

Chapter 1

The Optimum Quantity of Money

IT IS A COMMONPLACE of monetary theory that nothing is so unimportant as the quantity of money expressed in terms of the nominal monetary unit—dollars, or pounds, or pesos. Let the unit of account be changed from dollars to cents; that will multiply the quantity of money by 100, but have no other effect. Similarly, let the number of dollars in existence be multiplied by 100; that, too, will have no other essential effect, provided that all other nominal magnitudes (prices of goods and services, and quantities of other assets and liabilities that are expressed in nominal terms) are also multiplied by 100.

The situation is very different with respect to the real quantity of money—the quantity of goods and services that the nominal quantity of money can purchase, or the number of weeks' income to which the nominal quantity of money is equal. This real quantity of money has important effects on the efficiency of operation of the economic mechanism, on how wealthy people regard themselves as being and, indeed, on how wealthy they actually are. Yet

During the roughly two decades that I have puzzled over the problems covered in this paper, I have benefited from discussions with many friends, from the reactions of students to the presentation of some of this material in class (at the University of Chicago, Columbia University, and the University of California at Los Angeles), and from the reactions of audiences at several seminars at which I have presented the central ideas (at Stanford University and Princeton University). I owe a special debt to Kenneth Arrow, who saved me from several crucial errors, and to Alvin Marty and the late D. H. Robertson, who shared my interest and helped sharpen my understanding of the problem. I am indebted for helpful comments on the first draft of this paper to Martin Bronfenbrenner, Phillip Cagan, Elaine Goldstein, Franklin D. Mills, Anna J. Schwartz, and Lester Telser.

only recently has much thought been given to what the optimum quantity of money is, and, more important, to how the community can be induced to hold that quantity of money.

When this question is examined, it turns out to be intimately related to a number of topics that have received widespread attention over a long period of time, notably (1) the optimum behavior of the price level; (2) the optimum rate of interest; (3) the optimum stock of capital; and (4) the optimum structure of capital.

The optimum behavior of the price level, in particular, has been discussed for at least a century, though no definite and demonstrable answer has been reached. Interestingly enough, it turns out that when the question is tackled indirectly, via the optimum quantity of money, a definite answer can be given. The difference is that while the conventional discussion stresses short-period adjustments, this paper stresses long-run efficiency.

In examining the optimum quantity of money, I shall start in a rather round-about way—as befits a topic that belongs in capital theory at least as much as in monetary theory. I shall begin by examining a highly simplified hypothetical world in which the elementary but central principles of monetary theory stand out in sharp relief. Though this introduction covers familiar ground I urge the reader to be patient, since it will serve as a bridge to some unfamiliar propositions.

I. HYPOTHETICAL SIMPLE SOCIETY

Let us start with a stationary society in which there are (1) a constant population with (2) given tastes, (3) a fixed volume of physical resources, and (4) a given state of the arts. It will be simplest to regard the members of this society as being immortal and unchangeable.¹ (5) The society, though stationary, is not static. Aggregates are constant, but individuals are subject to uncertainty and change. Even the aggregates may change in a stochastic way, provided the mean values do not. (6) Competition reigns.

To this fairly common specification, let us add a number of special provisions: (7) Any capital goods which exist are infinitely durable, cannot be reproduced or used up, and require no maintenance (like Ricardo's original, indestructible powers of the soil). More important, (8) these capital goods though owned by individuals in the sense that the rents they yield go to their owners, cannot be bought and sold. (They are like human capital in our society.)

(9) Lending or borrowing is prohibited and the prohibition is effectively enforced.

(10) The only exchange is of services for money, or money for services, or

1. This is equivalent to regarding the community as having a constant distribution of persons by age, sex, etc. Each of our infinitely long-lived individuals stands, as it were, for a family line in the alternative population of changing individuals but unchanging aggregates.

services for services. Items (7) and (8) in effect rule out all exchange of commodities.

(11) Prices in terms of money are free to change, in the sense that there are no legal obstacles to buyers' and sellers' trading at any price they wish. There may be institutional frictions of various kinds that keep prices from adjusting instantaneously and fully to any change. In that sense there need not be "perfect flexibility" whatever that much overused term may be taken to mean.

(12) All money consists of strict fiat money, i.e., pieces of paper, each labelled "This is one dollar."

(13) To begin with, there are a fixed number of pieces of paper, say, 1,000.

The purpose of conditions (7), (8) and (9) is, of course, to rule out the existence of a market interest rate. We shall relax these conditions later.

II. INITIAL EQUILIBRIUM POSITION

Let us suppose that these conditions have been in existence long enough for the society to have reached a state of equilibrium. Relative prices are determined by the solution of a system of Walrasian equations. Absolute prices are determined by the level of cash balances desired relative to income.

