

STAFF REPORT  
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COSTS AND BENEFITS OF INFLATION

by

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## I. INTRODUCTION AND SUMMARY

To judge from the extraordinary price and wage freeze instituted by the President, and the initial extraordinary public support for his measures, to stop inflation is the first goal of current domestic economic policy. But with all of the discussion of how best to proceed to stop inflation, there is little discussion of why. What do we lose if we allow inflation to persist? What do we gain by stopping it? I have the impression that some people think they could have continued to enjoy the same increases in income if there had been no inflation; and it appears, from letters to the press and other public forums, that inflation is being blamed for shifts in relative prices and in real incomes that will go on no matter what happens to the general price level. Inflation may be a focus of attention for those who are generally discontented with their lot.

Much of the popular protest against inflation is no doubt uninformed, based on misconception of the benefits to be derived from a steady price level. Nevertheless, inflation does impose costs on the economy; it also conveys benefits. In this paper I review the analysis that economists have offered of its costs and benefits. Treatment of the costs of inflation in the economics literature has not been voluminous, or conclusive. With only a little forcing, the discussion can be divided into three topics.

The first topic is the most abstract, the farthest removed from the concerns of the public. I shall call it the cash balance cost of inflation.

Quite apart from the uncertainties and potential instability introduced by a continuing rise of prices, no matter how steady and predictably its rate, inflation has one inescapable consequence: it erodes the value of money.\* We all need to hold some cash to carry out transactions, and most of us hold more than we absolutely need. But as the cost of holding cash rises, it becomes advantageous to take more and more elaborate steps to reduce our cash holdings to a bare minimum. In taking these increasingly elaborate steps we use scarce resources that could otherwise serve different ends; these scarce resources consumed to reduce cash balances make up the cash balance cost of inflation. Milton Friedman and Martin Bailey have proposed a way to measure this cost, but the measure has been severely and, I think, properly criticized; at present we are left without a way to estimate the cash balance cost. Section II, below, summarizes the literature on this topic.

The second topic is the nature of the exchange we may make between inflation and unemployment, along the Phillips' curve. If price stability can be obtained only at the cost of high unemployment (as appears to be the case) then when we accept inflation we are rewarded by an employment gain. The microeconomic models that have been constructed to explain the Phillips curve are among the most interesting developments in economic theory of the past decade; but we have only the beginning of a theory, and there are many unsettled issues. The biggest unsettled issue is the permanence of the gain in employment that can be bought with inflation. At question is the effect of anticipation of future inflation on the behavior of job seekers and employers. Many theorists (notably Milton Friedman, and Edmund Phelps) believe that once inflation is fully anticipated, it can have

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\*The statement refers to fiat money, not necessarily to a commodity money such as gold, or cattle.

no lasting impact on the rate of unemployment. Others have built models in which, apparently, it can; and empirical evidence, inconclusive though it is on an issue of this sort, supports this view. The issue is discussed in Section III.

Finally, to come closer to the concerns of the typical voter who is neither unemployed nor devoting extraordinary effort to economizing on his cash balances, we consider the effect of inflation on the distribution of income and wealth. This question is almost entirely an empirical one; economic theory intrudes only to supplement inadequate statistics, in order to calculate some rough approximation to how different economic classes have fared. Very little research has been done on the question, but it seems that redistribution has been mixed in its impact. It benefits low-income debtors over high-income creditors, but harms low-income pensioners, welfare recipients and others whose nominal income is fixed. In terms of large identifiable aggregates of people, the impact has not been severe on the average. In Section IV this small literature on the distributional impact of inflation is reviewed, together with a catch-all collection of topics having to do with the impact of inflation on the efficiency of resource allocation. Among these, the threat of complete collapse of the monetary system through hyper-inflation stands out for its potential importance.

Concluding remarks make up a brief final section.

## II. FULLY-ANTICIPATED INFLATION IN A FULLY-EMPLOYED ECONOMY

The central fact of inflation is the decline in the purchasing power of money. A direct consequence is the reaction of wealth-holders as they try to avoid the loss by reducing their real cash balances. The consequent cost to the economy has been emphasized by Bailey [ 4 ] and Friedman [ 14 ]. In this section I summarize their argument and discuss several questions raised by their analysis.

### A. The Neoclassical Model\*

The framework for the discussion of this section is designed to isolate just those consequences of inflation having to do with the demand for real cash balances. We consider an economy in which no aggregate variables would change over time if the quantity of money remained constant. Technology, the stocks of physical and financial assets other than money, the labor force are all unchanging. All factors are fully employed so that, apart from any possible effects of changes in the money supply, output is constant. I say "no aggregate variables would change", above, because we must allow microeconomic variables to change. It is questionable whether there would be a motive for holding money, even for transactions purposes, if each individual were to repeat exactly the same pattern of transactions each year, forever; in that case it is possible that a once-and-for-all clearing could be arranged to eliminate the need for transactions balances. Following Friedman [ 14 ] I assume that total output is constant but individuals

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\* My terminology follows Samuelson [ 36 ]. Bailey does not specify a formal model in complete detail. Friedman does, but I do not stay within the strict confines of the model he presents. I may therefore be putting words into his mouth, in the following, which he would not accept. For the authentic Gospel read the scripture, in [ 14 ].

and firms face uncertainty concerning their future patterns of receipts and expenditures; the uncertainty and variation in payment patterns induces them to hold money.

The "money" in question is non-interest bearing fiat currency issued by the government; starting in year zero, its supply is increased at a steady rate to finance a persistent budget deficit. Everyone is assumed to be aware of the deficit financing, to anticipate with confidence the continuation of that deficit financing into the indefinite future, and to correctly foresee its effects.

The effect of the increasing money supply is held to be as follows:

(1) The steady increase in the money supply will cause a steady inflation. Unless the public had always known that the inflation would start when it did, there are inevitable redistributions of wealth from creditors to debtors and income (these all arise from the fact that contracts are not continuously renegotiated). Assume either that these redistributions have no effect on aggregates, or that their effects are transitory. In any event, ignore them; as soon as everyone comes to agree in their expectations regarding the future course of prices, all new contracts will fully account for the price rise, so there will be no further redistribution brought about by the inflation.

(2) If the public's desired holdings of real cash balances were unaffected by inflation, the rate of inflation would be equal to the rate of increase in the money supply which induces it, and resource allocation would be unaffected (transitory distributional questions apart).

Point (2) follows almost immediately from the definition of real cash balances,  $M/P$ . If  $M$  (the nominal money supply) grows at a constant rate and  $M/P$  is to be kept constant, then  $P$  (the level of prices however measured) must grow at the same rate. But what mechanism would force the supply of real cash



balances to adapt itself to the demand? The argument, basic to the monetarist view of the economy, is that the public achieves whatever level of real cash balances it wishes. The government may increase the supply of nominal money, but if the public does not wish to hold the money they will spend it. In a fully employed economy, the attempt to spend more just means higher prices, not more goods. When prices rise by enough to bring real cash balances back to their desired level, the excess demand disappears. Thus, if there is to be a steady increase in the money supply and if the demand for real cash balances is constant, prices must rise, steadily, at the same rate as the money supply. If they do, there is no reason for the economy to experience any real change, that is any change in the allocation of resources.

Alternatively the monetarist argument may be summarized by the following claim: were it not for the effect of anticipated inflation on the demand for real cash balances, and for transitory distributional effects, the general equilibrium of the economy could be described by a set of excess demand functions, homogeneous of degree zero in the stock of money and nominal prices: if all markets are cleared with a stock of money  $M$  and a price vector  $P$ , so would they be cleared with a stock of money  $kM$  and a price vector  $kP$ , for any positive  $k$ . Moreover, the disequilibrium dynamics of the economy are such that when the money supply changes from  $M$  to  $kM$  (with  $k > 1$ ), under the

circumstances specified here the economy would actually attain the equilibrium price vector  $kP$ .

(3) Contrary to the specification of paragraph (2), the quantity demanded of real cash balances will not remain constant, it will fall under the influence of anticipated inflation. Without inflation, the opportunity cost of \$1 held as cash balance is the \$1 worth of today's expenditures that could be purchased in exchange. With inflation, the opportunity cost is higher -- the \$1 worth of expenditures foregone today must be accompanied by a continual stream of foregone expenditures in the future, in order to maintain the real value of \$1 in cash balance constant. With inflation of 10% per year for example, each \$1 of today's cash balances must be augmented by 10% per year in nominal terms in order to maintain its real value.

Inflation, by raising the opportunity cost of real cash balances, lowers the quantity demanded.

(4) Thus in addition to the rise in prices brought about directly by the increase in the money supply (which would occur even if people attempted to maintain real cash balances constant), there is an additional increase as people attempt to spend some of their cash balances in response to the higher opportunity cost. This second increase is a once-and-for-all change: once prices have risen sufficiently that the marginal dollar of real balance is just worth its inflation-distorted opportunity cost they then need only rise at a rate adequate to maintain real balances at their new, lower level.

