On A Correct Measure of Inflation*

Two commonly cited and newsworthy price indices are the Bureau of Labor Statistic's Consumer Price Index and the Commerce Department's GNP deflator. These indices have become an important part of our economic intelligence and are frequently considered to be the operational counterparts of what economists call “the price level.” They, therefore, often are used as measures of inflation and often are targets or indicators of monetary and fiscal policy. Nevertheless, these price indices, which represent measures of current consumption service prices and current output prices, are theoretically inappropriate for the purpose to which they are generally put. The analysis in this paper bases a price index on the Fisherian tradition of a proper definition of intertemporal consumption and leads to the conclusion that a price index used to measure inflation must include asset prices. A correct measure of changes in the nominal money cost of a given utility level is a price index for wealth. If monetary impulses are transmitted to the real sector of the economy by producing transient changes in the relative prices of service flows and assets (i.e., by producing short-run changes in “the” real rate of interest), then the commonly used, incomplete, current flow price indices provide biased short-run measures of changes in “the purchasing power of money.” The inappropriate indices that dominate popular and professional literature and analyses

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are thereby shown to result in significant errors in monetary research, theory, and policy.

I. AN ISO-UTILITY PRICE INDEX WITH INTERTEMPORAL CONSUMPTION

A well recognized principle is that the appropriateness of a price index depends on the question to which an answer is sought.¹ For many situations we are interested in measuring the money cost of a fixed welfare or constant utility vector of goods as money prices change. This iso-utility price index, often called a cost-of-living or fixed welfare index, was first discussed formally by Konüs [24]. However, as early as 1906 Irving Fisher [9] (and others earlier, we conjecture) pointed out that an iso-utility vector included claims to future consumption. And more recently, Samuelson [31] elegantly restated the significance of wealth-like measures (instead of current income) in comparisons of welfare. We, therefore, regard the utility or preference ordering of any situation as a function of a vector of claims to present and future consumption,²

\[ U = U ([q(i, t)]) \]  

where the \( q(i, t) \) element represents the quantity of the \( i \)th consumption service flow at time \( t \).

Assume, initially, that markets exist for every consumption service flow to be delivered at every moment of time. At any moment an individual is assumed to be constrained by a scalar \( W \) (wealth), which he allocates over claims to present and

¹See, for example Frisch [15, p. 10], Mitchell [28, p. 23], Keynes [23, book II], and Ulmer [37, ch. 2]. Fisher, on the other hand, considered the problem of constructing a price index independent of purpose and concluded that “from a practical standpoint, it is quite unnecessary to discuss the fanciful arguments for using ‘one formula for one purpose and another for another’ in view of the great practical fact that all methods (if free of freakishness and bias) agree!” [11, p. 231, his italics]. However, Fisher [10, ch. 10] earlier stated that the correctness of an index depended on its purpose and he emphasized the theoretical importance of not basing an index of purchasing power to be used in long-term loan contracts solely on consumer service prices. Using an analysis similar to our own, he argued that:

Borrowers and lenders, in other words, may be more interested in purchasing factories, railroads, land, durable houses, etc., which yield services during a long future, then in purchasing more or better food, shelter and entertainments, which yield immediate satisfactions. To base our index number for time contracts solely on services and immediately consumable goods would therefore be illogical.

Although he asserts that the practical differences may be inconsequential, the broad-based index which he concludes that it is, on the whole, it is best to use the \( P \) in his equation of exchange, which is similar to our index in terms of its inclusiveness.

²Samuelson notes that Pigou [29, p. 37] explicitly recognized that economic welfare depends upon “total consumption” and not solely “immediate consumption.” See any recent mathematical price theory textbook, e.g. Henderson and Quandt [19, pp. 229-240], for a formal statement of this commonly accepted proposition.

While we consider present and future consumption as the sole elements in the utility function and emphasize wealth as claims to future consumption, we do not deny the possibility that individuals are willing to hold wealth in, and of, itself. See, for example, Dewey [8] for an analysis where consumption is not the sole end of economic activity. This alternative view is not inconsistent with the analysis of this paper.
future consumption flows at present prices quoted on these markets. If at each (current and future) moment there are \( n \) consumption services, then

\[
W_A = \int_0^\infty \left[ \sum_{i=1}^n q_A(i, t) p_A(i, t) \right] dt; \tag{2}
\]

where \( W_A \) is the individual’s current nominal wealth, \( p_A(i, t) \) is the current rental price of the \( i \)th consumption service for moment \( t \) (i.e., present prices include prices of present claims to future consumption) and \( q_A(i, t) \) is the magnitude of the \( i \)th consumption service flow at moment \( t \) which at the current price vector and wealth level maximizes the individual’s intertemporal utility. All of these values are described as given under condition \( A \). \(^3\)