Why, in this simple, hypothetical society, should people want to hold money? The basic reason is to serve as a medium of circulation, or temporary abode of purchasing power, in order to avoid the need for the famous "double coincidence" of barter. In the absence of money, an individual wanting to exchange A for B must find someone who wants to exchange precisely B for A. In a money economy, he can sell A for money, or generalized purchasing power, to anyone who wants A and has the purchasing power. The seller of A can then buy B for money from anyone who has B for sale, regardless of what the seller of B in turn wishes to purchase. This separation of the act of sale from the act of purchase is the fundamental productive function of money. It gives rise to the "transactions" motive stressed in the literature.

A second reason for holding money is as a reserve for future emergencies. In the actual world, money is but one of many assets that can serve this function. In our hypothetical world, it is the only such asset. This reason corresponds to the "asset" motive for holding money.

It is worth noting that both reasons depend critically on characteristic (5) of our economy, the existence of individual uncertainty. In a world that is purely static and individually repetitive, clearing arrangements could be made once and for all that would eliminate the first reason, and there would be no unforeseen emergencies to justify holding money for the second reason.

How much money would people want to hold for these reasons? Clearly, this question must be answered not in terms of nominal units but in terms of real quantities, i.e., the volume of goods and services over which people wish to have command in the form of money. I see no way to give any meaningful

answer to this question on an abstract level. The amount will depend on the details of the institutional payment arrangements that characterize the equilibrium position reached, which in turn will depend on the state of the arts, on tastes and preferences, and on the attitudes of the public toward uncertainty.

It is easier to say something about the amount of money people would want to hold on the basis of empirical evidence. If we identify the money in our hypothetical society with currency in the real world, then the quantity of currency the public chooses to hold is equal in value to about one-tenth of a year's income, or about 5.2 weeks' income.² That is, desired velocity is about ten per year.

If we identify money in our hypothetical society with all non-human wealth in the real world, then the relevant order of magnitude is about three to five years' income.³ That is, desired velocity is about .2 to .3 per year.

Since we are only provisionally treating our money as the equivalent of all wealth, I shall use the first comparison, and assume, therefore, that the equilibrium position is defined by an absolute level of prices which makes nominal national income equal to \$10,000 per year, so that the \$1,000 available to be held amounts to one-tenth of a year's income. This is an average. Particular individuals may hold cash equal to more or less than 5.2 weeks' income, depending on their individual transactions requirements and asset preferences. As always, nominal national income has several faces: the value of final services consumed, the value of productive services rendered, and the sum of the net value added by the enterprises in the community. In our hypothetical society all of the difficult problems of national income accounting are by-passed, so we need not distinguish between different concepts of national income.

III. EFFECT OF A ONCE-AND-FOR-ALL CHANGE IN THE NOMINAL QUANTITY OF MONEY

Let us suppose now that one day a helicopter flies over this community and drops an additional \$1,000 in bills from the sky, which is, of course, hastily

2. For the U.S., currency was a little over four weeks' income (personal disposable income) in the 1890's and is currently slightly under four weeks' income. It has ranged in that period from 2.1 weeks in 1917 to 8.2 weeks in 1948. In Israel, it is about the same as in the U.S. In Japan, it is about five weeks' income, in Yugoslavia, about six weeks. In a study of 27 countries, Morris Perlman found the highest figure to be fourteen weeks' (Belgium) and the lowest, two weeks' (Chile).

3. In 1958, the total national wealth of the United States was roughly four times net national product, and about 5.3 times personal disposable income. Since the wealth figure includes all government wealth, the first figure seems more relevant. Currency in the preceding footnote excluded for the U.S., and I believe also for the other countries, currency held by the Treasury and Federal Reserve. See Raymond Goldsmith, *The National Wealth of the United States in the Postwar Period* (Princeton, N.J.: Princeton University Press, 1962), p. 112.

collected by members of the community. Let us suppose further that everyone is convinced that this is a unique event which will never be repeated.

To begin with, suppose further that each individual happens to pick up an amount of money equal to the amount he held before, so that each individual finds himself with twice the cash balances he had before.

If every individual simply decided to hold on to the extra cash, nothing else would happen. Prices would remain what they were before, and income would remain at \$10,000 per year. The community's cash balances would simply be 10.4 weeks' income instead of 5.2.

But this is not the way people would behave. Nothing has occurred to make the holding of cash more attractive than it was before, given our assumption that everyone is convinced the helicopter miracle will not be repeated. (In the absence of that assumption, the appearance of the helicopter might increase the degree of uncertainty anticipated by members of the community, which, in turn, might change the demand for real cash balances.)