## II-5.

To summarize, suppose that after a period in which the money supply was constant, the money supply is made to grow at a steady rate of 10% per year, starting at  $t = 0$ ; then distributional effects aside, the equilibrium course of prices will be as represented in the semilogarithmic diagram of Fig. 1 (after Friedman, see [14, 16]). The initial rise in price, from  $P_0$  to  $P_1$ , lowers real balance to conform to the new, higher opportunity cost; thereafter real balances are kept constant at  $M_0/P_1$  (where  $M_0$  is the money supply at  $t=0$ )

(5) The reduction in real balances, from  $M_0/P_0$  to  $M_0/P_1$ , brings about the "cost" of inflation, in this model. Why? Cash balances yield utility, and they contribute to production. Cash balances are held for transactions by firms and households, in order to economize on the resources needed to carry out transactions. When the opportunity cost of cash balances rises, and people decide to hold less, in part they do so by substituting other (real) resources for cash in making transactions. A storekeeper may reduce his cash holdings, for example, by increasing the frequency of trips to the bank with receipts, by making frequent small orders for inventory rather than infrequent large ones, by paying his employees more frequently, by diligent attention to the opportunities for investing idle balances in financial assets -- all at a cost of time, postage, bookkeeping, and information gathering. Most firms and households have similar opportunities. Energies diverted from production of goods and services, or from leisure, to economizing on cash are energies wasted, from a social point of view.

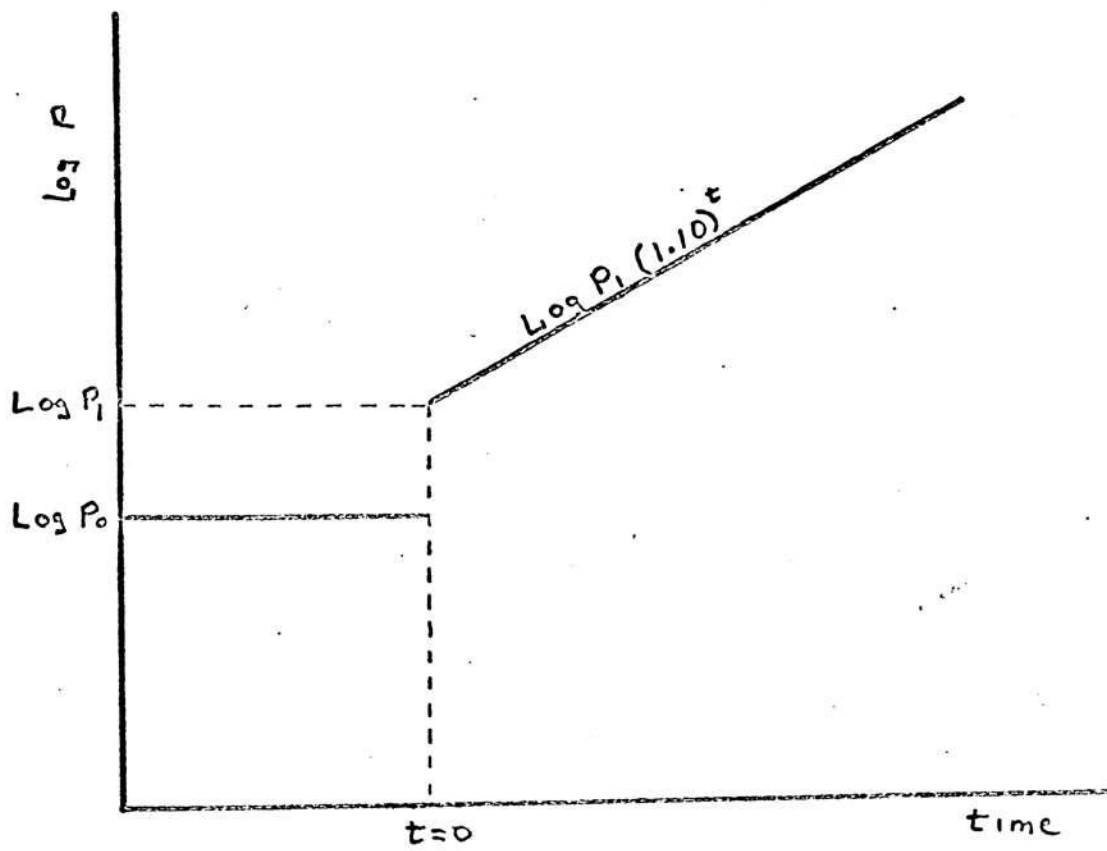


Figure 1.

Additionally, cash balances are held by both firms and households to guard against unexpected contingencies: providing peace of mind, and thereby utility, to the household, and increasing expected future profits, and thereby the present value, of the firm. To the extent that they are induced to forego the safety provided by cash balances, everyone is the poorer.

Is there no offset to these losses? People do, after all, spend the cash balances that they want to be rid of. But they spend them in a fully employed economy, and in the aggregate, cannot succeed in getting more goods (indeed, they may not even try to spend them: prices may rise just because everyone expects them to.)

(6) Can we measure the magnitude of the loss when the public reduces its real cash balances? It is helpful to consider the inflation as a tax: the government finances its deficit by printing currency, reducing the value of currency already in circulation in the process. This raises the cost of holding currency, and in the final equilibrium, the public pays the higher cost. But, as with any tax, the public tries to avoid it by avoiding the activity that bears the tax -- just as they use less oleomargarine or lipstick in response to an excise tax, in this case they use less cash <sup>in</sup> response to inflation. The reduction in cash balances causes a dead weight loss just as an excise tax does [4].

The analogy between inflation and an excise tax can be sharpened by introducing a demand curve for cash balances -- a liquidity preference curve. One alternative to holding cash is to spend it for current consumption (as argued in paragraph (2), above). Another is to exchange cash for bonds or other assets. Measured against bonds, the opportunity cost of cash is the foregone yield (interest and expected capital gain) on bonds. The higher the yield on bonds, the less willing is the public to hold

cash (ceteris paribus) and the relationship is summarized in a demand curve for cash balances, the liquidity preference curve (Fig. 2).<sup>\*</sup> This curve will permit a numerical estimate of the cost to society of the reduction in real cash balances brought about by inflation.

When the public is content with its portfolio balance between cash and bonds, they must be indifferent, at the margin, between the financial yield on \$1 of bonds and the additional services provided by \$1 of cash: So the yield on bonds measures the value of those services provided by cash which are not also provided by bonds; that is it measures the security and convenience provided by cash which is additional to that provided by bonds. When the public is induced to give up \$1 of real cash balances, it loses those services (and gets nothing in exchange); the monetary measure of its loss per year is the bond interest rate.

As the public is induced to give up more and more cash, the marginal dollar of cash balances becomes increasingly valuable -- as indicated by the negative slope of the liquidity preference curve. In Fig. 2, the narrow vertical bands suggest the increasing cost per (real) dollar as real cash balances fall from  $M_0/P_0$  to  $M_0/P_1$ . A money measure of the total loss incurred per year is the hatched area under the liquidity preference curve, between  $M_0/P_0$  and  $M_0/P_1$ .<sup>\*\*</sup> This area measures the loss due to inflation

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<sup>\*</sup> To keep life and this exposition simple, neglect the variety of financial assets available, and pretend that there is only one form of bond.

<sup>\*\*</sup> Questions regarding the appropriateness of this measure are discussed below. See Part C of this section.

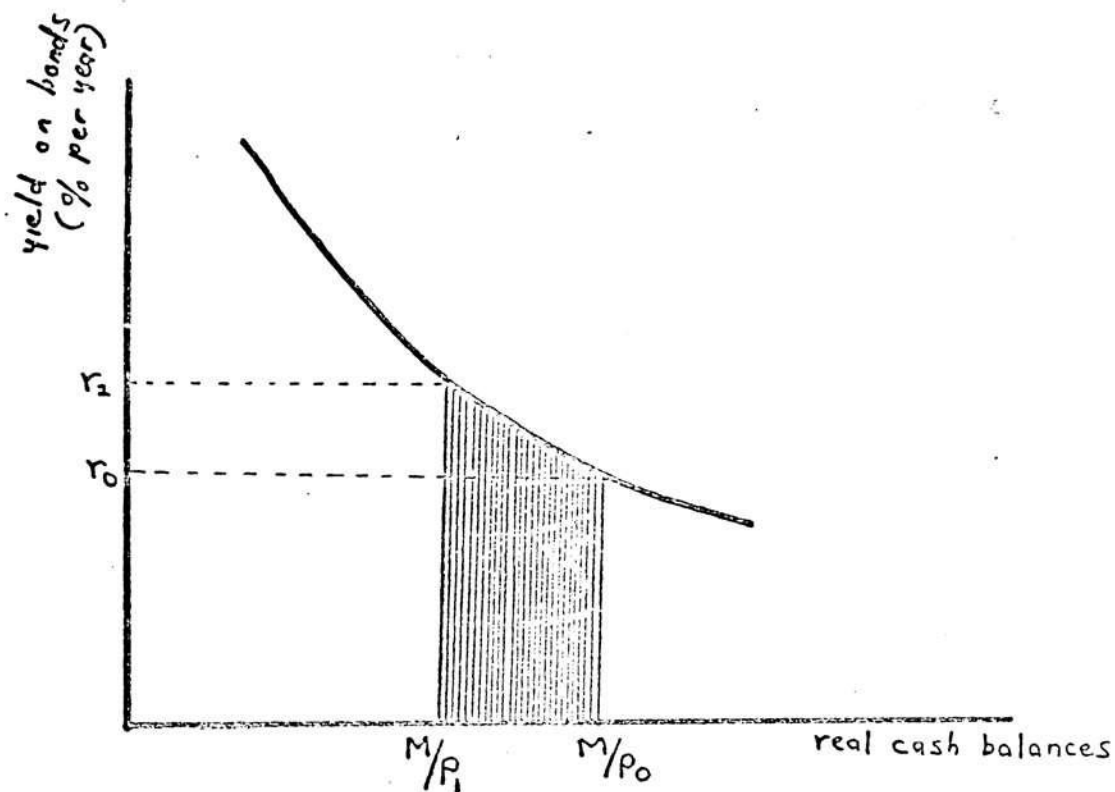


Figure 2. Liquidity Preference Curve

in real dollars per year; if we define prices so that the year zero price index,  $P_0$ , is one, then the loss is measured in dollars of year zero. The physical counterpart to the loss is the diversion of real resources to economize on cash balances, plus the reduced well-being of households, and reduced present value of firms, due to their reduced flexibility for responding to future emergencies or opportunities.