Let present flow prices, including present prices of future consumption services, change and describe this new state as condition \( B \). The question we are asking is whether prices, measured by a constant-utility index, have risen or fallen. We can, in principle, compute at the new set of present prices, \( [p_B(i, t)] \), the cost of an iso-utility consumption service vector, \( [q_B(i, t)] \). If, for example, the new cost under price condition \( B \), \( W_B \), is greater than under the initial price condition \( A \), we can say that the money cost of an iso-utility vector of goods has risen. \(^4\) The iso-utility price index implicit in this can be represented by

\[
P_{AB} = \frac{W_B}{W_A} = \frac{\int_0^\infty \left[ \sum_{i=1}^n q_B(i, t) p_B(i, t) \right] dt}{\int_0^\infty \left[ \sum_{i=1}^n q_A(i, t) p_A(i, t) \right] dt} \tag{3}
\]

where \( q_B(i, t) \) represents the \( (i, t) \) element in the minimum cost consumption vector that yields the same condition \( A \) utility at the new condition \( B \) price vector. If \( P_{AB} \) is greater than one, the nominal money cost of condition \( A \) utility has increased; an inflation has occurred.

To emphasize the intertemporal nature of this price index and the fact that it does not refer solely to the cost of the current moment’s consumption it could less mis-

\(^3\)This model, like the standard microeconomic model under which the usual price indices are derived, assumes the absence of all information or transaction costs and therefore lacks a theoretical justification for the value of a price index. (Introduction of uncertainty by the use of costlessly made contingency contracts (e.g., Arrow \([4]\)), where all transactors know the true state of the world when it occurs, is also economically equivalent to a world of perfect information with no rationale for a price index.) We will here ignore this fundamental question and concentrate solely on defining what is commonly considered to be a fixed welfare price index, recognizing that the usefulness of this or any other index depends crucially on the particular information and transaction costs assumed.

\(^4\)But we cannot, with a fixed quantity weighted index say it has risen. The analysis is exactly parallel, indeed is identical, to the standard price index theory where \( q \) is interpreted as current services. See Allen \([2, \text{pp.} 197-203]\).
leadingly be called the current “cost of life” index. Current instantaneous prices of current consumption flows enter this index, but insignificantly.

II. FUTURES AND ASSET PRICES

Current cash prices (to be paid now) for future consumption services are here called futures prices. Any price index that fails to include these current futures prices is deficient in not including the cost of all relevant elements of the utility function. Its incompleteness can result in a severe (negative or positive) bias of indicated change in the money price level of “life.” Prices of current services may rise while futures prices (present money prices of claims to future services) fall more than enough to lower the money cost—or the opposite may happen.

The major difficulty in making our index operational is that separate futures markets or contracts do not exist for all future consumption services. As a result, some futures prices required for a complete iso-utility price index will not be directly observable in explicit market prices. But since assets are sources of future services, asset prices provide clues to prices of present claims on future consumption. Current wealth can be represented by the sum of all asset values, or, equivalently, interpreted as the sum of all present valued claims to all consumption service flows over time. Symbolically, if there are \( m \) assets, wealth is denotable by:

\[
W_A = \sum_{j=1}^{m} P_A(j) Q_A(j) = \int_0^\infty \left[ \sum_{i=1}^{n} q_A(i, t) p_A(i, t) \right] dt
\]

where \( W_A \) is the individual’s current nominal wealth and \( [Q_A(j)] \) is the current

The current futures price of the \( i \)th consumption service at moment \( t \), \( p(i, t) \), is related to the future (or forward) price currently anticipated at moment \( t \), \( f(i, t) \), by an implicit market rate of interest, \( r(i, t) \); \( p(i, t) = f(i, t) e^{-r(i,t)} \). If interest rates are assumed not to vary over different consumption service flows, equation (2) restated in terms of forward, rather than futures, prices is therefore:

\[
W_A = \int_0^\infty \left[ \sum_{i=1}^{n} q_A(i, t) f_A(i, t) e^{-\int_0^\infty r_A(t) dt} \right] dt
\]

Our terminology here may be somewhat confusing since “futures” conventionally refers to the price paid later but agreed to now in a futures contract on a commodity exchange, while “forward” price is also often used to refer to a price to be paid in the future upon future delivery but agreed to now. With apologies to our readers, and on the assumption that forewarned is forearmed, we use the word “futures” to denote a price agreed to now, “payable now” for services to be received in the future.

