' *The General Theory of Employment, Interest and Money,* in 1936. The influence of Keynes's ideas on macro-economics is so pervasive that only few people will disagree that the basis of modern macro-economics is deeply rooted in his General Theory. This is not to imply, however, that the study of major macro-economic problems is a new area of interest. Indeed, the development of macro-economic thought could be traced to the Mercantilist System in the sixteenth century; and before Keynes, the classical tradition dominated economic thought with the publication of Adam Smith's *Wealth of Nations* in 1776. However, Keynes seemed to provide adequate explanation for the macro-economic disequilibrium that has characterized most economies since the Great Depression of the 1930's.

Macro-economic policy belongs to the realm of normative or prescriptive macro-economics. It involves the conscious manipulation of a number of policy instruments or tools – fiscal, monetary, exchange rates, and income policy measures – to achieve a set of stated objectives or targets. But what are these stated objectives? The following are some of the objectives or goals which macro-economic policies are directed at:

(i) full employment of productive resources;
(ii) reasonable price stability;
(iii) an acceptable rate of economic growth;
(iv) an equitable distribution of income;
(v) stability in external trade relations and a balance of payments equilibrium.

Achieving these goals would be challenging and this is made moreso because some of the objectives may be inherently conflicting. The choice of tools of macro-economic policy to achieve these objectives has always been influenced by changing economic and political conditions. For instance, in the 1930's when most industrialized economies were experiencing unemployed resources and monetary policy proved impotent, fiscal policy was effectively used in revamping the economies. However, in the 1950's when inflation was the major problem, monetary policy experienced a resurgence and was effective in moderating the rate of inflation.

Before discussing macro-economic policy questions, we need to construct a model and develop some tools of macro-economic analysis. This is imperative because policy formulation cannot take place in a vacuum. It has to be within an adequate theoretical framework. Theory is essential for economic analysis and the theory must be valid to permit prediction and viable policy. We need a systematic guide that allows for the imposition of some semblance of order to the complexities of the real world for us to understand and interpret it.

Theoretical Framework

The macro-economic model underlying most policy matters since the post second world war era has been Keynes' *General Theory of Employment, Inerest and Money.* This will be developed in stages, starting with a static analysis of the simple Keynesian multiplier.

This model (Model I) is represented by the following three equations:

C	=	Co	+	cY	Consumption function	(1.1)
I	=	Io			Investment relationship	(1.2)
Y	=	C	+	I	Equilibrium condition	(1.3)

Here C is consumption expenditure planned by households. I is investment expenditure planned by firms, and Y is gross national product (GNP). The subscript-o-indicates that the variable is not explained within the model but is determined by outside forces. Co is consumption expenditure which is unrelated to income, while c is the marginal propensity to consume (MPC) assumed to be a positive fraction between Zero and unity in value.

By substituting equations (1.1) and (1.2) into (1.3), we obtain

$$Y = cY + Co + Io \quad \text{.....................................} \quad (1.4), \text{ and}$$

when this is solved for Y, the following result is obtained

$$Y = \frac{1}{1 - C} (C_o + I_o) \text{ ....} (1.5)$$

If there is a change in Co or Io, income and consumption will also change.

$$\frac{dY}{dC_o} = \frac{dY}{dI_o} = \frac{1}{1 - C} > 0.$$

Introduction of Fiscal Policy

An important shortcoming of the model just discussed is that no allowance is made for the activities of government. In order to correct this defect, we shall introduce government expenditures and taxation. Taxes are assumed to be levied on households, while consumption depends on disposable income – income after taxes.

The new model is expressed in the following equations:

C	=	Co	+	cYd	(2.1)
Yd	=	Y-T			(2.2)
T	=	T*	+	xY	(2.3)

$$I = Io \quad (2.4)$$
$$G = G^* \quad (2.5)$$
$$Y = C + I + G \quad (2.6)$$

In this and following models, as was the case in Model I, the subscript zero identifies variables which are determined by forces outside of the model and which cannot be controlled by the government for policy purposes. We have also introduced a second category of variables determined outside of the model: those which are manipulable by the authorities. Such variables are also known as "policy instrument" and are designated by the asterisk (*).