(7) Notice that the preceding argument implicitly leads to the conclusion that bond yields must rise during anticipated inflation. If we can determine by how far the bond yield must rise (or by how far real balances will fall) and if we know the shape of the liquidity preference function, we can provide a numerical estimate of the welfare loss resulting from lower real cash balances. Bailey and Friedman (and, for that matter, Irving Fisher) predict the rise in the bond yield to be equal to the rate of inflation. If the bond yield were 5% before inflation and the rate of fully anticipated inflation is 10%, the equilibrium bond yield after inflation must be 15%.\*

This conclusion comes from considering another aspect of portfolio balance, the equilibrium between bonds and physical assets. With inflation the physical assets will enjoy an advantage over bonds at the old (pre-inflation) interest rate. In real terms, the bond yield is reduced by the loss of purchasing power on the principle and interest yield, while the physical asset's yield is unaffected. Alternatively, in nominal terms the physical asset's yield is increased by the capital gain as its price rises with inflation while (at the pre-inflation interest rate) the bond's yield is unaffected. In order to keep wealth-owners content in

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\* If continuously compounded; with annual compounding the rate will be 15.5%, obtained by calculating  $(1.05)(1.10) - 1$ .



dividing their assets between bonds and physical assets in the proportions actually available, the bond rate must rise (i.e., there is initially an excess supply of bonds, and the price must be bid down). It is assumed that there is a unique real rate of return on bonds for which all wealth-owners are content to hold the current stock, given the current stock of physical assets. If so, we conclude that the real yield on bonds must rise to the pre-inflation rate; that is, the nominal yield must rise by the full amount of inflation.

Using this approach, appropriately modified to apply to a world with bank money as well as currency, Friedman's estimates imply that the welfare loss brought about by a fully-anticipated 4% inflation would have been \$200 million to \$400 million per year, in 1968.\* Compared to GNP, the loss is inconsequential; but if the inflation were brought about by money creation, used deliberately to finance a government deficit, the appropriate standard for comparison is not the magnitude of GNP, but rather the magnitude of the "tax" collected. The cost imposed by inflation should be compared with the cost of collection for feasible alternative taxes.

In 1968, the relevant "high powered money" (currency plus deposits in Federal Reserve Banks, excluding deposits of the Treasury [14, p. 41] ) was about \$70 billion. If 4% of this total were transferred to the government by inflation, the tax receipts would have been \$2.8 billion; the implied welfare cost of collection is 1%- 2%.

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\* See [ 14, p. 44]. Friedman does not estimate directly these figures; instead he estimates the gain that would accrue in moving from inflation to deflation at a rate sufficient to bring the nominal interest on bonds to zero. My estimate is derived from his data and assumptions.

The analysis presented here is based on two premises: first that the area under the liquidity preference curve provides an appropriate measure of the loss; second that the rise in the <sup>1</sup>nominal interest rate, which determines the magnitude of the loss, must equal the rate of inflation. Predictably, both of these premises have been challenged. Parts B and C below summarize the discussions, still within the framework of full anticipation and full employment. First we take up the issue of the interest rate.

#### B. The Effect of Inflation on the Interest Rate

The assertion that the interest rate rises to the full extent of the inflation goes back at least to Irving Fisher [ 11 ]; the counter assertion goes back at least to Keynes [ 25 , p. 142]. Keynes argued as follows: The impact of inflation on the interest rate comes not through the market for assets but through the demand for investment. As soon as inflation is foreseen, the price of currently existing assets immediately is adjusted, so that portfolio balance between money and physical capital is maintained.\* At the initial nominal interest rate, however, investment is now made more attractive because of the rise in anticipated nominal returns: the investment-demand schedule shifts up. Because of the increased demand for investment, the interest rate rises. We know that the interest rate does not rise by the full extent of the inflation, because we know that inflation stimulates the

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\* But Keynes does not explain how the market for bonds is also cleared, without a change in the interest rate.

economy;\* whereas all the stimulative effect would be removed if the rate of interest were to rise by the full rate of inflation.

In the context of a fully employed economy, our standard text-book macro-economic model would provide the following conclusion to Keynes' analysis: Because output cannot expand, the increased demand for investment represents excess demand for output in general. The excess demand vanishes only when interest rates rise by enough to bring the demand for investment back to its original level. The mechanism that drives up the interest rate operates through the money market: Excess demand for goods drives up the price level, which reduces real money balances below their equilibrium level; the attempt to readjust portfolios drives up the interest rate, and finally stems the investment demand. As Keynes pointed out, the rise in the interest rate must exactly equal the newly anticipated rate of inflation, in order to remove all of the excess demand. More briefly, a 5% anticipated inflation shifts the IS curve up by that amount, and to restore equilibrium the price level rises sufficiently to force a corresponding shift in the LM curve (see Fig. 3)

The textbook supplement to Keynes' argument would require amendment if the expectation of future inflation, or the consequent rise in present prices, brought other shifts in the IS curve. Mundell [ 28 ] suggested that saving should be affected by the rise in present prices: real balances fall as the price

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\*This weak link in the argument is implicit, not explicit. But it seems quite clearly to be there: "Indeed," says Keynes, "Professor Fisher's theory could best be rewritten in terms of a 'real rate of interest' defined as being the rate of interest which would have to rule, consequently on a change in the state of expectations as to the future value of money, in order that this change should have no effect on current output." [ 25, p. 143] (emphasis added).

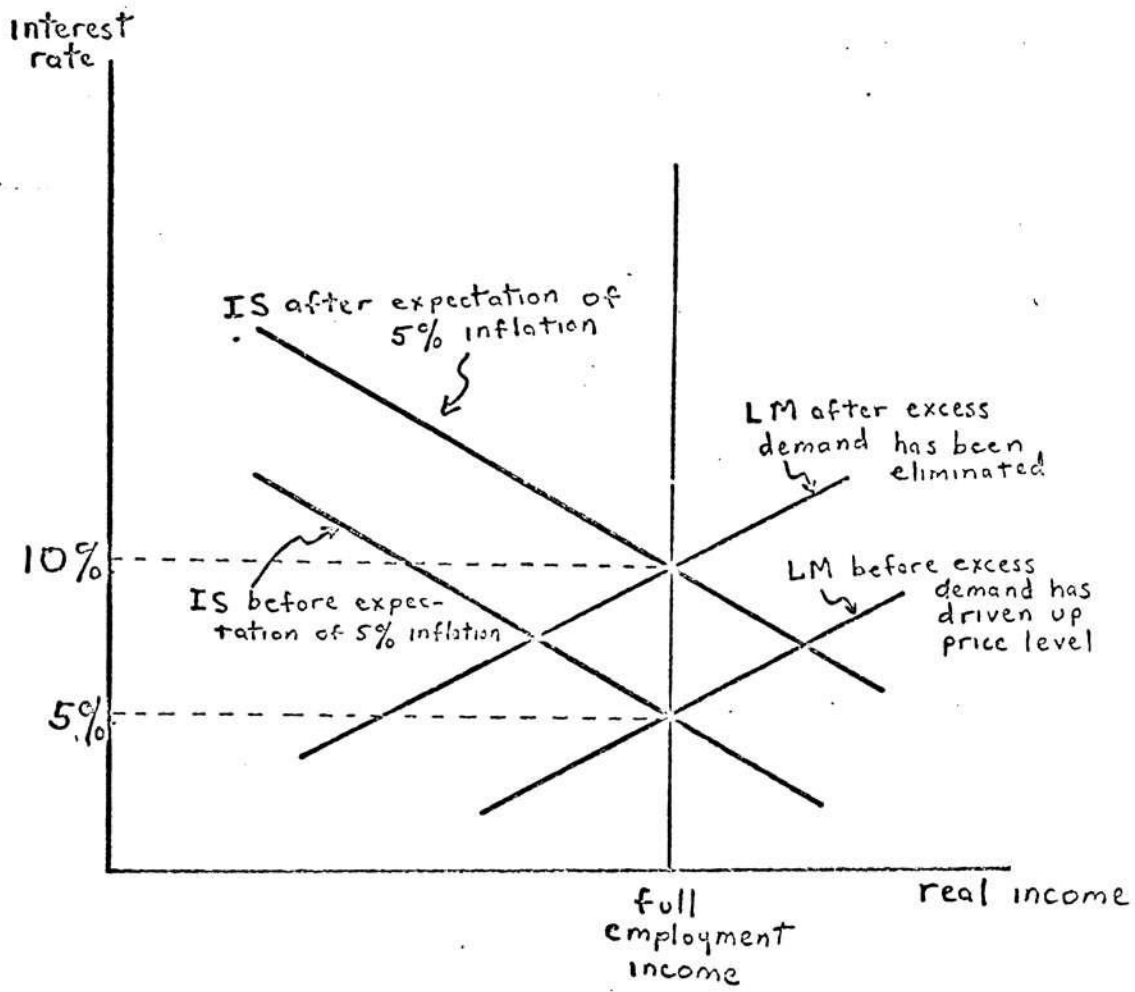


Figure 3.

level goes up to restore equilibrium, meaning that real wealth falls too (offset, in part, by the associated rise in the interest rate which raises the value of today's capital stock). The fall in real wealth induces households to increase their saving as a fraction of income; thus the post-inflation IS curve shifts down (compared to the result of Fig. 3) and in equilibrium the interest rate rises by less than the rate of inflation.