Houthakker [21] theoretically examines why futures markets exist only for a rather small number of commodities. The answer to this important question must be based on the transaction costs of purchasing and selling particular commodities. These costs are determined, in part, by the costs of obtaining information about “characteristics” of assets and the distribution of such information among transactors in society (where “characteristics” is an economic and not a physical concept) and have implications for the essential properties of money (cf. Brunner and Meltzer [5, pp. 258–61]).
vector of asset quantities that would yield his intertemporal utility maximizing consumption service stream, \([q_A (i, t)]\). If assets are standardized in terms of their present and future service flows, the current vector of asset prices, \([p_A (j)]\), can therefore be used as a proxy for current futures prices, \(p_A (i, t)\).

When relative prices change, one can, in principle, determine the vector of assets, \([Q_B (j)]\), which will yield the minimum cost iso-utility consumption service stream \([q_B (i, t)]\) at the new set of asset prices \([p_B (j)]\) and implicit futures prices \(p_B (i, t)\). Current asset prices can therefore be used to construct our constant welfare price index

\[
P_{AB} = \frac{W_B}{W_A} = \frac{\sum_{j=1}^{m} p_B (j) Q_B (j)}{\sum_{j=1}^{m} p_A (j) Q_A (j)}
\]

where \(W_B\) is the nominal cost of the vector of assets that will yield a flow of present and future consumption services equal in utility to the initial condition \(A\) consumption service stream.

It is crucial to emphasize that the vectors \([Q_A (j)]\) and \([Q_B (j)]\) must include all assets—consumer and producer, durable and nondurable, tangible and intangible, financial and nonfinancial, human and nonhuman. All sources of present and future consumption services must be considered. The vectors do not represent the actual assets held by the representative individual, but the asset combination that would yield the individual’s desired consumption service flows. An individual may hold some assets that yield the exact pattern of consumption service flows that he demands over time, e.g., a house that yields his present and future desired housing service flow. But, more generally, due to transaction costs individuals will hold some assets not because they yield services that coincide with their consumption plans, but because they are an efficient form in which to hold wealth. The services from these assets or the assets themselves are later sold and exchanged for desired consumption services. Human capital is the most obvious example.

Since our asset price index is not constructed on the basis of assets actually owned by an individual we are therefore not measuring whether the individual is better or worse off after a change in prices, only whether he requires more or less money to reach the same utility level. We must distinguish between actual shifts in the budget constraint with corresponding welfare changes and changes in our measure of inflation. \(W_B\) is compared to \(W_A\) to determine the change in the individual’s money cost of a constant utility level. The individual’s actual nominal wealth under condition \(B\) must be compared to \(W_B\) to determine if he is better or worse off under the new set of prices. An individual, for example, may own a coal mine not because he consumes the coal yielded by the mine over time, but because the coal mine is an efficient form in which to hold his wealth. He sells most of the coal for income to purchase
other consumption flows, and he intends to sell the mine and retire to an Hawaiian resort in a few years. If under condition B the only change is an increase in the price of coal, the individual's current wealth will rise more than $W_B$; he is better off while he experiences an inflation. Alternatively, if the price of Hawaiian land increases under condition B, the individual's nominal wealth remains unchanged (if he did not own any of the land) while $W_B$ increases; he is worse off and experiences an inflation. Any combination of inflation or deflation and better off or worse off is possible.

III. THE SYSTEMATIC BIAS OF CURRENT SERVICE FLOW PRICE INDICES

A money price index based on considerations we have outlined is fundamentally different from the CPI, which is constructed on the basis of prices of current consumption services. The CPI considers the prices of only a part of the utility function and is therefore inadequate in principle as a constant utility money price measure. The CPI attempts to measure changes in the cost of only the iso-utility current consumption flows and therefore supplies an answer to a question distinct from whether the present money cost of consumer utility has changed.7

Current service flow prices are related to asset prices by implicit real rates of interest and therefore our iso-utility price index is logically equivalent to an index based on current service flow prices and a broadly defined interest rate vector. If our representative individual moved to a new society where current service flow prices are identical but where real interest rates are higher, our iso-utility price index would fall. The individual would substitute future consumption for present consumption and his money cost of life would decrease.8

If we assume that society's equilibrium rate of time preference and real productivity of investment remains constant, is there any reason to suppose that use of a current service flow price index provides a deceptive measure of inflation? If real interest rates remain constant and the prices of current services and the prices of current assets move together then, as a practical matter, a current service price index can be used as a perfect proxy for the theoretically correct wealth price index. There is, however, reason to expect a major systematic discrepancy in the transitory movement of a current service flow price index and a current asset price index. And it is this discrepancy which makes a current service flow price index an especially poor short-run indicator and target of monetary policy.