Upon substitution of equations (2.2) and (2.3) into (2.1), the following equation is obtained:

$$C = Co - CT^* + c(1-x)Y \ldots\ldots (2.7)$$

Then, equations (2.4), (2.5) and (2.7) can be substituted into (2.6) to obtain

$$Y = Co - CT^* + c(1-x)Y + Io + G^* \ldots\ldots (2.8)$$

Solving this equation explicitly for Y, we obtain

$$Y = \frac{1}{1 - C(1-x)} (C_o - CT^* + I_o + G^*)$$

From (2.9)

$$\frac{dY}{dT^*} = \frac{-C}{1-c(1-x)} < 0 \; and \; \frac{dY}{-dT^*} = \frac{C}{1-c(1-x)} > 0$$

The negative multiplier is explained because an increase in taxes would lower disposable income, reduce consumption and lead to a decline in income. The opposite would result in the case of a reduction in taxes.

It is possible to derive a multiplier expression which summarizes the effect of a shift in any of these variables on any variable determined within the model. Thus, for example, the effects on total tax collection (ΔT) of a shift in the level of the consumption function (ΔCo) can be derived. From e.g. 2.3 we note that:

$$T = T^* + xY \ldots\ldots (2.3)$$

$$then, \; \frac{dT}{dC_o} = x\frac{dY}{dC_o}$$

But from (2.9)

$$\frac{dY}{dC_o} = \frac{1}{1-c(1-x)}$$

$$therefore \; \frac{dT}{dC_o} = x\frac{1}{1-c(1-x)} = x\frac{dY}{dC_o}$$

$$and \; \frac{dT}{dC_o} = \frac{x}{1-c(1-x)}$$

It may be useful to illustrate the model with some numerical examples. If we assume that C = .75, tax to increase by 20% of any rise in GNP (x = 0.2). Suppose further that Co = 70, T* = -40, Io = 145 and G* = 155.

In this case, equations (2.1) to (2.6) become

$$
\begin{aligned}
C &= 70 + 75Yd \\
Yd &= Y - T \\
T &= -40 + .2Y \\
I &= 145 \\
G &= 155 \\
Y &= C + I + G.
\end{aligned}
$$

The multiplier relating changes in GNP to changes in government purchases (or investment or autonomous changes in consumption) is

$$\frac{dY}{dG^*} = \frac{1}{1-c(1-x)} = \frac{1}{.40} = 2.5$$

and equiibrium income calculated from 2.9 is

$$Y = \frac{1}{1-c(1-x)} (Co - CT^* + Io + G^*)$$

$$
\begin{aligned}
Y &= (2.5)\ (400) \\
Y &= 1000
\end{aligned}
$$

Numerical Example of Multiplier for Government Expendutures

Variable	Original Equlibrium	New Equilibrium*	Change
GNP (Y)	1000	1050	50
Consumption (C)	700	730	30
Investment (I)	145	145	0
Govt. Purchases (G)	155	175	20
Taxes (T)	160	170	10
Yd	840	880	40
Private Saving Yd-C	140	150	10
Govt. Deficit (G-T)	-5	5	10

* After an increase of 20 in the rate of government purchases. The new equilibrium will not, of course, be reached immediately. The movement of GNP and its components to the new level involves a complex and time-consuming set of economic adjustments.

From this model, a cut in taxes of $\Delta T^* = -20$ would raise GNP by 37.5.

$$\frac{dY}{dT^*} = \frac{-c}{1-c(1-x)} = \frac{-0.75}{.4} = 1.875$$

$$(-1.875) \quad (.20) \quad = \quad 37.5$$

This model illustrates in a simple way the rationale for the use of fiscal policy - changes in government expenditures and taxes – to regulate aggregate demand for goods and services in the interest of full employment and price stability.

