THE NEW ECONOMIC SCHOOL
Macroeconomics 4

Problem Set 1
Year 2002-2003

1 The Baumol–Tobin Model

Baumol and Tobin attempted to derive a demand–for–money function from first principles, and predict the sizes of the income and interest elasticities. They made the following assumptions:

Each person is paid Y dollars per period (in a direct deposit to the bank). People have to decide on the optimal number of trips to the bank, N, to withdraw money over the course of the period. Assume that each trip they draw out the same amount of money, Y/N. The bank pays interest at rate i on deposits. Cash of course earns no interest. Each trip to the bank costs the consumer a fixed cost in foregone time and inconvenience. Assume that this cost is F dollars.

a) Solve for the optimal number of trips to the bank, N^*. (*Search for a simple solution, even if not strictly correct mathematically*)
b) What is the average amount of money that the consumer holds? What are the elasticities of money demand with respect to income, Y, and the interest rate, i?
c) Milton Friedman, a famous monetarist, championed the quantity theory of money: $M/P = aY$. What is the implication of this theory for the fiscal policy multiplier in the IS–LM model?
d) Why do you think that Tobin, a famous fiscalist, worked out his model of money demand? How do its implications for the fiscal multiplier contrast to those of the quantity theory?

2 Testing the Baumol–Tobin Model

a) Empirical estimates of money demand place the income elasticity of money demand close to 1. Suppose you alter the Baumol–Tobin model to make the cost of a trip to the bank depend on income: instead of a cost, F, that is equal across consumers, assume it takes all consumers the same number of minutes to go to the bank, so that opportunity cost varies linearly with income. How does this modification of the model alter its prediction about the income elasticity and the interest elasticity of money demand?

b) People typically carry much less cash than the Baumol–Tobin model predicts, and go to the bank more often. Try the following exercise to see whether you can rationalize this finding.

i) Suppose your bank account pays you 5 percent interest per year. You spend \$100 in cash each week. It takes 10 minutes of your time to make a trip to the bank. The opportunity cost of your time (your wage) is \$12 per hour. According to the Baumol–Tobin model, how often should you go to the bank, and how much should you withdraw each time? (Be careful about the units of measurement.)

ii) In addition to the cost of foregone interest, a cost of holding money is that you might be robbed or lose your wallet. How high does the probability of this event need to be to make it rational for you to go to the bank once a week?

3 The Mundell–Tobin Effect

Consider the following full-employment IS-LM model:
$IS : Y = C(Y - T, M/P) + I(r) + G.$
$LM : M/P = L(r + \pi, Y).$
$AS : Y = Y^*.$
a) Notice that investment depends on the real interest rate, r, but money demand depends on the nominal interest rate, $r + \pi$. In addition, consumption depends on real money balances. Explain why each of these assumptions is reasonable.
b) Robert Mundell pointed out that, in this model, changes in the rate of inflation (π) affect the real interest rate. Hence, even though prices are fully flexible, money is not "super–neutral"; a change in the growth rate of money alters some real variables. Solve for $\mathrm{d}r/\mathrm{d}\pi$ in this model. What is its sign? Explain.
c) Is this effect, which is called the Mundell effect (sometimes called the Mundell–Tobin effect) important quantitatively? That is, do you expect $dr/d\pi$ to be large or small? In answering this question, you might need some of the following parameter values:

Interest elasticity of investment = 0.8
Interest elasticity of money demand = 0.1
Income elasticity of money demand = 1.0
Investment/GNP ratio = 0.15
Marginal propensity to consume out of income = 0.5
Money/GNP ratio = 0.1
Marginal propensity to consume out of wealth = 0.05

4 The Lucas Critique and the Phillips Curve

Suppose an economy is governed by an expectations–augmented Phillips curve: $u = u^* - \alpha(\pi - E\pi)$ where u is unemployment, u^* the natural rate of unemployment, π inflation, $E\pi$ expected inflation.
a) What is the time path of unemployment if
i) inflation is always zero?
ii) if inflation is a constant five percent?
b) Suppose inflation is random, uniformly distributed between zero and five percent.
i) What is expected inflation?
ii) What does the observed Phillips Curve look like?
c) Suppose the stochastic process generating inflation changes to be uniform from 5 to 15 percent. What will the observed Phillips Curve look like now?
d) What menu of inflation–unemployment combinations does this economy offer to policy makers? What menu might policy makers think they have available?

5 Rational expectations

Solve problem 4 in Chapter 8 of Bennett McCallum, *Monetary Economics: Theory and Policy*, page 172.