7It is interesting to note that a major gap between a theoretically correct constant utility price index and the actual CPI is often said to be the improper inclusion of some consumer durable prices, such as new and used automobiles and houses, in the index. The proper price for these durables is said to be the current rental price or current cost of using the services from the asset and not the purchase price of the asset itself (cf., for example, Steiner [33]). We would claim, on the other hand, that the CPI is inappropriate because of the emphasis on current prices and the insufficient weight given to asset prices.

8On the contrary, nominal interest rates (current mortgage rates) enter the CPI positively. An increase in nominal interest rates due to an increase in anticipated future (or forward) prices which leaves real rates and current future prices unchanged will not alter our price of wealth index.
Changes in the quantity of money cause a "nonadiabatic" adjustment process in the money market which is terminated when all prices have changed proportionately. The initial price changes will depend upon how the monetary change is accomplished; but, ignoring distribution effects among individuals which may cause permanent changes in relative prices, the initial changes will "diffuse themselves equally after a certain time through all price-levels alike," [23, p. 90]. But all prices may not change at the same rate. Keynes [23, ch. 7] emphasized the possibility that price levels might not be rapidly "diffused" and that the failure of different price levels to move in the same way was a crucial element in the explanation of short-period fluctuations. Differential adjustment speeds among prices, of consumption goods and capital goods (or of service flows and durable assets) in particular, formed a cornerstone of his theory of the trade cycle.

The behavior of current service flow prices relative to asset prices as a crucial element in the transmission process between monetary stock changes and economic fluctuations has also been emphasized by Friedman and Schwartz [14, pp. 229-231]. They maintain that monetary changes temporarily affect real income by producing transient changes in the interest rate structure, defined by the ratio of current rental prices of services to the price of current assets as sources of the services, i.e., by changing wealth relative to income. A decrease in the supply of nominal money, for example, decreases the demand for and prices of financial and non-financial assets as individuals adjust their portfolios by attempting to add to their depleted cash holdings. This causes asset prices to fall relative to service flow prices and relative to the cost of producing new assets. (The general fall in the asset price level is a rise in "the" real interest rate; wealth falls relative to income.) In turn, the reduced profitability of producing new assets decreases their production (i.e., leads to a fall in the rate of "investment"), and the higher interest rate implicit in the current rental asset price ratio stimulates asset purchases relative to rentals (i.e., leads to a rise in the rate of "saving"—in the sense that consumption of current services is reduced).

If such an "interest rate" mechanism actually operates, then short-run effects on "the purchasing power of money" of a change in the rate of growth of money will be underestimated by a current service flow price index compared to an index that also includes asset prices. But, unfortunately, we have not been able to verify the existence of such a mechanism. Very little reliable information exists on transaction prices of used assets and almost none on a quarterly or monthly basis. Given the

9Leijonhufvud's recent interpretation of Keynes emphasizes the importance Keynes placed on an "inappropriately" low relative price of assets (or high interest rate) as a "cause of unemployment" [26, pp. 335-338].

10In addition to asset prices generally adjusting more rapidly than current flow prices, prices of "liquid" (low transaction costs) assets will adjust more rapidly than prices of "illiquid" assets.

Even if relative prices are not affected by the monetary change, real income will be affected if anticipations about market clearing prices lag behind changing reality—which is costly to detect and adjust to instantly. C.f., Alchian [1].

11Goldsmith and Lipsey [16] have constructed an annual wealth price index in the context of estimating a national and sectoral balance sheet. The components of their index, however, are not based on transaction prices but on owner estimates of the market value of their property
assumed importance of asset prices in the transmission of monetary changes, this
deficiency in the data and lack of any previous systematic empirical analysis of the
behavior of asset relative to flow price is truly shocking. Some suggestive evidence
on the existence of this cyclical relative price process can be obtained, however, by
examining recent movements in common stock price indices relative to flow price
indices and by examining movements in estimates of "the" real rate of interest.
Although there are significant problems in the interpretation of the movement of
stock prices (see section VI), they should be included in our iso-utility price index
since they implicitly measure current prices of capital assets owned by corporations
and represent the only readily available data on current market prices of assets.
And changes in the real rate of interest can be considered an indirect measure of
changes in the relative prices of service flows to capital stocks.12

