I. A Review of Closed Economy Macroeconomics

We begin by reviewing some of the basics of closed economy macroeconomics that are indispensable in understanding the rest of the course. Specifically, we would like to remind ourselves of; (i) endogenous vs. exogenous variables and movements of a curve vs. movements along a curve, (ii) how to conduct Comparative Statics in an IS-LM model and (iii) the relation between IS-LM and aggregate supply/demand functions.

Endogenous and exogenous variables

An endogenous variable is a variable whose value is determined inside the model, by solving the model (i.e. by finding an equilibrium). An exogenous variable is a variable whose value is set/changed outside the model, by the economist conducting the analysis. Unless changed deliberately, the value remains constant.

For instance, in this simple IS-LM model:

IS: $Y = C(Y - T(Y)) + I(r) + G$ equilibrium in the goods market

LM: $\frac{M}{P} = L(Y, r)$ equilibrium in the money market

the endogenous variables are r, Y, and the exogenous variables are G, M, P (P is often treated as a constant in basic Keynesian settings).

Comparative Statics

The purpose of macroeconomic analyses is to determine what happens to the endogenous variables when the exogenous variables change. The process of determining this is called "Comparative Statics".

There are two methods:

①. Find the equilibrium point by drawing the IS and LM curves in the (r, Y) plane, and study how the equilibrium point moves in response to changes in the exogenous variables.

②. Solve the equations mathematically for the endogenous variables, and study how the equilibrium values change in response to changes in the exogenous variables.

Either method can be used, both lead to the same conclusion.

The IS-LM curves

The IS and LM equations show the combinations of (r, Y) that maintain equilibrium in, respectively, the goods and money markets. The curves corresponding to these equations trace combinations (r, Y) that maintain equilibrium in, respectively, the goods and money markets. Both of these curves are drawn for given levels of exogenous variables. The curves shift when the exogenous variables change (change in exogenous variables → shift of the curve itself). The curves do NOT shift when the endogenous variables change (change in endogenous variables → movement along the curve).

In order to draw these curves in the (r, Y) plane, we need to find their slopes. This is done by totally differentiating the two equations.

IS $\rightarrow$ $dY = C_Y dY - C_Y T_Y dY + I_r dr + dG$

where $C_Y \equiv \dfrac{dC}{dY^D}$ is the marginal propensity to consume out of disposable income $Y^D \equiv (Y - T(Y))$.

From this we have $[1 - C_Y(1 - T_Y)]dY = I_r dr + dG$

so $$\left.\frac{dr}{dY}\right|_{IS} = \frac{1 - C_Y(1 - T_Y)}{Ir} \quad \text{given } G$$

$$\left.\begin{array}{l} I_r < 0 \\ 1 - C_Y(\ ) > 0 \end{array}\right\} \text{ and therefore, } \left.\frac{dr}{dY}\right|_{IS} < 0.$$

LM $\rightarrow$ $\dfrac{dM}{P} - \dfrac{M}{P^2}dP = L_Y dY + L_r dr$

so $$\left.\frac{dr}{dY}\right|_{LM} = -\frac{L_Y}{L_r} \quad \text{given } M, P$$

$$\left.\begin{array}{l} L_Y > 0 \\ L_r < 0 \end{array}\right\} \text{ and therefore, } \left.\frac{dr}{dY}\right|_{LM} > 0.$$

The IS curve is downward sloping and the LM curve is upward sloping in the (r, Y) plane.

Again, the IS and LM curves are drawn for given values of G, M, P. When one of the exogenous variables G, M, P changes, the curves shift. Exogenous variables are usually changed one at a time. The shifts of the curves determine how the exogenous changes influence the endogenous variables (r, Y).

In this model, G appears only in the IS and M only appears in the LM. So when only

G changes ($dG \neq 0$), only the IS curve shifts and when only M changes ($dM \neq 0$), only the LM curve shifts.

Perhaps it would be helpful to see this in terms of a more familiar equation. Think of an equation such as $y = ax + b$, where a is the slope and b is the intercept. The line corresponding to this equation in (y, x) space shifts when the intercept b changes. This line will not shift when a different intercept, such as d in $y = cx + d$ changes. In the same way, when only G in the IS changes and G does not appear in the LM, then only the IS will shift and the LM will not shift.

