1 Aggregate Demand: An IS-LM Framework

The traditional IS-LM model describes the aggregate demand (AD) side of the economy.

1.1 IS Curve

The IS relationship describes all combinations of interest rates \( r \) and output \( Y \) that generate equilibrium in the goods market. The building blocks are

\[
C = C(Y - T) \quad \text{(Consumption)}
\]

\[
I = I(r) \quad \text{(Investment)}
\]

\[
G = G \quad \text{(Government Spending)}
\]

\[
T = T \quad \text{(Taxes)}
\]

\[
NX = NX \quad \text{(Net Exports)}
\]

\[
Y = C + I + G + NX \quad \text{(Equilibrium)}
\]

Therefore, the IS curve can be written as

\[
Y = C(Y - T) + I(r) + G + NX, \quad (1)
\]

where there is an inverse relationship between \( r \) and \( Y \). A higher interest rate reduces investment demand, which requires a reduction in output to restore equilibrium between output and expenditures. Total differentiation of (1) with some algebra produces various multipliers. For example, the government spending multiplier is

\[
\frac{dY}{dG} = (1 - C_Y)^{-1}, \quad (2)
\]

where \( C_Y = \frac{dC}{dY} \) is the marginal propensity to consume. Because \( 0 < C_Y < 1 \), the government spending multiplier is greater than one.
1.2 LM Curve

The LM relationship describes all combinations of interest rates \((r)\) and output \((Y)\) that generate equilibrium in the money market. The building blocks are

\[
\frac{M}{P} = L(Y, r) \quad \text{(Money Demand)}
\]

\[
\frac{M}{P}^* = \frac{M}{P} \quad \text{(Money Supply)}
\]

\[
\left(\frac{M}{P}\right)^d = \left(\frac{M}{P}\right)^* \quad \text{(Equilibrium)}
\]

Therefore, the LM curve can be written as

\[
\frac{M}{P} = L(Y, r) \quad (3)
\]

where there is a positive relationship between \(r\) and \(Y\). A higher interest rate reduces the demand for real money balances so that income must rise in order to restore demand back to the level that equates it with the fixed money supply.

1.3 AD Curve

The AD curve depicts combinations of \(P\) and \(Y\) that simultaneously clear the goods and money markets. The AD curve is found by using \(r\) to combine the IS curve

\[
Y = C(Y - \bar{T}) + I(r) + \bar{G} + \bar{NX}
\]

and the LM curve

\[
\frac{M}{P} = L(Y, r).
\]

The AD curve slopes down because a higher \(P\) reduces the supply of real money balances and thus \(Y\) decreases (and \(r\) increases) to restore equilibrium in the money and goods markets. Assuming the LM curve is not horizontal, the government spending multiplier is smaller when incorporating the money market because the increase spending raises interest rates and ends up crowding out some private investment. The IS-LM relationship involves three endogenous variables \((r, P\) and \(Y)\) and only two equations. Therefore, we need aggregate supply (AS) to determine the general equilibrium.
2 Aggregate Supply

In the short run, there are various theories as to why the aggregate supply curve ($P$ on the vertical axis and $Y$ on the horizontal axis) has an upward slope. We will explore several of these theories in later papers. In the long run, the AS curve is vertical such that output is determined by technology and the factors of production. The AS curve takes the form

$$Y = \bar{Y} + \alpha(P - P^e) \quad (4)$$

where the natural level of output ($\bar{Y}$) is given by the production function, the capital stock ($\bar{K}$) and the labor force ($\bar{L}$)

$$\bar{Y} = F(\bar{K}, \bar{L}) \quad (5)$$

Since $\alpha > 0$, when the price level ($P$) is higher than expected ($P^e$), output is above its natural rate. Conversely, when $P^e > P$, output is below its natural rate. Finally, when $P^e = P$, output is at its natural rate (i.e., $Y = \bar{Y}$). The IS-LM-AS equations uniquely determine the equilibrium levels of $r$, $P$ and $Y$ for given values of the exogenous variables.

The advantage of the traditional IS-LM-AS framework is its simplicity. It can be a useful tool to analyze, for example, how changes in government policy will impact the macroeconomy. However, the traditional IS-LM-AS model lacks microfundamental, dynamics and a well-specified expectations mechanism.