The sharp decrease in the growth rate of money during 1969 provides a classic
element of the bias involved in measuring inflation by considering only, for exam-
ple, movements in the CPI. Narrowly defined money, which had grown at a 7.6 per-
cent annual rate over the two previous years, grew at only a 2.9 percent annual rate
from January, 1969, to February, 1970. (Most of this restraint, as recorded in the
figures revised for the unusually large volume of Eurodollar borrowing in early
1969, came in the second half of 1969). Although real magnitudes were clearly af-
fected, this policy was generally considered to have been a failure in curbing the
rate of inflation. The CPI, which rose at a 5.8 percent annual rate during the second
half of 1969 showed no sign of decelerating and rose at a 6.0 percent annual rate
during the first half of 1970. Absence of any perceived response of prices in the
face of rising unemployment led to the total abandonment of monetary restraint
during 1970 and early 1971 and ultimately to the imposition of wage and price con-
trols. But there is some evidence that asset prices responded almost immediately
and quite dramatically to the change in policy.

Standard and Poor's Composite (500) Common Stock Price Index started to de-
cline in early 1969, and by June, 1970, had fallen nearly thirty percent to the level
of early 1964. In addition, the real rate of interest as measured by the Federal Re-
serve Bank of St. Louis (the nominal corporate Aaa bond yield minus the average annual rate of change of the GNP deflator over the previous 24 months) rose about one percentage point during the last half of 1969 and the first half of 1970—from 2.3 per cent in June, 1969, to 3.3 percent in June, 1970.\(^{13}\) This evidence suggests that asset prices declined relative to flow prices over the period and that movements in the CPI severely underestimated the deflationary effects of the tight money policy.

IV. CURRENT OUTPUT FLOW PRICES, STOCK PRICES AND THE DEMAND FOR MONEY

Another commonly employed index of inflation is the GNP deflator, which measures the price of current output flows. This price index includes the prices of newly produced assets but does not include the prices of previously existing items of wealth and therefore is conceptually distinct from our iso-utility wealth price index. Therefore, although it is useful for other purposes, a current output price index also provides a biased estimate of changes in the money cost of consumer utility. The theoretical considerations outlined above with regards to the bias in the movement of the CPI compared to a wealth price index also suggest a similar systematic bias in the movement of the GNP deflator relative to a wealth price index. Prices of already produced assets will, we conjecture, generally be more flexible than prices of currently produced goods, which are based on current costs that are often made less flexible by long-term contracts. And given the rigidity of current production costs relative to asset prices, a fall in the rate of growth of money decreases the profitability (and therefore the rate) of new asset production. Concern during 1969-70 about the rigidity in the rate of rise of current output flow prices should therefore be based on the evidence this gave us on the extent of the recession, not on the extent of the inflation.\(^{14}\)

\(^{13}\)The Federal Reserve Bank of St. Louis discontinued publishing their real rate series shortly after this episode. Although their measured real rate showed remarkable stability over the 1960s, this unique precipitous rise should have been expected as part of the normal relative price reaction to monetary disturbances. What might have been misleading is that the previous tight money episode of 1966, although similar in magnitude to 1969, did not produce such severe relative price changes. (The money stock showed no change from April, 1966, to January 1967, after rising at about a six percent annual rate over the previous year. This produced a clear deceleration of the rate of increases in the CPI, which rose at a 4.5 percent annual rate from January to August of 1966 and only a 1.6 percent annual rate over the following six months; while stock prices, which fell more than thirteen percent from January to August, 1966, quickly recovered and rose more than eight percent over the next six months; the St. Louis real rate remained essentially unchanged over the period, rising less than ten basis points from April to August 1966 and then quickly falling back to and then below its original level). This dramatic difference in the relative price movement between the two most recent contractionary episodes may explain why the downturn in economic activity was much milder in 1966-67 than in 1969-70, but the surprising flexibility of flow prices in 1966 remains unexplained.

\(^{14}\)In a crude “monetarist” model such as Anderson and Carlsson’s [3] changes in money imply changes in nominal income; and the movement of current output prices, which depends on past output price changes, determines the division of the nominal income change between real income and prices. Therefore, the flexibility of current output flow prices is an important determinant of cyclical economic activity.
The GNP deflator is incorrectly used not only as a measure of inflation, but also almost universally used as the deflator of nominal money balances in demand for money studies. If, however, money is considered to be a capital asset and the demand for money treated as an application of the general theory of wealth constrained inter-temporal portfolio choice, the purchasing power of money is more meaningfully measured in terms of our price of wealth index.\footnote{One of the major developments in monetary theory in the postwar period has been the integration of monetary theory with capital theory and the recognition of money as an asset in an optimum wealth portfolio (cf., e.g., Friedman \cite{Friedman12} and Tobin \cite{Tobin36}). Friedman's empirical work explicitly takes account of the fact that money holders "judge the 'real' amount of cash balances in terms of the quantity of goods and services to which the balances are equivalent, not at any given moment of time, but over a sizable and indefinite period" \cite[p. 121]{Friedman13} by deflating nominal balances by "permanent" or "expected" prices. But this price variable is merely a weighted average of current and past GNP deflators and does not properly consider anticipated future prices as embodied in current asset prices.}