Consider the "representative" individual who formerly held 5.2 weeks' income in cash and now holds 10.4 weeks' income. He could have held 10.4 weeks' income before if he had wanted to—by spending less than he received for a sufficiently long period. When he held 5.2 weeks' income in cash, he did not regard the gain from having \$1 extra in cash balances as worth the sacrifice of consuming at the rate of \$1 per year less for one year, or at the rate of ten cents less per year for ten years. Why should he now, when he holds 10.4 weeks' income in cash? The assumption that he was in a stable equilibrium position before means that he will now want to raise his consumption and reduce his cash balances until they are back at the former level. Only at that level is the sacrifice of consuming at a lower rate just balanced by the gain from holding correspondingly higher cash balances.

Note that there are two different questions for the individual:

(1) To what level will he want ultimately to reduce his cash balances? Since the appearance of the helicopter did not change his real income or any other basic condition, we can answer this unambiguously: to their former level.

(2) How rapidly will he want to return to the former level? To this question, we have no answer. The answer depends on characteristics of his preferences that are not reflected in the stationary equilibrium position.

We know only that each individual will seek to reduce his cash balances at some rate. He will do so by trying to spend more than he receives. But one man's expenditure is another man's receipt. The members of the community as a whole cannot spend more than the community as a whole receives—this is precisely the accounting identity underlying the multiple faces of national income. It is also a reflection of the capital identity: the sum of individual cash balances is equal to the amount of cash available to be held. Individuals as a whole cannot "spend" balances; they can only transfer them. One man can spend more than he receives only by inducing another to receive more than he spends.

It is easy to see what the final position will be. People's attempts to spend more than they receive will be frustrated, but in the process these attempts will bid up the nominal value of services. The additional pieces of paper do not alter the basic conditions of the community. They make no additional productive capacity available. They alter no tastes. They alter neither the apparent nor actual rates of substitution. Hence the final equilibrium must be a nominal income of \$20,000 instead of \$10,000, with precisely the same flow of real services as before.

It is much harder to say anything about the transition. To begin with, some producers may be slow to adjust their prices and may let themselves be induced to produce more for the market at the expense of non-market uses of resources. Others may try to make spending exceed receipts by taking a vacation from production for the market. Hence, measured income at initial nominal prices may either rise or fall during the transition. Similarly, some prices may adjust more rapidly than others, so relative prices and quantities may be affected. There might be overshooting and, as a result, a cyclical adjustment pattern. In short, without a much more detailed specification of reaction patterns than we have made, we can predict little about the transition. It might vary all the way from an instantaneous adjustment, with all prices doubling overnight, to a long drawn out adjustment, with many ups and downs in prices and output for the market.

We can now drop the assumption that each individual happened to pick up an amount of cash equal to the amount he had to begin with. Let the amount each individual picks up be purely a chance matter. This will introduce initial distribution effects. During the transition, some men will have net gains in consumption, others net losses in consumption. But the ultimate position will be the same, *not only for the aggregate, but for each individual separately*. After picking up the cash, each individual is in a position that he could have attained earlier, if he had wished to. But he preferred the position he had attained prior to the arrival of the helicopter. Nothing has occurred to change the ultimate alternatives open to him. Hence he will eventually return to his former position. The distributional effects vanish when equilibrium is re-attained.⁴

The existence of initial distributional effects has, however, one substantive implication: the transition can no longer, even as a conceptual possibility, be instantaneous, since it involves more than a mere bidding up of prices. Let prices

4. This conclusion depends on the assumption of infinitely lived people, but not on any assumption about the extent or quality of their foresight. The basic point, to put it in other terms, is that their permanent income or wealth is unchanged. Their having picked up more or less than their pro-rata share of cash is a transitory event that has purely transitory effects.

See G. C. Archibald and R. G. Lipsey, "Monetary and Value Theory: A Critique of Lange and Patinkin," *Review of Economic Studies*, vol. 26 (1958), pp. 1-22; R. W. Clower and M. L. Burstein, "On the Invariance of Demand for Cash and Other Assets," *ibid.*, vol. 28 (1960), pp. 32-36; Nissan Liviatan, "On the Long-Run Theory of Consumption and Real Balances," *Oxford Economic Papers* (July, 1965), pp. 205-18; Don Patinkin, *Money, Interest, and Prices*, 2nd edition, New York: Harper and Row (1965), pp. 50-59.

double overnight. The result will still be a disequilibrium position. Those individuals who have picked up more than their pro-rata share of cash will now have larger real balances than they want to maintain. They will want to "spend" the excess but over a period of time, not immediately. (Indeed, given continuous flows and only services to purchase, they can spend a finite extra amount immediately only by spending at an infinite rate for an infinitesimal time unit.)