Introduction of Money and Interest

To be able to capture the influence of money and interest rates, we shall add additional variables and equations to the previous model:

C	=	Co + CYd	(3.1)
Yd	=	Y - T	(3.2)
T	=	T* + xY	(3.3)
I	=	Io - vr	(3.4)
G	=	G*	(3.5)
Y	=	C + I + G	(3.6)
Md	=	Mo + kY - mr	(3.7)
Ms	=	M*	(3.8)
Md	=	Ms	(3.9)

The monetary sector is represented by equation (3.7), 3.8) and (3.9). If we substitute equation (3.2) and (3.3) into (3.1), we obtain:

$$C = Co - cT^* + c(1-x)Y \text{ ....(3.10)}$$

Then, substitute (3.4), 3.5) and (3.10) into (3.6) to obtain

$$Y = Co - cT^* + c(1-x)Y + Io - vr + G^* \text{ ....(3.11)}$$

and solving explicitly for r in terms of Y

$$r = \frac{Co - CT^* + Io + G^*}{v} - \frac{(1-c(1-x)Y}{v} \text{ ....(3.12)}$$

Next, substitute (3.7) and (3.8) into (3.9)

$$M^* = Mo + kY - mr \text{ ....(3.13)}$$

Solving explicitly for r in terms of Y yields

$$r = \frac{Mo - M^*}{m} + \frac{kY}{m} \text{ ....(3.14)}$$

Equation (3.12) is the IS curve. It is derived from equations (3.1) to (3.6) and represents the various combinations of income and the interest which will bring the product market into equilibrium: Y = C + I + G

The slope of the line $\frac{dr}{dY} = \frac{-(1-c(1-x)}{v}$

Since c and x are both less than unity, 1-c(1-x) is necessarily positive, as is v. Consequently, the slope of the IS curve is negative. The economic meaning being that a reduced interest rate will lead to more investment, which through the multiplier, will raise income, thus, a fall in the rate of interest will be associated with a higher level of income.

Equation (3.14) is the Lm curve. It is derived from equation (3.7) to (3.9) and represents the various combinations of Y and r that will result in equilibrium in the money market M = Md. The slope of the Lm curve $\frac{dr}{dY} = \frac{k}{m}$. Since both k and m are positive numbers, the slope must be positive. The demand for transactions balances may be regarded as related positively to income, and the demand for asset balances as being related negatively to interest rate.

Equilibrium for the entire economy - product and money markets occurs at the point of inter-section of the IS and Lm curves. The equilibrium level can be derived explicitly by eliminating r between equations (3.11) and (3.14). When this is done, we have:

$$Y = Co - cT^* + c(1-x)Y + Io - vr + G^* \quad \ldots\ldots\ldots\ldots (3.11)$$

r from 3.14 is $r = \frac{Mo - M^*}{m} + \frac{kY}{m}$

Substituting r in (3.14) into the corresponding value in (3.11), we obtain:

$$Y = Co - cT^* + c(1-x)Y + Io - v$$

$$Y = C_o - cT^* + c(1-x)\,Y + I_o - v\,[\frac{M_o - M^*}{m} + \frac{k}{m}*\,Y] + G^*$$

Simplifying

$$Y = \frac{1}{1-c(1-x) + \frac{VK}{m}}\,[C_o + cT^* + I_o + G^* - \frac{v}{m}\,(M_o - M)]$$

This model contains 3 policy instruments which the authorities can adjust in order to control aggregate demand: the fiscal authorities can change government expenditure (G*) or the tax level (T*), while the monetary authorities can adjust the stock of money (M*):

$$\frac{dY}{dG^*} = \frac{1}{1-c(1-x) + \frac{VK}{m}} \quad \frac{dY}{dT^*} = \frac{-c}{1-c(1-x) + \frac{VK}{m}} \; or \; \frac{1}{[1-c(1-x)]\,\frac{M}{v} + K}$$

If we compare the multiplier for government expenditure with that in Model II, we find that the difference consists in the presence of the additional term $\frac{vk}{m}$ in its denominator.