Final choice of the proper price deflator in the demand for money, however, is conditional upon the particular structural specification from which the demand for money is derived. An explicit theory of the demand for money is necessary before we can determine the price index that should be used. If money is alternatively considered, for example, solely as a medium of exchange and the demand for money derived on the basis of an inventory-transactions-type model, the use of the GNP deflator as the relevant price variable in the demand for money function remains theoretically unjustified. Money is used to purchase assets of varying durability and age. The demand for money therefore cannot be dependent solely on the prices of current output flows which represent only a part of what money can buy. Hence, within the context of a transactions demand framework or a wealth portfolio choice framework, the GNP deflator is incomplete and the purchasing power of money could be more meaningfully measured in terms of our more inclusive price of wealth index.\footnote{Keynes \cite[ch. 6]{Keynes23} defines two price indexes, a cash-transactions index and a cash-balances index, that may be superior deflators of nominal balances within these theoretical frameworks. Both of these indexes, like our iso-utility wealth price index, include all objects of possible expenditure, but the weights applied to the objects are significantly different. The cash-transactions index weights objects in proportion to the amount of money transactions to which they give rise per unit time and the cash-balances index weights objects in proportion to the demand for money they occasion, representing the \( P \) in the Fisher and Cambridge quantity equations respectively.}

If nominal money balances are deflated by our asset price index, then the connection between income (not wealth) velocity of money and the demand for real cash balances is no longer as direct as once thought. The ratio of our asset price index to the current output price index that is used to deflate nominal income now enters as an additional variable, i.e., both asset prices and current output prices enter the velocity function. Since asset prices are generally more flexible than output prices, if "real" balances are (incorrectly) defined in terms of a current output price index (and asset prices ignored), a decrease in the nominal stock of money leads to an overestimate of the initial resultant decline in real cash balances and hence to an "unexplained" increase in velocity. Movements in the relative prices of assets to flows may explain the initial offsetting changes of velocity in response to monetary changes without invoking a presumption of a short-run disequilibrium (i.e., slow
The introduction of a vector of interest rates (to reflect relative prices of current services and wealth) in an incorrectly specified demand for "real" money may then serve as a proxy for the more complete price of wealth deflator. This implies that use of the incomplete current output price index as the price deflator in the demand for money induces, to some extent, the observed existence of a significant interest rate effect on the demand for "real" cash balances. If a wealth price index were employed instead, interest rates would then implicitly enter in a more general way, while "the" observed interest rate effect would be reduced and possibly eliminated.\(^\text{17}\)

The question is essentially an empirical one of whether the commonly used interest rates on financial assets are sufficient to pick up this short-run "liquidity" effect of changes in money on the relative prices of existing stocks and flows. The significance of the dividend yield in the demand for money (cf. e.g., Hamburger [18] may, in fact, be reflecting the inability of the prices of financial assets to completely pick up this relative price movement. The dividend yield is statistically significant in a quarterly demand for money regression over the 1951-71 period.\(^\text{18}\)

\[
\Delta \log \left( \frac{M_1}{P} \right) = -0.0011 + 0.3096 \Delta \log \left( \frac{Y}{P} \right) - 0.0044 \Delta \log r_S - 0.0359 \Delta \log r_D
\]

\[R^2 = 0.295\]
\[DW = 1.06\]
\[SE = 0.0058\]

But the significance can be attributed solely to the variability of real stock prices and not to the variability of real dividends. If we substitute stock prices deflated by the GNP deflator for the dividend yield in the above regression (where \(S\) refers to Standard and Poors 500 Common Stock price index), we observe that stock prices actually enter slightly more significantly than the dividend yield. This implies that,

\[
\Delta \log \left( \frac{M_1}{P} \right) = -0.0011 + 0.2914 \Delta \log \left( \frac{Y}{P} \right) - 0.0053 \Delta \log r_S + 0.0369 \Delta \log \left( \frac{S}{P} \right)
\]

\[R^2 = 0.297\]
\[DW = 1.03\]
\[SE = 0.0058\]

\(^{17}\)This factor is taken account of most fully in Brunner and Meltzer's empirical work (e.g. [5] and [27]). They, however, use a price index for nonhuman wealth not as a measure of the purchasing power of money, but as a deflator of the wealth constraint. They assume the relevant deflator of nominal balances is the GNP deflator and it is therefore entered as an additional variable in the demand for money.