Phelps has objected to Mundell's argument [ 31 ] on the grounds that it does not adequately account for government fiscal and monetary policy. A more telling criticism is that Mundell's analysis is not relevant to the Bailey-Friedman question: they measure the effect of inflation after short-term shocks have vanished, while Mundell's amendment to the theory has relevance only in the short run: once wealth has been restored to the desired level, the stimulus to saving vanishes and the text-book answer of Fig. 3 is again valid.

It appears that, to date, no one has successfully attacked the proposition that the interest rate should rise by the full extent of the inflation. But neither has anyone satisfactorily defended that proposition. The analysis has been casual, and frequently based on static models. A more satisfactory analysis would incorporate an explicit model of portfolio choice in a macro-economic growth model. This has not yet been done in a way that would answer the question discussed here, and warrants further work.\*

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Foley and Sidrauski [12],

\*Tobin [ 42 ], Sidrauski [ 39 ], Park [ 29 ],<sup>n</sup> Foley, Shell and Sidrauski [ 13 ] and probably others have combined the elements of macro-economic flow with portfolio decisions on stocks, all except [ 29 ] within the explicit context of a growth model. But I have not been able to apply their analyses directly to the question discussed in this section. I hope to clear up the question in a future paper, however.

For what it is worth, one empirical study has confirmed that anticipated inflation in fact has almost a one-for-one impact on the equilibrium interest rate [ 10 ]; others have not (see especially Sargent [ 37 ], and, for a review of earlier studies, Yoke and Karnosky [ 46 ]).

### C. The "Consumers' Surplus" Loss Measure

Both Bailey and Friedman have used the area under the liquidity preference curve to measure the cash balance cost of inflation. This construction has since been attacked on several grounds.\* Frank Hahn, in a scathing review of Friedman's The Optimum Quantity of Money and Other Essays, offers a closely reasoned critique [20].

I think it is fair to summarize his argument by saying that it is difficult to measure the loss from a reduction in real balances, when we do not know the benefit from real balances; so many things are happening at once, in moving from one steady-state rate of inflation to another, that without a fully articulated theory of the demand for money it is impossible to say what gains and losses occur. For example, to the extent that cash is held for precautionary purposes, what prices are relevant for defining real balances so as to reflect a given level of security? The answer must depend on the alternative patterns of emergency expenditures being envisioned by the cash holder. A shift in the expected rate of inflation will penalize holders of precautionary balances to different degrees, depending on how far in the future they anticipate their emergency expenditures will be made, and it is not clear that all of the resulting shifts in real wealth and in demand for cash can be subsumed under "transitional effects," some of the changes may be permanent, persisting even after stocks have been brought back to their desired levels by all agents in the economy.

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\*In Section III B, below, I cast further doubt on the measure if it is applied to an economy undergoing wage inflation.

As a second example of the difficulty raised by lack of a fully developed theory, does the standard deviation of expected future prices influence the utility derived from cash, or does the coefficient of variation?\* Which, if either, is assumed to remain constant under changes in the rate of inflation?

These criticisms, and others raised by Hahn all call into question the stability of the liquidity preference curve, and of the measuring rod being used (the marginal utility of \$1 of real balances). A completely separate question is whether the social benefit from cash balances is appropriately measured as the sum of the private benefits. Responding specifically to Friedman's work, within the past 18 months, both Hahn [ 20 ] and Winch [ 44 ] have said no. And Vickrey made the same point over a decade ago [ 43 ]. The argument is as follows: To the extent that cash balances are held for precautionary motives, people anticipate spending them if adverse contingencies should arise. If expenditures in response to those adverse contingencies for different individuals are completely uncorrelated, they can give rise to constant aggregate expenditures over time. But if adverse contingencies for different individuals occur together (e.g., natural disaster, epidemic, technical or institutional changes) individuals will find that the "services" provided by precautionary balances vanish, because the real resources will not be available in exchange for the cash. There is a degree of illusion in the utility provided by precautionary balances, and the higher are cash balances, the higher the illusion. So when real cash balances are reduced in response to a rise in their opportunity cost, part of the utility sacrificed is illusory; social benefits

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\* The coefficient of variation is the standard deviation divided by the mean.

from cash balances are lower than private benefits.

We are left with the argument that real resources are consumed for transactions purposes, and that these real resources are substituted for cash, when cash becomes more expensive because of inflation. But we cannot rely on the simple estimate of the extent of the loss obtained by measuring consumers' surplus triangles.



## III. WAGE INFLATION

A model should be a good mimic; it cannot be expected to reproduce its subject in every detail, but if it is to be effective it must capture the essential features. The model of Section II is a fully employed economy; its flow of output hums along at full capacity and its inflation can be blamed only to monetary excess. Does it adequately describe the inflationary process in a world of unemployment, union contracts, price freezes and incomes policies?

Today's inflation is thought to be inherent in the processes of the labor market. It is widely believed that we may choose lower rates of inflation at a cost of higher rates of unemployment, at least in the short run; it is debated whether such exchanges can be effected in the long run, when everyone has come to fully anticipate the inflation and fully adapt his behavior to it. If this view of inflation is correct, there may be offsetting benefits, or further costs to add to the cash balance costs discussed by Bailey and Friedman.

There has been overwhelming empirical evidence of the association of low unemployment with high inflation, and vice versa; the evidence covers wide spans of time and a varied collection of economics. Until very recently, the theoretical explanation of this Phillips' curve relationship has been casual; but we now have a collection of alternative formal models each of which yield relationships broadly consistent with the empirical evidence (see, e.g. the 1970 collection of papers edited by Phelps [ 34 ] and the collection presented at the 1968 annual meeting of the American Economic Association [ 35 ]. On grounds of compatibility with the data there is little to choose among the alternative models that I have seen; but only one, that of Charles Holt [ 22 ],

yields the possibility of a long-run exchange between inflation and unemployment.\* A summary of his model is provided in Part A, followed by a discussion of the implications of his model for our topic in Part B, and a brief review of how the competing models differ from Holt's in Part C.

#### A. Holt's Model

Holt's model of the wage-unemployment relation [ 2.2 ] concentrates on the annual turnover of workers -- the 35% or more of jobs in the economy that must be refilled each year because of resignation or discharge. The wages offered and accepted for these vacancies affect directly one-third of the work force; and there are pressures to keep the other two-thirds more or less in line.

Both job seekers and employers with vacancies are viewed as uncertain about the state of the market, principally because of the high search costs for information. Employers are assumed to respond to this environment by varying the wage offered in response to changing rates of resignation of their own employes, and changing degrees of difficulty in filling vacancies. Job seekers are assumed to respond by establishing a "reservation wage," a target wage rate above which they will accept any new job offer. For the currently unemployed the reservation wage is presumed to start out higher than the last wage earned, and to decline over time (inflation and general wage trends apart). An employed job-seeker's reservation wage is expected to remain permanently above his current wage, of course.

Holt provides a succinct summary of the premises of his model [ 2.2, p. 60-61].

a. The longer a worker is unemployed, the lower money wage or the less desirable job he is willing to accept; i.e., he has a declining aspiration level with the passage of time unemployed.

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\* Since writing this, a similar model by Gronau has come to my attention [19]. Gronau does not deal directly with the question of anticipated price rises, and I am not yet sure whether his model allows a long-term trade-off; it appears to.

### III-3

- b. The unemployed worker's wage aspiration level also is influenced by concurrent changes in the general wage level and by the number of job vacancies.
- c. On-the-job changes in wages move in response to changes in wages between jobs.
- d. The average duration of unemployment is relatively high when unemployment is high.
- e. Employers usually offer higher wages to prospective employees than the bare minimum that they would accept.
- f. Employed workers will tend to switch jobs, or quit to search, in response to an increase in the number of high-paying vacancies.
- g. Employers make on-the-job wage increases in response to their quit losses and recruiting difficulties.
- h. The general money wage level changes as the result of wage changes that unemployed workers experience between jobs, wage changes that occur when changing jobs without unemployment, and wage changes which occur on the job.

From an initial equilibrium, suppose now that vacancies rise due to higher aggregate demand. We wish to show that unemployment falls and prices rise. Employers are led by increased vacancies to offer higher wages; with higher wages job seekers find acceptable jobs sooner, and the rate of unemployment falls as the trend of wages for newly-employed workers is pushed up. Wages for the other workers must also rise, or their employers will be faced with higher rates of resignation (as currently employed job-seekers find more attractive jobs elsewhere) and worker discontent that lowers productivity. Thus an initial increase in aggregate demand lowers unemployment and raises wages. Prices follow wages, under a simple mark-up pricing theory. The upward wage and price drift at high employment is continuous, because vacancies will always be in evidence and employers will always be attempting to bid workers away from each other.

At low rates of employment, employers will find that resignations are less of a problem, and that workers who do resign can be replaced fairly easily at low wages (the higher the rate of unemployment, the longer its average duration and so the lower the wage the job-seeker is willing to accept). At extremely high rates of unemployment, employers will discover that they can fill vacancies at wages lower than they had paid before; this can even result in wage decreases for current employees.

It should be emphasized that this story does not simply associate high employment with high wages, and low with low. It associates high employment with rapidly rising wages. Due to the constant turnover of the work force, workers moving from job to job do so at ever higher rates of pay when the labor market is tight. The looser the labor market, the more likely it is that employers can fill their vacancies with small, or even negative, wage increases.