Note that both r and Y change even when only one of G or M changes (only one of the curves shifts). This is because r and Y are simultaneously determined, at the equilibrium where the two curves intersect.

Comparative Statics using the IS-LM curves

Now we are ready to examine how (r, Y) respond to changes in G and M. By totally differentiating the IS and LM, we have:

$$\text{IS} \rightarrow \left[1 - C_Y(1 - T_Y)\right]dY - I_r dr = dG.$$

$$\text{LM} \rightarrow L_r dr + L_Y dY = \frac{1}{P}dM - \frac{M}{P^2}dP.$$

Recall that the IS and LM trace the combinations (r, Y) that maintain equilibrium in the goods and money markets. Therefore, the total differentiations of these equations show the mutual relationship which the small changes in each variable must maintain, if the respective markets are to remain in equilibrium. In other words, the variables in these equations can change in response to the exogenous changes, but if the markets are to stay in equilibrium, the changes must stay within the confines of the mutual relationship shown by these differentiated forms.

Using this feature, we can find out which way the curves shift, and therefore where the new equilibrium point goes after a change in G or M. Imagine what would happen if one of the endogenous variables did not react at all. The other variable will have to bare the entire burden of adjustment, and the change in this other variable will show us the direction in which the curves must shift. It does not matter which endogenous variable is assumed to remain constant, the result will be the same. Normally, it suffices to hypothetically stop one of the endogenous variables. But for confirmation, we will try both r and Y here.

▼ $dG > 0$

Suppose hypothetically that $dr = 0$, then $\left.\frac{dY}{dG}\right|_{IS,dr=0} = \frac{1}{1 - C_Y(1 - T_Y)} > 0$.

This means that for a given level of r, Y must be at a higher level after a rise in G ($dG > 0$), if the IS equilibrium is to be maintained. Therefore, the IS curve will shift above and to the right. The result; $r\uparrow$, $Y\uparrow$.

Suppose hypothetically that $dY = 0$, then $\left.\frac{dr}{dG}\right|_{IS,dY=0} = -\frac{1}{I_r} > 0$.

This means that for a given level of Y, r must be at a higher level after a rise in G ($dG > 0$), if the IS equilibrium is to be maintained. Therefore, the IS curve will shift above and to the right. The result; $r\uparrow$, $Y\uparrow$.

▼ $dM > 0$

Suppose hypothetically that $dr = 0$, then $\left.\frac{dY}{dM}\right|_{LM,dr=0} = \frac{1}{P \cdot L_Y} > 0$.

This means that for a given level of r, Y must be at a higher level after a rise in M ($dM > 0$), if the LM equilibrium is to be maintained. Therefore, the LM curve will shift down and to the right. The result; $r\downarrow$, $Y\uparrow$.

Suppose hypothetically that $dY = 0$, then $\left.\frac{dr}{dM}\right|_{LM,dY=0} = \frac{1}{P \cdot L_r} < 0$

This means that for a given level of Y, r must be at a lower level after a rise in M ($dM > 0$), if the LM equilibrium is to be maintained. Therefore, the LM curve will shift down and to the right. The result; $r\downarrow$, $Y\uparrow$.

Once we have the results of our Comparative Statics exercises, we need to explain the results using economic logic. An expansion in government spending increases effective demand and leads to $Y\uparrow$, but to a smaller degree than if r remained constant, because $r\uparrow$ suppresses spending. Higher levels of Y and r are also consistent with maintaining LM equilibrium, after an increase in G. An increase in the money supply leads to excess supply of money leading to $r\downarrow$, which stimulates investment and produces $Y\uparrow$. A lower level of r and a higher level of Y are also consistent with maintaining IS equilibrium, after an increase in M .

Comparative Statics using Cramer's Rule

Cramer's Rule is a formula we can use in solving

$$\mathbb{A}\mathcal{X}=\mathbb{B} \qquad \text{or}$$

$$\begin{bmatrix} a_{11} & a_{12} & \cdots\cdots & a_{1n} \\ a_{21} & a_{22} & \cdots\cdots & a_{2n} \\ \vdots & \vdots & & \\ a_{n1} & a_{n2} & \cdots\cdots & a_{nn} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{bmatrix} \qquad \text{for } x_i .$$

The rule tells us that when solving for $x_i \quad (i = 1,2,\cdots n)$, we can make a new matrix $\mathbb{A}_i$ by replacing the i-th row of the coefficient matrix $\mathbb{A}$ with the matrix (vector) $\mathbb{B}$, derive the determinant of $\mathbb{A}_i$ and divide it by the determinant of the original coefficient matrix $\mathbb{A}$.