Since v, m, and k are all positive, then the term $\frac{vk}{m}$ is positive. It increases the denominator and therefore reduces the size of the multiplier. The term $\frac{vk}{m}$ arises from the existence of monetary forces which were absent in Model II.

Some Numerical Examples

If C = .75	Then, equations (3.1) to (3.9) become			
x = .20				
G = 70				
T* = -40	C	=	70 + .75Yd	
G* = 155	Yd	=	Y-T	
v = 4	T	=	-40 + .2Y	
Io = 165	I	=	165 4r	
k = .25	G	=	155	
m = .10	Y	=	C + I + G	
Mo = 20	Md	=	20 + .25Y - 10r	
M* = 220	Ms	=	220	
	Md	=	Ms	

$$\frac{dY}{dG} = \frac{1}{1-c(1-x)\frac{VK}{m}} = \frac{1}{.50} = 2.$$

Income calculated from (3.15) = 500

Then, the multiplier times income is 2(500) = 1000.

Numerical Example of Multiplier for Government Expenditure

Variable	Original Equilibrium	New Equlibrium	Change
GNP (Y)	1000	1040	+ 40
C	700	724	+ 24
I	145	141	- 4
G	155	175	+ 20
T	160	168	+ 8
Y-T	840	872	+ 32
Yd-C	140	148	+ 8
G-T	- 5	7	+ 12
Interest Rate (r)	5%	6%	+ 1%

* After an increase of 20 in the rate of government purchases, the corresponding changes is given in the table above. The main difference between the results shown here and those produced in Model II is that the rise in GNP increases the demand for money and drives up the interest rate from 5 to 6%, and this in turn reduces investment by 4. That is why the multiplier is only 2 instead of 2.5 as in Model II.

The monetary effect in the model can be seen in:

$$\frac{dY}{dM} = \frac{1}{1-c(1-x)\frac{m}{v}+K} \quad \textit{which is} \; \frac{1}{1.25} = .8$$

Thus, an increase in 20 in G will increase GNP by 16.

Numerical Example for Multiplier for Changes in Money Stock

Variable	Original Equilibrium	New Equilibrium	Change
Y	1000	1016.0	+16.0
C	700	709.6	+ 9.6
I	145	151.4	+ 6.4
G	155	155.0	0
T	160	163.2	+ 3.2
Y-T	840	852.8	+12.8
Yd-C	140	143.2	+ 3.2
G-T	- 5	- 8.2	- 3.2
M*	220	240.0	+20.0
r	5%	3.4%	- 1.6

The increase in money stock produces its effect by lowering the interest rate from 5 to 3.4 per cent thereby stimulating investment; the rise in investment spending stimulates production and income, setting off a multiplier effect which raises consumption. It is interesting to note that the increase in income leads to a rise in tax collection which reduces the government deficit.

According to our analysis of Model 3, it is possible to change aggregate demand and GNP by fiscal measures G and T or by monetary policy M. Of course, the three types of measures could be combined in various ways to produce a desired effect on GNP.

The choice of proper combinatioh in giving circumstances would depend on various considerations – the relative speeds with which they produce their results, their effects on goals other than the level of GNP, such as the rate of long-term growth, balance of payments, and so on.

Conclusion

Economic reality is very complex involving the outputs and prices of thousands of different kinds of labour and so on. If the economist tried to deal with all the vast multitude of variables and relationships involved, he would soon become hopelessly bogged down. The only way to make headway, therefore is to work with "models" which abstract from most of the details and focus on the important variables related to the issues at hand.

The models which we have considered appear to be useful in analyzing the forces determining many of the major variables relating to the economy as a whole: the level of national income (y), employment (n) and the general level of prices. The models also represent the major economic relationships necessary to analyze many important issues of economic policy.

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