On the other hand, those individuals who have picked up less than their pro-rata share have lower real balances than they want to maintain. But they cannot restore their cash balances instantaneously, since their stream of receipts flows at a finite time rate. They will have some desired rate at which they wish to build up their balances. Hence, even if all prices adjusted instantaneously and everyone had perfect foresight, there would still be an equilibrium path of adjustment to the initial differential disturbance of real balances. This path defines the rate at which the relative gainers transfer their excess balances to the relative losers. The relative gainers will have a higher than equilibrium level of consumption and a lower level of production during the period of adjustment. The relative losers will have a lower than equilibrium level of consumption, and a higher level of production.

This analysis carries over immediately from a change in the nominal quantity of cash to a once-and-for-all change in preferences with respect to cash. Let individuals on the average decide to hold half as much cash, and the ultimate result will be a doubling of the price level, a nominal income of \$20,000 a year with the initial \$1,000 of cash.

IV. BASIC PRINCIPLES ILLUSTRATED

Our simple example embodies most of the basic principles of monetary theory:

(1) The central role of the distinction between the *nominal* and the *real* quantity of money.

(2) The equally crucial role of the distinction between the alternatives open to the individual and to the community as a whole.

These two distinctions are the core of all monetary theory.

(2a) An alternative way to express (2) is the importance of accounting identities: the *flow* identity that the sum of expenditures equals the sum of receipts (or, the value of final services acquired equals the value of productive services rendered) and the *stock* identity that the sum of cash balances equals the total stock of money in existence.

(3) The importance of attempts, summarized in the famous distinction between *ex ante* and *ex post*. At the moment when the additional cash has been picked up, desired spending exceeds anticipated receipts (*ex ante*, spending exceeds receipts). *Ex post*, the two must be equal. But the *attempt* of individuals

to spend more than they receive, even though doomed to be frustrated, has the effect of raising total nominal expenditures (and receipts).

(4) The distinction between the final position and the transition to the final position: between long-run statics and short-run dynamics.

(5) The meaning of the "real balance" effect and its role in producing a transition from one stationary equilibrium position to another.

Our example also embodies two essential empirical generalizations of long-run monetary theory:

(1) The nominal amount of money is determined primarily by conditions of supply.

(2) The real amount of money is determined primarily by conditions of demand—by the functional relation between the real amount of money demanded and other variables in the system.

V. EFFECT OF A CONTINUOUS INCREASE IN QUANTITY OF MONEY

Let us now complicate our example by supposing that the dropping of money, instead of being a unique, miraculous event, becomes a continuous process, which, perhaps after a lag, becomes fully anticipated by everyone. Money rains down from heaven at a rate which produces a steady increase in the quantity of money, let us say, of 10 per cent per year. The path of the quantity of money is shown in Figure 1, M_0 being the initial quantity of money (\$1,000 in our ex-

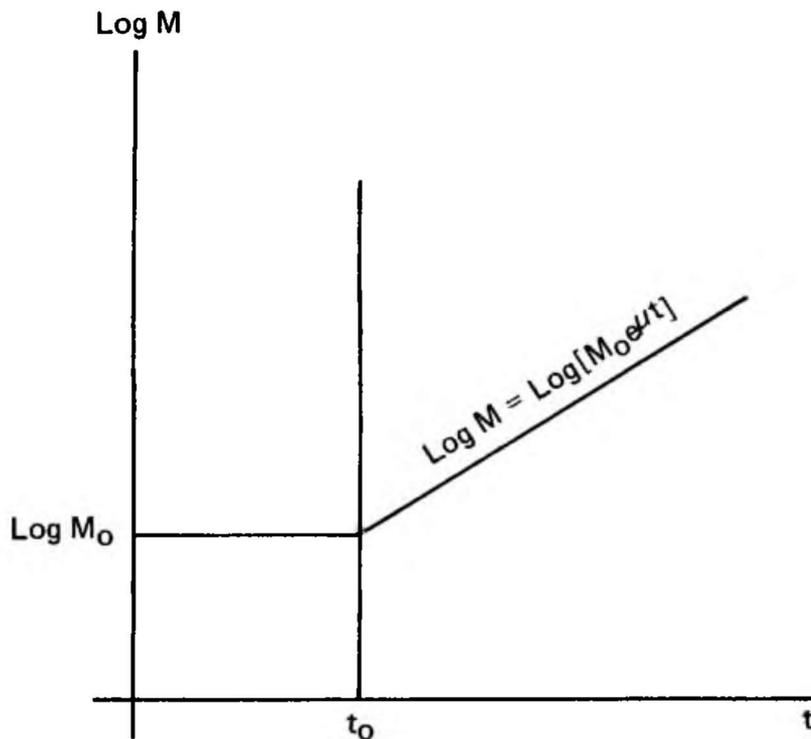


FIG. 1