\(^{18}\)M\(_1\) equals currency plus demand deposits, \(P\) is the GNP deflator, \(Y\) is nominal GNP, \(r_S\) is the four-to-six month commercial paper rate, \(r_D\) equals Standard and Poors dividend yield of corporate stock, log refers to natural logarithm, \(R^2\) is the coefficient of determination adjusted for degrees of freedom, \(DW\) is the Durbin-Watson statistic and \(SE\) is the standard error of estimate. The values in parentheses are the \(t\)-values of the estimated regression coefficient. The regression is reported in first difference form since \(r_D\) enters a level regression highly positively with a \(DW\) less than .2, indicating that clearly a variable is missing. Even in the first difference form the autocorrelation of the residuals remains disturbingly high.
if anything, changes in dividend payments go in the "wrong direction." Further, stock prices become insignificant when the same regression is run over the same period using annually averaged data.¹⁹ Both of these pieces

\[
\Delta \log \left( \frac{M_1}{P} \right) = -0.0129 + 0.5757 \Delta \log \left( \frac{Y}{P} \right) - 0.0217 \Delta \log r_s \\
R^2 = 0.463 \\
SE = 0.0134 \\
(3.57) (1.42) (1.1)'
\]

of evidence suggest that the dividend yield enters the demand for money function not as a measure of the direct cost of holding money but as a proxy for the short-run movement of asset prices relative to the GNP deflator.²⁰ In addition, the significance of stock prices in a short-run but not in a long-run demand for money regression also provides evidence against the hypothesis that stock prices enter as a wealth variable as, for example, Thompson and Pierce [35] maintain.²¹

V. POLICY IMPLICATIONS

Nearly fifty years ago Keynes emphasized the fundamental policy mistakes risked by the use of an inappropriate price index. He claimed [22, pp. 249-250] Churchill returned England to the gold standard in 1925 at the prewar parity primarily

¹⁹Our hypothesis implies that cycle average data would reduce the statistical significance even further. The annually averaged regression for the dividend yield indicates slightly better results.

\[
\Delta \log \left( \frac{M_1}{P} \right) = -0.0129 + 0.5757 \Delta \log \left( \frac{Y}{P} \right) - 0.0420 \Delta \log r_D \\
R^2 = 0.463 \\
SE = 0.0134 \\
(3.57) (1.36) (1.42) DW = 0.871 (1.1)'
\]

²⁰Similarly, changes in the quantity of money can be expected to influence stock prices in the short run not, as commonly believed, because stocks are close substitutes for cash balances or because the short run liquidity effect influences the rate at which future earnings are discounted but because of the differential flexibility of stock prices to the monetary change. Fisher [10, ch. 9] outlined a similar mechanism in the context of the transactions version of the quantity theory. He emphasized that many prices are rigid and are likely to change less than in proportion to monetary fluctuations in the short-run and, therefore, other prices must change more than in proportion in the short-run for the quantity equation to hold; and he noted that stock prices are likely to be the most "supersensitive" of these other prices to changes in the quantity of money. Since the quantity equation is now generally stated in income form where "the" price level that is determined does not include existing items of wealth, this mechanism cannot be recognized.

²¹Thompson and Pierce [35] use a total public wealth variable based on Goldsmith and Lipsey's work in a monthly demand for money study. But month to month changes in their variable are dominated by stock price changes. In addition, Thompson and Pierce fail to distinguish between nominal and real values of wealth and money and assume (as most macro models do) that the money market can only be cleared by movements in a small subset of interest rates on financial assets, ignoring the possible short-run adjustment of a broader spectrum of asset prices.
because Churchill was "gravely misled by his experts" who, by using the inappro-
priate but commonly employed wholesale price index, significantly underestimated
the extent of the necessary deflation.