In other words, $x_i = \dfrac{|\mathbb{A}_i|}{|\mathbb{A}|}$ provided $|\mathbb{A}| \neq 0$.

Details on Cramer's Rule can be found in lecture #20 (under `Cramer's Rule, Inverse Matrix, and Volume') of Professor Strang's lectures at
http://ocw.mit.edu/OcwWeb/Mathematics/18-06Spring-2005/VideoLectures/

Going back to our IS-LM analysis, the total differentials we derived above

$$\begin{cases} [1 - C_Y(1-T_Y)]dY - I_r dr = dG \\ L_Y dY + L_r dr = \dfrac{1}{P}dM - \dfrac{M}{P^2}dP \end{cases}$$

can be rewritten as

$$\begin{bmatrix} 1 - C_Y(1-T_Y) & -Ir \\ L_Y & L_r \end{bmatrix} \begin{bmatrix} dY \\ dr \end{bmatrix} = \begin{bmatrix} dG \\ \dfrac{1}{P}dM - \dfrac{M}{P^2}dP \end{bmatrix}.$$

We now apply Cramer's Rule to derive $\dfrac{dY}{dG}$、$\dfrac{dr}{dG}$、$\dfrac{dY}{dM}$、$\dfrac{dr}{dM}$.

▼ $dG > 0$

Let $dM = 0$. Then, $\begin{cases} [1 - C_Y(1-T_Y)]dY - I_r dr = dG \\ L_Y dY + Lrdr = 0 \end{cases}$.

Divide both sides by dG and we have

$$\begin{bmatrix} 1-C_Y(1-T_Y) & -Ir \\ L_Y & L_r \end{bmatrix} \begin{bmatrix} \frac{dY}{dG} \\ \frac{dr}{dG} \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}.$$

The determinant of the coefficient matrix is $D \equiv Lr[1-C_Y(1-T_Y)] + IrLY < 0$, not zero. So we can use Cramer's Rule and

$$\frac{dY}{dG} = \frac{1}{D}\begin{vmatrix} 1 & -Ir \\ 0 & L_r \end{vmatrix} = \frac{L_r}{D} > 0.$$

$G\uparrow$ → $r\uparrow$ → $L(r,Y)\downarrow$ → Y$\uparrow$ → $L(r,Y)\uparrow$ to maintain LM equilibrium.
└→ Aggregate Supply < Aggregate Demand → $Y\uparrow$ to recover IS equilibrium.

$$\frac{dr}{dG} = \frac{1}{D}\begin{vmatrix} 1-C_Y(1-T_Y) & 1 \\ L_Y & 0 \end{vmatrix} = -\frac{L_Y}{D} > 0.$$

$G\uparrow$ → $Y\uparrow$ → $L(r,Y)\uparrow$ → $r\uparrow$ → $L(r,Y)\downarrow$ to maintain LM equilibrium.
└→ Aggregate Supply < Aggregate Demand → $r\uparrow$ → $I(r)\downarrow$ to recover IS equilibrium.

▼ $dM > 0$

Letting $dG = 0$ and dividing both sides by dM,

$$\begin{bmatrix} 1-C_Y(1-T_Y) & -Ir \\ L_Y & L_r \end{bmatrix} \begin{bmatrix} \frac{dY}{dM} \\ \frac{dr}{dM} \end{bmatrix} = \begin{bmatrix} 0 \\ \frac{1}{P} \end{bmatrix}.$$

$$\frac{dY}{dM} = \frac{1}{D}\begin{vmatrix} 0 & -Ir \\ \frac{1}{P} & Lr \end{vmatrix} = \frac{Ir}{D \cdot P} > 0.$$

$M\uparrow$ → $r\downarrow$ → $I\uparrow$ → $Y\uparrow$ to maintain IS equilibrium ($C\uparrow$ is smaller than $Y\uparrow$).
└→ $M/P > L(r,Y)$ → $r\downarrow$ → $L(r,Y)\uparrow$ to recover LM equilibrium.