#### B. Costs and Benefits of Wage Inflation (Holt's Model)

Three issues require discussion:

First, the extent to which anticipation of inflation lowers the rate of exchange between inflation and unemployment; second, the effect on the cash-balance cost of inflation of removing the full-employment ceiling of Section II; and third, the effect of inflation on the efficiency of the labor market.

#### The Effect of Anticipations on Inflation and Unemployment.

We need to develop Holt's equation of the Phillips curve. For simplicity, I shall assume that the labor force is constant, and all job seekers resign from

their old jobs to devote full time to searching for new ones (this means that all new hires come from the pool of unemployed); and I shall assume that all of the unemployed are voluntarily unemployed, in a position to seek a "good" job offer rather than take the first offer. These assumptions simplify Holt's model, but they do not depart from its spirit.

Suppose that, when a job seeker resigns from his old job, his terminal wage rate was  $w$ ; he immediately establishes a reservation wage,

$$r = A w, \quad A > 1.$$

The coefficient  $A$  reflects his hope for a higher wage in his new job. It is assumed that initially, the job seeker sets a reservation wage higher than he expects to achieve, to protect against the error of excessive conservatism. As his job search continues, the reservation wage will then change for two reasons. First, the job seeker confirms that his initial reservation wage was over-optimistic, he exhausts his most promising job prospects, and he is drawing down his liquid assets for living expenses -- so he lowers his aspiration level at the rate  $a$  per period. Second, wages generally will be rising at a rate the job seeker believes to be  $b$ , and his reservation wage follows. Altogether then, after  $T$  periods of search the relation between his last earned wage,  $w$ , and his reservation wage  $r$ , is given by

$$r(T) = A w e^{(b-a)T}$$

Now suppose that the job seeker is offered an acceptable job, after  $T$  periods of search. He would be willing to work for  $r(T)$ , but unless the employer is prescient he will not know that, and the actual wage will be  $w(T) = B r(T)$ , with  $B \geq 1$  representing a bonus (or economic rent) to the employee. Thus over the

duration of his unemployment, the job seeker will experience an increase of

$$\frac{w(T)}{w} = AB e^{(b-a)T}$$

in his wage rate. If we let  $u$  represent his average rate of wage increase per period during his unemployment, we have

$$e^{uT} = AB e^{(b-a)T}$$

from which

$$(1) \quad u = \frac{\log AB}{T} + (b-a)$$

If we assume that the job seeker of our discussion is "typical" in the parameters of his wage change, and that his duration of unemployment was exactly equal to the average for the economy, then the  $u$  of equation (1) describes the average rate of wage increase per period for all newly employed workers. These are the people who are actively in the labor market, and it is their experience that determines wage increases for everyone. Assume that workers who do not resign enjoy wage increases at the rate  $ku$ ,  $k \leq 1$  ( $ku$  is the rate at which employers find it necessary to increase wages for their old employees, to keep resignations and discontent in bounds). Then the general rate of wage increase,  $g$ , is a weighted average of  $u$  and  $ku$ :

$$g = [U + (1-U)k] u$$

where  $U$  is the fraction of the labor force unemployed. Or using (1),

$$(2) \quad g = [U + (1-U)k] \left[ \frac{\log AB}{T} + (b-a) \right]$$

Several variables in (2) have the misleading appearance of exogenously determined parameters. Certainly  $T$ , the average duration of unemployment, varies with  $U$ .

Let  $F$  be the turnover rate, defined as the fraction of the labor force which resigns, per unit time, in order to seek work. This flow is related to the stock of unemployed workers by the relation

$$F T = U.$$

It is reasonable to assume that  $F$  varies inversely with the unemployment rate (the lower is  $U$  the more vacancies, and the more resignations to look for a better job). Thus we have

$$T = U/F$$

and

$$\frac{dT}{dU} = \frac{1}{F} - \frac{U}{F^2} \frac{dF}{dU} > 0$$

Very likely the behavioral parameters  $A$ ,  $B$  and  $k$  vary inversely with the unemployment rate, and  $b$ , the expected rate of general wage increase, varies with  $g$ , the actual rate -- perhaps with a lag. With these relationships in mind, equation (2) provides one variant of the Phillips curve; it shows the trade-off between unemployment and the rate of wage increase.

Our present purpose is to investigate the properties of equation (2) when inflation is fully anticipated, that is when  $b = g$ . Note that if  $k = 1$  and  $b = g$ , (2) reduces to

$$(3) \quad g = \frac{\log AB}{T} + g - a$$

Equation (3) can be satisfied only if

$$\log AB/T - a = 0$$

Earlier we concluded that  $T$  is a function of the unemployment rate with  $\frac{dT}{dU} > 0$  and suggested that  $A$  and  $B$  might be expected to move inversely with  $U$ , if at all; so we would expect  $\log AB/T$  to be a downward-sloping function of the unemployment rate (see Fig.4). The parameter  $a$ , if it varies with  $U$  at all, should be an increasing function (the more scarce jobs are, the more rapidly job seekers lower their wage demands). Hence, as Figure 4 indicates, there would be (at most) one rate of unemployment compatible with fully anticipated inflation, when  $k = 1$ . There is a "natural" rate of unemployment generated by the Walrasian general equilibrium system (see Friedman, [15, p.8]) and once people realize that inflation is occurring the Phillips curve shifts so that the natural unemployment rate is restored. In such a world, we could hope to decrease unemployment below the natural rate, along the Phillips curve derived from equation (2), only temporarily and only because the anticipated rate of wage increase,  $b$ , is lower than the actual rate. When anticipations adjust unemployment would return to its natural level, and the economy would have gained only a temporary increase in employment at the cost of a permanent increase in the rate of inflation. To lower the rate of inflation back to its old level would require that the public's anticipations be modified. In the framework of the model (where "jawboning" and wage freezes do not enter) such a lowering of anticipated wage increases would require a temporary reduction in employment to a rate below its natural level.

A diagrammatic summary of the preceding argument is provided in Fig. 5, which graphs equation (2) (with  $k = 1$ ) for two different values of  $b$ . The initial equilibrium yields unemployment of  $U_0$  (the natural rate) and wages



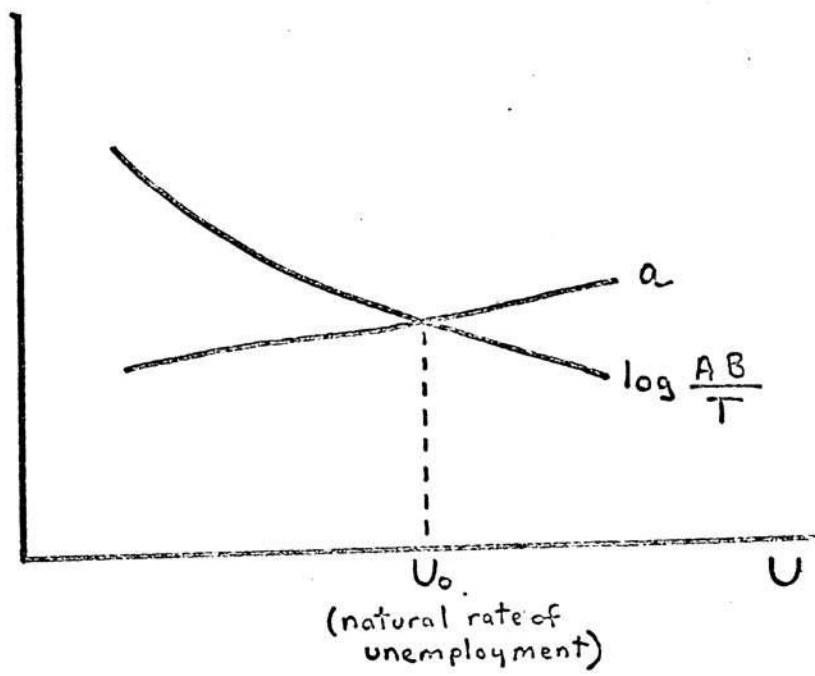


Figure 4.