$$\frac{dr}{dM} = \frac{1}{D}\begin{vmatrix} 1 - C_Y(1-T_Y) & 0 \\ L_Y & \frac{1}{P} \end{vmatrix} = \frac{1 - C_Y(1-T_Y)}{D \cdot P} < 0 .$$

$M \uparrow \to Y \uparrow \to I \uparrow$ via $r \downarrow$ to maintain IS equilibrium.
$\quad \hookrightarrow M / P > L(r,Y) \to Y \uparrow \to L(r,Y) \uparrow$ to recover LM equilibrium.

We can confirm that the two methods (IS-LM curves and Cramer's Rule) lead us to the same Comparative Statics result.

The importance of partial derivatives

In Comparative Statics, the importance of partial derivatives cannot be overemphasised. An example of a partial derivative is the marginal propensity to consume out of disposable income C_Y. It shows how C reacts when disposable income $(Y - T(Y))$ changes, and is derived by differentiating the consumption function $C = C(Y - T(Y))$ with respect to $(Y - T(Y))$.

More generally, partial derivatives show how economic variables such as consumption, investment, tax revenue and money demand react to changes in the variables they depend on. Many of the variables they depend on are endogenous variables. Here in this model, the endogenous variables are income Y and the rate of interest r. Y and r change in response to changes in exogenous variables such as M and G. In other words, partial derivatives show the reaction of an economic agent (economic variable) to exogenous changes (including but not only policy changes).

We can confirm the importance of partial derivatives by going back to our Comparative Statics results. In the analysis using IS-LM curves, the partial derivatives determine the slope of the curves as well as the direction and amount of shifts (in response to changes in exogenous variables) of the curves. When we use Cramer's Rule, the results of our calculations are functions of partial derivatives. Clearly, the effects of monetary and fiscal policy are determined by partial derivatives, or how economic agents respond. One might think that it is only natural that policy effectiveness depends on how economic agents react. Macroeconomic models correctly reflect this.

Partial derivatives also guide us in giving economic interpretations to the results. This is more visible when we use Cramer's Rule. The partial derivatives appear in the results of our calculation, showing us the path through which the exogenous changes come to affect the endogenous variables.

All of this means that we must be careful. Because the result of Comparative Statics depends on partial derivatives, the analysis could turn out irrelevant or even harmful if the actual partial derivatives took values that were very different from those assumed. Take as an example the effect of a tax cut on the economy. A tax cut increases disposable income. The expansionary effect on the economy is higher, the higher the marginal propensity to consume (response of consumption to changes in disposable income). Suppose the economy was in a recession and the government budget was in deficit. Assuming that the marginal propensity to consume was high enough, we could conclude that a tax cut was desirable. Even if it temporarily increased the budget deficit, the resulting economic expansion would eventually improve tax revenue. This scenario breaks down if the marginal propensity to consume were too low. We may even end up with a larger budget deficit and an economy that has not expanded at all.

In fact, changes in partial derivatives in response to policy were at the core of the criticism against traditional Keynesian economic policies put forth in the 1970s and 80s. In applying results of economic analyses to policy recommendations, we need to pay close attention to the values of partial derivatives, along with the structure of the model itself.

IS-LM and aggregate demand/supply

We turn now to the relationship of the IS-LM and aggregate demand/supply functions. Technically, this involves moving from a system that determines two endogenous variables (r, Y) to one that determines three endogenous variables (r, P, Y). The variable P which used to be exogenous in the IS-LM analysis now becomes endogenous. This means that we need to add another independent equation to the model. To be solvable, a model must have at least as many independent equations as endogenous variables.

In the present case, we add the production function of the representative firm. This equation, together with the "first-order-condition" for the firm's optimisation, gives us the aggregate supply function. The aggregate demand function is obtained by substituting out r from the IS and LM equations.

The aggregate supply function

The production function of a representative firm, in its most general form, would be:

$Y = f(N, K)$ where

$$\frac{dY}{dN} > 0 \qquad f' > 0 \qquad \frac{d^2Y}{dN^2} < 0 \qquad f'' < 0$$

If this representative firm maximises profit or

$$\max_{N} (PY - WN) \text{ given } P,$$

the first-order-condition (foc) is

$$P \cdot \frac{dY}{dN} - W = 0$$

and the real wage $\frac{W}{P} = \frac{dY}{dN} =$ marginal productivity of labour ("Classical Axiom No.1").