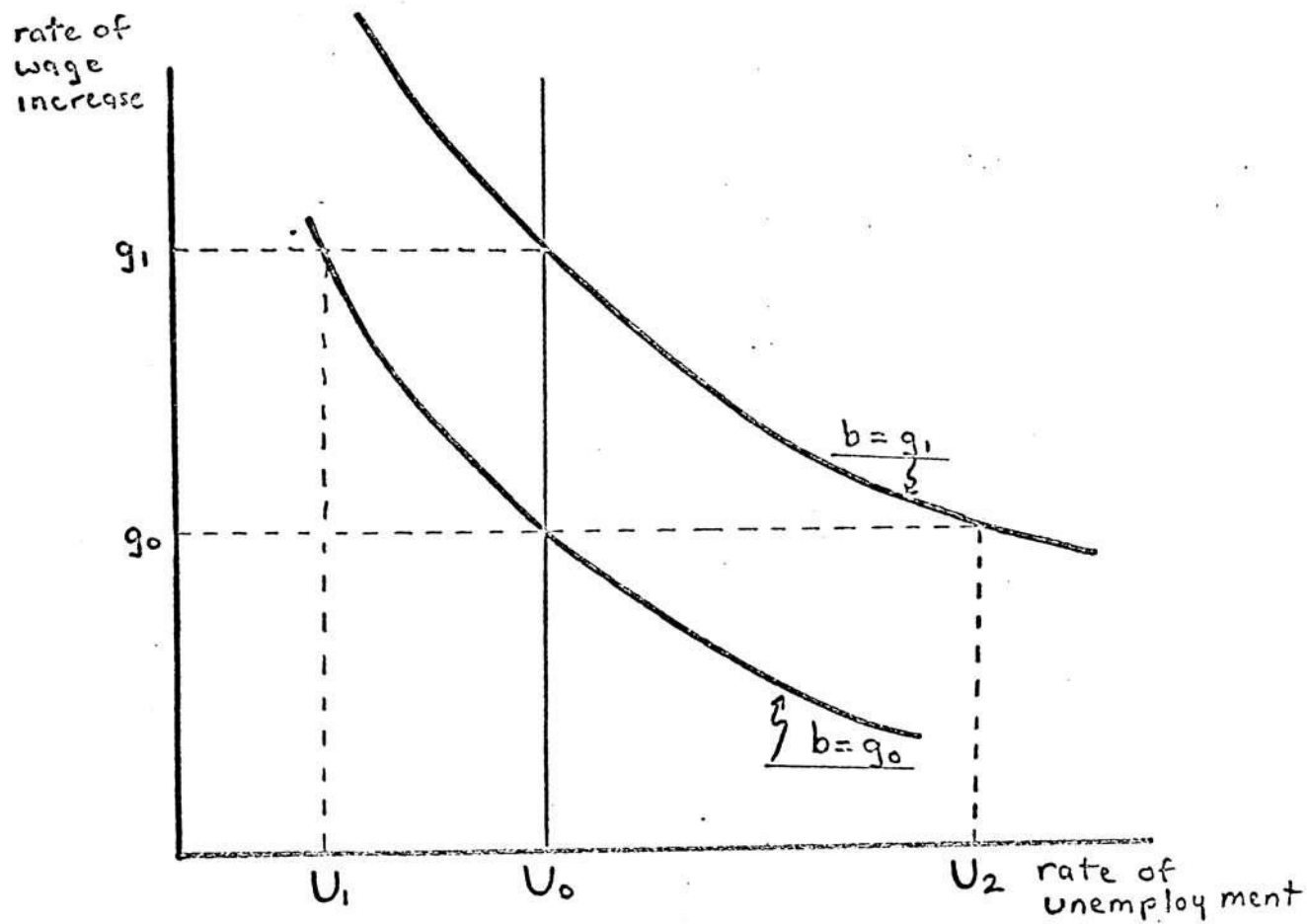


Figure 5.

increasing at the rate  $g_0$ , with compatible anticipations ( $b = g_0$ ). If the government should attempt, by fiscal or other means, to lower unemployment to  $U_1$  they could succeed, at the cost of a rise in the rate of wage increase to  $g_1$ , as long as the anticipated rate of wage increase did not rise. But when  $b$  rises to  $g_2$ , the unemployment gain is eliminated; the Phillips curve shifts, and the economy is left with unemployment of  $U_0$ , wage increase of  $g_1$ . In order to return the economy to the original Phillips curve it would be necessary to teach the public to anticipate wage increases of  $g_0$  -- by temporarily lowering employment to  $U_2$ , along the new, higher Phillips curve.\*

It remains to consider the possibility that  $k < 1$ , in equation (2), with  $b = g$ . We then have

$$(4) \quad g = \frac{U + (1-U)k}{(1-U)(1-k)} \left( \frac{\log AB}{T} - a \right)$$

In (4) the slope  $dg/dU$  is not algebraically determinate: as  $U$  rises the rate of wage increase for job seekers  $u$ , falls, but in the expression

$$g = U \cdot u + (1-U) ku$$

the relative weight is also shifting from  $ku$  to  $u$  -- from the smaller to the larger term. Plausible values of the variables yield a negatively sloped relation, however. So it is clear that the possibility of permanently trading unemployment against inflation requires that rates of wage increase be systematically

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\*The prospect of permanent inflation as the price for temporary employment gains led Edmund Phelps to work out an optimal time path for employment and prices under the assumption that today's policy makers discount the future and that they can establish a preference ordering over alternative combinations of inflation and unemployment; his analysis is of course based on an explicit model for the adaptation of wage expectations to the recent wage history of the economy. See [ 33 ].

lower for those who do not seek new jobs than for those who do; more precisely, it requires that workers who are not at the moment seeking new jobs receive lower rates of increase than those who are. Holt suggests that this outcome is plausible [ 21, p. 145]:

"We could reasonably assume that the typical worker would recognize the real costs of search and unemployment, and, for a time, would avoid quitting his job even though he recognized that in continuing it his wages were not fully keeping up with inflation. He might also be partially trapped by the fact that some of his work experience might not be transferable and his productivity might be lower elsewhere. Also there is an element of uncertainty in changing jobs, and he is likely to have some aversion to risk.

Given the fact then that he has voluntarily accepted some real losses by failing fully to keep up with the inflation on his old job, it appears reasonable that he would set his aspirations to try to catch up on some of the inflation that occurred during the time span [since his last new job] but he may not think it feasible to catch up fully\* and he accepts partial compensation ...."

These suggestions do not provide proof, of course, but they do at least indicate that it is an open question whether the frictions caused by job search can be totally eliminated in the long run. Holt's position is lent some support by the succession of empirical studies which have arrived at the same conclusion; see Gordon [17, 18], and especially Solow's comment [ 40 ] .

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\*He recognizes that employers in judging his productivity are influenced by his past wage.

Gordon's paper [17] was designed as an explicit test of the "accelerationist hypothesis." This is the idea that as anticipations adapt to a steady rate of inflation, the Phillips curve shifts up to eliminate all employment gains; so the rate of inflation must be continually accelerated to achieve permanent employment gains, by permanently exceeding the anticipated rate of inflation. Gordon found that anticipated inflation does lower the trade-off between employment and inflation (consistent with equation (4) above) but it does not eliminate it.

Solow, as discussant for a paper designed to test the accelerationist hypothesis, did not feel that the hypothesis was even worth discussion [40,p.42]:

My comment number zero is that the paper demonstrates that the accelerationist idea of inflation gets essentially no support from the data -- confirming my own work and that of others. I would suggest that we leave that theoretical question out of our discussion unless somebody has something new to offer.

But we cannot completely reject the accelerationist theory on the basis of evidence so far accumulated. Peoples' anticipations of inflation are not an observable variable, and the best we can do, in testing the theory, is to invent some plausible story about how they are formed, or work backwards from observed behavior to guess what their anticipations must have been; in other words we must estimate peoples' anticipations from other data, and use our estimates as a proxy for the true anticipations, in statistical tests. In Gordon's test the accelerationist hypothesis would be supported if a certain regression parameter were equal to 1.0. He found the coefficient to be significantly lower than that -- which allows us to conclude only that one of the two following statements is true:

- (a) the estimate for anticipations is adequate, and if we could have observed the true anticipations instead we would have rejected the accelerationist hypothesis
- (b) the estimate for anticipations is inadequate, and if we could have observed the true anticipations instead we would have accepted the accelerationist hypothesis.

When a proxy variable is being used, any statistical test is a combined test of two hypotheses: that generated by the underlying theory, and the additional hypothesis that the proxy is adequate. Positive results tend to support the underlying theory but negative results cannot be used to reject it.

This issue clearly deserves more research. The gain in employment potentially offers a benefit that could offset the cash balance and other costs arising from inflation; it would be nice to have a firm base in theory and in empirical research for our conclusion, whether it be that the employment gain will evaporate in the long run, or the reverse.

#### Cash Balance Costs of Wage Inflation:

Money balances are "taxed" by inflation no matter what its underlying cause, and the public will attempt to avoid the tax by economizing on cash. So the basic argument of Section II is not changed; but the argument is changed in two details.

First, if output can rise in the long run when the inflation is fully anticipated, the real cash balances demanded will not fall by so much as in the case of constant output. Thus the once-and-for-all rise in prices as the public reduces its real cash balances will be smaller, with wage inflation. Moreover, if the equilibrium level of output rises there will be adjustments in the marginal

efficiency of investment, in equilibrium interest rates and other prices; in consequence the liquidity preference curve will shift. These small adjustments are not likely to have any major impact on the economy but they will have a major impact on the economists: they greatly weaken the (already shaky) theoretical basis for measuring the cash balance cost of inflation as the area under the liquidity preference curve. We are left without a defensible measure of the cash balance cost.

The second detail in which the argument of Section II changes concerns the public's attempt to reduce its cash balances, when they learn to anticipate

inflation. In Section II we could argue that this attempt to reduce cash balances simply drives up prices; the desire to spend more cannot generate higher output in an economy operating at absolute capacity, so the public gets nothing in exchange for the real cash balances it gives up. We can no longer make that argument. Now we must acknowledge that if the public attempts to trade cash for physical assets, more physical assets can be produced and wealth holders can get something in exchange for the real cash balances they give up. The extra output provides a benefit to partly offset the cash balance cost of inflation, but I do not see any way to measure the size of that offsetting benefit; it depends upon too many unknowns.

When the public comes to realize that there is inflation, and decides to lower its real cash balances, it may divert part of its real cash balances into a consumption flow (deliberately lowering wealth) or it may divert all of the excess cash into alternative assets. Depending upon wealthholders' speed of

adjustment, goods prices will rise, and output will be increased. The elasticity of supply with respect to price depends not only on the technology, but on the extent to which this new, supplemental price rise is anticipated (is the expansion of output along a long-run or a short-run Phillips curve?)

I conclude that wage inflation produces lower cash balance costs than "pure" inflation but I am at a loss to measure its magnitude.

#### Wage Inflation and Efficiency of the Labor Market.

It is Holt's hypothesis that the labor market is likely to function more smoothly, with workers more quickly moving to take advantage of openings to which they are well suited, in periods of inflation and low unemployment.

When jobs are widely available (and widely advertised) the search cost for finding a new job is low, so a large fraction of the labor force will be induced to search for new jobs [ 22 p.77]. However, the benefits cited by Holt do not represent a net gain: high turnover means that much job-specific training is wasted, and increased recruiting efforts by employers represents additional social cost. It would be difficult to measure the magnitude of the net gain.

#### C. Alternative Wage Inflation Models

The models of Phelps [ 32 ] and Mortensen [ 27 ] do not provide the possibility of a long-run Phillips curve; it is only through faulty expectations, in their models, that inflation can increase employment. The result follows directly from their assumptions, so no new light is shed on the issue by providing a summary of their models; and no other complete microeconomic models of wage inflation have come to my attention.



However, their models present an interesting issue regarding the short-run effects of inflation: If workers and employers are simply duped by inflation into increasing employment, is the employment increase good or bad? Under some sets of assumptions, the increase in employment lowers welfare. A clear statement of the argument is given by Armen Alchian, in [1].

Like Holt, Alchian pursues the implications of a world in which information on available jobs is costly to collect, but more costly for one who is working than for one who is unemployed (the unemployed person may specialize, temporarily, in the collection of market information). Jobs are always available immediately, but typically at relatively low pay. By searching for a longer time, the job seeker can expect to get a better offer. Unemployment is thus a form of investment to the individual, calculated to permit him to make the best use of his talents; the investment is socially useful, because society can produce more when all of its pegs are in properly shaped holes.

Alchian's paper does not focus on the macroeconomic implications of his model, but he does point out one important macroeconomic implication: The general effect of unanticipated inflation is to fool some job seekers; they think that they have encountered high relative wages when they have merely encountered a rising general level of wages. If so, the inflation can reduce unemployment (at least until anticipations adjust to the actual state of affairs). But in this model, the reduction in unemployment is a cost of inflation, not a benefit:

"very low unemployment resulting from inflationary forces can be socially inefficient, because resources mistakenly accept new jobs with too little search for better ones." [ 1, p.45].

There is no doubt some truth to this argument. But the bizarre policy conclusion to which it gives rise serves to emphasize a general characteristic of all of the wage inflation models: unemployment in these models is a voluntary state. While acknowledging the importance of the frictional unemployment emphasized in these models, we are entitled to wonder whether they are relevant to a situation in which two hundred men line up, hours before the personnel office opens, to compete for twenty jobs, and in which experienced engineers take jobs as motel desk clerks while others are rejected for employment on the grounds that they are "overqualified" for the available jobs. Such people would probably have difficulty recognizing themselves in the models of frictional unemployment we have discussed here. It seems probable that we have something yet to learn about the combination of inflation and involuntary unemployment; I am not convinced that the combination of 6% unemployment and 5% inflation that we have experienced in 1971 fits comfortably into the models presented to date.

## IV. INFLATION IN THE U. S. ECONOMY

President Nixon's dramatic wage and price freeze was not designed to reduce the cash-balance cost of inflation, a la Friedman, or to save the unemployed from the risk of accepting the wrong job, a la Alchian. The discussion in Sections II and III of this paper has little to do with the cost of inflation as seen from Washington. I assume that what most worries government officials about inflation are its impact on the balance of payments, the redistribution of income and wealth it carries with it, the political divisiveness it creates as unions and other groups struggle to protect their own real incomes, the uncertainty and loss of confidence it generates; perhaps too, there is fear that inflation will grow into hyperinflation, with a general flight from cash and collapse of the payment system.

These are legitimate and important concerns; and the concerns that are beyond the power of economic theory to analyze -- the political, sociological and psychological issues -- may be the most important. But economic theory does have some observations to make on "practical" issues, both those with high political impact and others. These are the subject for discussion in this section: the possible effects of inflation on the economy, that are not treated in Sections II and III.

I will exclude the effect of inflation on the balance of payments, both because the topic is sufficiently large to justify a separate paper and because future effects, with a payments mechanism that is not yet settled, are likely to differ from those of the recent past. The following observations are

classified under two heads: effects of inflation on <sup>the</sup> distribution of income and wealth and on resource allocation.

#### A. Distribution of Income and Wealth

Each and Ando provide a convenient summary of the redistributive effects of (unanticipated) inflation [ 2, p.2]:

1. Inflation redistributes real purchasing power ... from those whose incomes rise less rapidly than the prices they pay ... to those whose incomes rise more rapidly relative to the prices they pay.
2. ... from those whose assets rise more slowly in price ... to those whose assets rise more rapidly in price.
3. ... from creditors to deb tors, when debts are stated in fixed dollar terms.

A moment's contemplation of the list suggests that we will never obtain definitive answers concerning the effects of inflation on income distribution. We need first to be able to single out the unanticipated(!) changes in relative prices caused by inflation, including subtle questions of timing such as lags in wage or interest rate adjustments; then we need detailed microeconomic information on the way households share in the resulting gains and losses. Until Budd and Seiders' study published this summer [ 6 ] so far as I know no one even attempted a study based on individual households. Now, their study,

arbitrary as it surely is in some of its dimensions,\* suggests that the short-run impact of an increase in the rate of inflation would:

- (1) redistribute wealth in a modest way from the upper 20% to the lower 80% of the population ranked by wealth (because the ratio of net claims to net worth is negative for the lower 80% of the population)
- (2) redistribute income in percentage terms from the lowest 40% and the highest 4% to the remainder in the middle (because both transfer payments and property incomes were found to lag in a period of general price rise, and wages do not).

It must be emphasized, of course, that the gain or loss from inflation to any single individual can differ in sign and magnitude from the averages discussed here.

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\*Most importantly, Budd and Seiders abstract from changes in unemployment; they thereby ignore one of the potentially most favorable and significant distributional effects of inflation. Moreover, they have to assume that all wages, all corporate dividends, etc., share equally in the aggregate gains or losses of their class of income. But their study provides a major advance over earlier work, first in making careful econometric estimates of the response to inflation of interest rates, dividends, wages and other classes of income, and second in using detailed household data (drawn from the 1962 Survey of Financial Characteristics of Consumers, conducted for the Federal Reserve Board) for information on the detailed structure of household income and balance sheets.

Earlier studies came to the following conclusions: Both Kessel [23] and De Alessi [ 8] conclude that borrowers and lenders probably systematically fail to take future inflation fully into account, hence inflation tends to transfer funds from debtors to creditors. Each and Ando [ 2 ] found that gross shifts in the functional distribution of income over the period 1930-1952 did not bear any relation to the customary predictions of shifts that should occur under inflation (wages and rents were expected to lag, business income to lead); they therefore concluded that either inflation was adequately anticipated, or that its effects are sufficiently minor to be swamped by other forces. They observed that households generally suffered a loss to the government (and taxpayers) but noted that the pattern of holding government debt roughly coincides by income class with the pattern of Federal tax payments. Pesek [ 30 ] later compared taxes and inflationary burdens more carefully, and concluded that either income or sales taxes would be more progressive than inflation, as a form of taxation. Brownlee and Conrad [ 5 ] seem to support those conclusions, though it is difficult to compare the two studies. Unfortunately Eudd and Seiders did not report the combined effect on households of the income and net worth changes, so it is not possible to say whether or not their conclusions agree.

None of the studies mentioned here attempts to answer the question that seems most relevant for policy purposes. To judge the seriousness of the income redistribution caused by inflation, I would like to know not just what the average poor family gains or loses, but the detail: a frequency distribution of gains and losses, for each income class. And I would like some

standard to compare it with; the functioning of the market hands out gains and losses everyday, inflation or no. To start, it would be informative to have a simple frequency distribution of changes in income classified by income level, for years with varying degrees of inflation. Such a study presumably could be done only through access to OASI, IRS or State tax files.

An additional set of questions concerns the redistribution brought about by government procedures under the impact of inflation. Because legislation and administrative regulations on economic affairs are almost universally stated in nominal rather than real terms, inflation is bound to have at least short-run effects on the distribution of tax burdens, transfer payments and real expenditures of governments, and incomes of regulated industries. The Federal income tax provides an important example. Because the rate structure is progressive, income taxes take a larger share of total income as prices rise; and because the structure is not equally progressive at all levels of income, the pattern of increased tax burden is markedly non-uniform -- the burden falls most heavily on low and high income classes. Table 1 illustrates the effect of a 10% inflation on tax rates for different income levels, from the 1970 tax schedule. Goetz and Weber [16a] have recently traced the effect of inflation and personal income tax rate changes from 1954 to 1970. They found that, despite the substantial reductions in nominal rates of 1964-65, some families with low incomes and large families paid more in 1970, on a constant real pre-tax income, than they paid in 1954.