Since the marginal productivity of labour is a function of N, we can write

$$\frac{W}{P} = f'(N, \overline{K}) = g(N).$$

Therefore

$$N = g^{-1}\left(\frac{W}{P}\right) = h\left(\frac{W}{P}\right), \qquad h' < 0$$

Substituting this into $Y = f(N, K)$, we have $Y = f\left(g^{-1}\left(\frac{W}{P}\right), \overline{K}\right) = f\left(h\left(\frac{W}{P}\right), \overline{K}\right)$

From which

$$\frac{dY}{dP} = \underset{\oplus}{f'} \ \underset{\ominus}{h'} \left(-\frac{W}{P^2}\right) > 0$$

And since the inverse has the same sign, $\frac{dP}{dY} > 0$.

In other words, in the (P, Y) plane, the aggregate supply curve slopes upward.

More specifically, if we use the Cobb-Douglas production function

$$Y = N^{\alpha} K^{1-\alpha} \qquad 0 < \alpha < 1,$$

$$\frac{dY}{dN} = \alpha \frac{Y}{N} \quad \text{therefore} \quad \frac{W}{p} = \alpha \frac{Y}{N}.$$

The firm's demand for labour is $N = \alpha Y \frac{P}{W}$

and substituting this into $Y = N^{\alpha} K^{1-\alpha}$,

$$Y = \left(\alpha Y \frac{P}{W}\right)^{\alpha} K^{1-\alpha} = Y^{\alpha} \cdot \left(\frac{\alpha P}{W}\right)^{\alpha} K^{1-\alpha}$$

$$Y^{1-\alpha} = \left(\frac{\alpha P}{W}\right)^{\alpha} K^{1-\alpha}$$

$$\therefore Y = \left(\frac{\alpha P}{W}\right)^{\frac{\alpha}{1-\alpha}} K$$

Therefore,

$$\left.\frac{dY}{dP}\right|_S = \frac{\alpha}{1-\alpha} P^{\frac{2\alpha-1}{1-\alpha}} \left(\frac{\alpha}{W}\right)^{\frac{\alpha}{1-\alpha}} K > 0$$

where we have used $\frac{\alpha}{1-\alpha} - 1 = \frac{\alpha - 1 + \alpha}{1-\alpha} = \frac{2\alpha - 1}{1-\alpha}$

And since the inverse has the same sign, $\frac{dP}{dY} > 0$

or the slope of the aggregate supply curve is upward in the (P, Y) plane.

The aggregate demand function

In the IS-LM analysis earlier, we set $dP = 0$ and allowed only dM, dG to be non-zero. Now, dP is also non-zero and what we would like to do is to derive a relationship between (p, Y) from the partial derivatives

$$\begin{cases} [1 - C_Y(1 - T_Y)]dY - I_r dr = 0 \\ \qquad L_Y dY \quad + L_r dr = -\dfrac{M}{P^2} dP \end{cases}.$$

In order to do that, we substitute out dr. We do this by first solving the total differential of IS for dr,

$$I_r dr = [1 - C_Y(1 - T_Y)]dY \qquad \Rightarrow \qquad dr = \frac{1 - C_Y(1 - T_Y)}{I_r} dY$$

then substituting it into the dr in the total differential of LM to have:

$$L_Y dY + \frac{Lr}{Ir}[1 - C_Y(1 - T_Y)]dY = -\frac{M}{P^2} dP.$$

Therefore, $\left.\frac{dP}{dY}\right|_D = -\frac{P^2}{M}\left\{L_Y + \frac{Lr}{I_r}[1 - C_Y(1 - T_Y)]\right\} < 0.$

And the aggregate demand curve is downward sloping in the (P, Y) plane.

Note that this slope $\to \infty$ according as $\left\langle \begin{matrix} Lr \to \infty \\ Ir \to 0 \end{matrix} \right.$.

The equilibrium values of (P, Y) are found where the aggregate supply and aggregate demand curves intersect. Both curves shift in reaction to changes in exogenous variables, and the resulting change in the intersection will show us the changes in (P, Y). As with the IS and LM curves, the aggregate supply and aggregate demand curves shift only in response to changes in exogenous variables they are functions of. For the aggregate supply curve, these are all variables taken as exogenous in the production function and the firm's optimization process (such as $\overline{K}$, W or technology). For the aggregate demand curve, these are exogenous variables that shift IS and LM.

It is extremely important to keep in mind that r remains endogenous throughout the aggregate supply and demand analysis. When an endogenous variable is substituted out, it does not become exogenous. Rather, it keeps changing in the background, along with the endogenous variables that remain visible. We can find the change in the hidden endogenous variable by using the relationship between endogenous variables. In the present case, we can substitute dY into $dr = 1 - C_Y(1 - T_Y)\frac{dY}{Ir}$ to find dr.

A note about Economic Models

Some people criticise economic models for not depicting the actual economy in which we live. They think that economic models are far too simplified and rationalised compared to the real world, and that policy recommendations derived from such models are dangerous or even downright harmful.

To be sure, the economies described by economic models never correspond exactly to reality, and in that sense, do not really exist. But that is no reason to deny the usefulness of economic models. To understand the raison d'être of economic models, it is useful to think of them as comprising two types.

One type of model tells us how an economy "should be". An example is a model with perfect competition. It has been said that most economists endorse the theorem that "a perfectly competitive market brings about a Pareto Optimal resource allocation". This theorem is often misunderstood as a reflection of blind faith in the market mechanism. But even economists know that the real world is not exactly the same as a perfectly competitive market. The model is useful because it shows how the economy will work under perfect competition.

Knowing the workings of such a model is like knowing the workings of a completely healthy human body. In the real world, there is no such thing as a perfectly healthy body. Some people have bad teeth or bad backs, yet others more serious conditions that require hospitalisation. In any event, nobody has a body that fits a textbook description of perfect health. Yet, the idea of how a body "should be" if it has no illnesses (which we might call a model body), is indispensable if we wanted to stay healthy. It is because we have this model that doctors can examine us, compare us to this model and make a diagnosis. Nobody says that this idea of a perfectly healthy body is useless or harmful, just because no such thing really exists. In fact we should be grateful for its existence, because that is precisely why doctors can tell us how we are different from how we should be, and help us.

In the same way, an economic model which depicts an economy without inefficiencies and ridigities offers a benchmark. It was because economists knew the outcome when resource allocation was left to a perfectly competitive market that they could proceed to investigate the implications of "market failures" such as externalities and imperfect information.

The other type of economic model steps somewhat closer to the economy as it "is". Such a model incorporates those aspects of the real economy most relevant to the question the economist is asking. If an economist tries to incorporate everything, the model becomes too complicated to be workable, so the economist must choose. For instance, if the issue in question is how to reduce unemployment, then it may be wise to put wage stickiness into the model.

Obviously, economists need to remain aware of the limits of the models they are using. Their diagnosis is useful in as much as their model reflected the features of the economy most relevant to the investigation underway. If some important features were missing, the model needs to be revised. Even if the topic of investigation remained the same, the appropriate model might change with the times. This is because economic structures and people's reactions change with the times. We will come back to this latter point, when we discuss the implications of response of economic agents (change in partial derivatives) to policy effectiveness.

Summary

In this section we went over some of the basics in closed macroeconomics that are needed in following the rest of the course. The main points can be summarized as follows.

1. The model's equilibrium determines the value of endogenous variables, while the economist (or someone outside the model) determines the value of exogenous variables. Comparative Statics is an exercise in which we analyse the effects of changes in exogenous variables on endogenous variables, using the IS-LM curves or Cramer's Rule.

2. Partial derivatives decide and explain the results of Comparative Statics. This reflects the simple fact that effects of policy depend on the reaction of economic agents.
3. The aggregate supply and demand system simultaneously determines the three endogenous variables (r, P, Y). In moving to this system from to the IS-LM system, r does not become exogenous or remain at levels inconsistent with equilibrium. In order to turn P from an exogenous variable into an endogenous variable, we need another equation, the production function. Behind the aggregate supply function, there is the production function and the optimizing behaviour of the representative firm. Behind the aggregate demand function is the IS-LM equilibrium.