Eventually legislators do respond to the shifting burdens of taxes and transfers -- witness the periodic adjustments of social security payments, and the combined recent and prospective adjustments to the individual exemptions

TABLE 1. EFFECT OF 10% INFLATION ON FEDERAL PERSONAL INCOME TAX RATES

(for a married taxpayer filing jointly, with 10% deductions and 4 exemptions, at 1970 rates neglecting the surtax)

(1) Adjusted Gross Income, without inflation	(2) Tax as % of col. (1)	(3) Adj. gross income, with 10% inflation	(4) Tax as % of col. (3)	(4) - (2): Increase in tax rate due to inflation
\$ 3,600	.001	\$ 3,960	.020	.019
4,000	.022	4,400	.040	.018
5,000	.055	5,500	.065	.010
6,000	.073	6,600	.080	.007
8,000	.095	8,800	.102	.007
10,000	.110	11,000	.115	.005
15,000	.136	16,500	.142	.006
20,000	.156	22,000	.165	.009
30,000	.195	33,000	.206	.011
50,000	.267	55,000	.283	.016
100,000	.377	110,000	.391	.014

Source: 1970 Federal Income Tax Forms. For income levels under \$10,000 taxes were as computed by the Internal Revenue Service taking advantage of minimum deductions. For income levels of \$10,000 and over, taxes were computed from IRS. tax rate schedules.



under the Federal income tax. But the lags are frequently lengthy, and markedly uneven. It is my impression that local welfare payments have not responded to inflation as smoothly as have Federal OASI payments, for example, and Conard suggests that institutional populations (those of orphanages, prisons, mental hospitals and so on) have suffered particularly because of their weak voice in legislatures [ 7 ]. I have not been able to find any systematic study of these issues.

#### B. Allocation of Resources.

The chief distributional impact of inflation comes from unanticipated price increases; its impact on the allocation of resources comes only when it is anticipated. Sections II and III of this paper treat two major questions having to do with resource allocation: actions of wealth holders to avoid the tax on cash balances, and possible effects of inflation on employment. There remain the possibilities that inflation will systematically affect relative prices, and thereby distort the allocation of resources, that it will increase the degree of uncertainty in the economy, or -- most worrisome of all -- that it will lead to complete financial collapse through hyperinflation.

#### Uncertainty

Much of the economic analysis of inflation proceeds under the assumption of a fully anticipated constant rate of inflation. Yet to judge from consumer attitude surveys, and some of the gyrations of the stock market, the fact of inflation makes people feel insecure, and uncertain about the future. The insecurity may be justified. From observation of Latin American experience,

Graeme Dorrance concludes that increased uncertainty is inherent in higher rates of inflation [ 9, p.41]: "if the current rate of price rise is 20 percent a year, the rate next year may almost equally well be approximately 10 percent or over 40 percent." We have not had that sort of variability in the United States, but it is the expectation regarding the future, not the fact of the past, that is relevant here. If inflation does increase uncertainty, what is the consequence?

First, uncertainty in itself is a "bad" which lowers utility.\* So it produces an immediate, direct cost. Second, if people anticipate increased variability of prices, their portfolio decisions are likely to be quite different than if they anticipate steady inflation. It is frequently suggested that inflation distorts investment choices, with particular encouragement to inventory investment, real estate speculation, and construction. Such effects, if they occur, can best be rationalized by appeal to uncertainty and variability of expectations.

It may be, for example, that individuals of modest wealth may prefer not to entrust their funds to financial intermediaries (for fear that the interest payments might not keep pace with inflation) instead investing in physical assets. If so, real estate and business inventories represent readily available forms of investment that do not demand exceptionally large financial commitment. If this distortion occurs, the economy loses in two ways -- through the diversion of resources to less productive physical assets, and through the loss of the services of intermediation (the spreading of risks, and individual flexibility

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\*Gambling, mountain climbing, speculation on the soybean market and similar recreations notwithstanding.

of saving decisions).

As another example, variability of expectations concerning the rate of price rise encourages those who expect rapid price rises to borrow from those who do not, for speculative purposes. Speculation would be encouraged, too, if inflation increases the dispersion of prices. Dorrance, referring to Latin American experience, suggests that speculation almost inevitably accompanies inflation, and that it carries costs in addition to the simple distortion of investments; some speculators are bound to win, so inflation creates a class of new rich with low propensity to save and ostentatious consumption patterns that can exacerbate social tensions [ 9, p. 45 ].

It is difficult to suggest a research program to study the possible costs treated in this section. U. S. experience does not include high rates of inflation and I suspect that distortions of the kind discussed here could not be detected in U. S. data, though possibly survey research could provide some help. And we could not confidently forecast how our economy would respond to higher rates of inflation by looking at experience abroad; the extent of uncertainty, and response to it surely depend heavily on the specific institutions and tastes of the society.

### Hyperinflation

The most serious potential consequence of inflation is the threat that it will build on itself until the monetary system collapses completely, requiring a virtual return to barter and exacting huge costs in resources devoted to transactions. The Scitovskys review the evidence, and come to an optimistic conclusion concerning this threat [ 38, pp. 448-449].

There is ample information now on many inflations in many countries; and it shows that such flights from cash have occurred ... only in rare cases, where external pressures brought about a very fast inflation already before the self-reinforcing tendencies came into action,... The surprising -- and comforting --- aspect of the empirical evidence is that so many inflations have occurred and continued for a decade or more ... in countries at varying stages of development and with populations of very different degrees of economic sophistication; and that these inflations, although often proceeding at an average annual rate of 15% or more for over a decade, and occasionally rising to a 60 or even 100% annual price rise for a year or two, should not have led to a flight from cash ....

For reassurance against a potentially catastrophic eventuality, one would prefer to have more solid evidence and a more thorough understanding of the pathology <sup>of hyperinflation</sup> but we are not likely to get it. A reassuring aspect of the question is that hyperinflation is not likely to spring up, full-blown, overnight. Inflation of 100% and more per month is preceded by inflation of 20% per year, 50% per year and so on. Controls can be imposed along the way, if inflation seems to be accelerating dangerously.

#### Changes in Relative Prices

After suggesting that inflation does not generate flight from cash except under extreme circumstances, the Scitovskys go on to suggest a possible reason [ 38, p. 449 ]:

The empirical evidence therefore forces one to revise the theory ... When the public finds its stock of purchasing power depreciating, it seeks other and better forms [than cash] in which to hold this stock and usually turns to gold, foreign exchange, corporate stocks, and sometimes to real estate or jewelry ...

The general price rise therefore is not accelerated; instead, the prices of these few commodities (whose supply is usually inelastic) are raised ... and raised more than in proportion to the rise in the general price level....

The effect of the shift in portfolios on relative prices and resource allocation over time would most naturally be investigated within the framework of a growth model of at least two sectors (capital goods and consumer goods) and at least three assets (money, bonds and physical capital goods). Several such models have been developed recently, but I believe that no one has yet explicitly considered the effect of inflation within this context; for references see p. II-12, n., above.

There could well be other effects of inflation on relative prices; regulated industries probably do not keep up with inflation, and to the extent that their profits suffer, investment in those industries might be discouraged [41] (New York's housing problems under its rent control law have been notorious). To the extent that some occupations have been unsuccessful in maintaining real incomes (teachers? policemen? civil servants?) there is likely to be a decline in quality of the entrants into those occupations, leading to distribution of abilities among jobs that is less than optimal (see Ball [3, p. 20]). Certainly those goods whose production is relatively cash-intensive will suffer a relative price rise [24].

There is a distinct possibility that inflation may affect the speed of adjustment of relative prices, hindering or helping the economy to adapt to changing demand and supply conditions. Most obviously, if prices are rigid downward, inflation can allow relative price adjustments that make the economy function more efficiently (Scitovsky and Scitovsky, [38]). Formal analysis of this question would require a good microeconomic theory of price determination.

Such a theory is now being developed, together with the theory of wage determination treated in Section III (see [34] for references) but it has not yet been applied to the issue of inflation. Harold Wolojin attempted an empirical study [45]. His question was pertinent ("does creeping inflation weaken the price mechanism in its role of directing and rationing resources in response to changes in relative demand and supply?") but, the method of analysis is inconclusive. He could find no movements in relative prices that appeared inconsistent with the forces of demand and supply, but his method was simple visual inspection of relative price movements, related to casual evidence on the forces of demand and supply.

## V. CONCLUSION

Before we can assess the impact of inflation on the economy even approximately (if we ever can) we will need better answers than we now have to several questions, some of them factual, some of them quite technical questions of economic theory. Among these questions, in my opinion three stand out as being of potential major significance:

- ... the long-run trade-off between inflation and unemployment
- ... the impact of inflation on the distribution of income and wealth
- ... the impact of inflation on the degree of uncertainty in the economy,  
and the nature of peoples' response to increased uncertainty.

I would add the threat of hyperinflation to that list, if I considered it to be a present danger, but for no very good reason, I do not. Another question of potential major significance, though not subject to analysis by techniques of the economist, is the adverse effect of inflation on the cohesiveness of society. Does inflation cause unrest, bitterness and division as group fights group to protect their real incomes? Some people think so, and if true it is a high price to pay for whatever benefits it provides.

The other unanswered questions have to do with the effect of inflation on the efficiency of resource allocation: the cash balance cost of inflation, and its potential effect on relative prices. It seems to me unlikely that these can turn out to represent major burdens on the economy -- they would not justify reporting our inflationary experience on page one of the newspaper, along with reports

of war, urban riots, environmental disasters and the like.\* This is not to say that these minor costs are not worth the attention of the economics profession or of government policy designed to mitigate them. A saving of "only" one or two hundred million dollars can justify the expenditure of many man-years of effort. But I think that the three questions listed above deserve more attention.

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\*How can one defend reaching such a conclusion, without a shred of numerical evidence? Surely a scholarly agnosticism would be more appropriate? My belief that the inefficiencies brought by inflation have a minor impact comes only from analogy. When economists have set out to measure the impact of other distortions that alter relative prices in the economy, they have almost always found them to have a small overall impact; see Leibenstein [ 26] for a summary of the literature and an interpretation of the phenomenon.



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