An analogous situation may exist today. Presently employed price indices are
improper measures of the change in the money cost of an iso-utility consumption
package. Reliance on these biased numbers as an indicator or target of monetary
policy makes it difficult for the monetary authorities to know what they are doing,
let alone what they should be doing. And action on the basis of these numbers can
lead to inappropriate decisions; policy changes will often come too late and move
too far. Recent monetary policy provides an instructive example. The authorities' 
preoccupation with the movement of inappropriate flow prices indices to the al-
most complete exclusion of asset prices was partially responsible for a monetary
policy that was too easy for too long a period (1967-68) and then a policy that was
too tight for too long a period (1969) followed by a policy that was once again too
easy (1970-early 1971). A crude modification of the CPI, with say, an index of 
stock prices would have provided a much more useful indicator and target for price 
level stability.22

Our discussion also helps explain the general reluctance of contracting parties to
adopt escalator clauses. If long-term contracts were set in "real" terms, i.e., tied to
"the price level," economic uncertainty would seem to be decreased.23 But "the 
price level" must be made operational by a particular, arbitrary and incomplete,
price index. And the fact that price indices are not generally used in long-term 
contracts (or a tabular standard not adopted) provides some evidence that the in-
dices are poor measures of "the price level." Only if the variance of future antici-
pated price change is high will the use of, for example, a CPI price escalator clause
decrease the anticipated variance of the real pay off. This may explain the more fre-
quent use of price escalators in foreign countries that have experienced great price 
variability and the recent trend towards increased use of price escalators in the U.S. 
(see [7]).

22Simons [32, p. 349], in discussing the feasibility of a monetary policy designed to stabilize 
a price index, notes that the particular price index chosen "must be highly sensitive; otherwise, 
the administrative authority would be compelled to postpone its actions unduly after significant 
disturbances."

Realization of our ignorance about movements of the appropriate isutility price index does
not necessarily imply that we should adopt a monetary rule. Discretionary monetary policy can
still be based on income and employment statistics, and, of course, the inappropriate flow price
indices could be used if we knew and took cognizance of the differing lags of adjustment of 
prices to monetary disturbances. In this context, our discussion may supply some support for 
those that believe that "money market conditions" (i.e., the behavior of interest rates) is a
relevant short-run indicator of monetary policy. If the acceleration of the money supply is not
considered, the inclusion of short-run interest rate movements with price movements may
provide a much less misleading monetary indicator than price movements alone since price 
anticipations are probably relatively rigid over the short term and therefore short-run changes 
in market interest rates will be related to short-run changes in real rates and short-run changes 
in the relative prices of assets and current flows.

23And a rationale for administrative wage-price "jawboning," that it is necessary to convince 
negotiating parties that the government intends to reduce the future rate of inflation, would be 
eliminated.
Strictly speaking there is no such thing as a "correct" price index. As we stated initially, the appropriateness of an index can be judged only by the answer it supplies to a particular decision problem. Our price index answers the standard textbook question of whether an individual needs more or less money to remain at the same level of satisfaction. An individual in attempting to determine how much money wealth he now needs for a particular level of present and future consumption would use our index.

But why, then, isn’t there a demand for a price index that includes asset prices and why do movements in the CPI appear to be politically important? Within the context of our model it is difficult to find a rationale for the fact that rising consumer service flow prices are generally unpopular while falling asset prices are generally unpopular. The relevance of our intertemporal iso-utility index appears to be seriously questioned by common attitudes. One possible explanation may be that individuals fail to recognize that price changes of assets they do not own may significantly affect their money cost of life and their welfare. While individuals that, for example, own houses are aware of the decrease in their wealth when prices of houses fall, individuals that do not own houses do not appear to recognize that such a price change also affects them by lowering future housing service prices. Individuals are more fully aware of changes in their nominal wealth than of changes in the nominal cost of future consumption, possibly because an intertemporal consumption index is not now published. Alternatively, the CPI may be a politically relevant index because many individuals have utility functions that only contain current consumption service flows. Old individuals who do not have the real quantity of wealth they can leave their heirs as an important argument in their utility function and housewives who do not make any capital transactions or budgeting decisions within the family, for example, will both be myopic in terms of the time horizon of consumption services prices they are concerned with. This is the major unanswered question we are left with. Is the focus that is presently placed on the CPI as a measure of inflation merely an historical "accident," or are individuals narrowly concerned only about movements in prices of a small subset of the goods in their utility function?

Would a redefinition of our concepts and the replacement of what is now commonly called "inflation" by "current consumer service flow price inflation" alter any of the recent discussion of many journalists, politicians and economists of the extreme rigidity of the rate of price change and the need for some form of wage-price controls? We will be able to answer these questions more satisfactorily after a price of wealth index is constructed and employed.

24 However, Kramer [25] found that movements in the CPI, holding real income and some other variables constant, had no significant effect on the division of the national vote for the U.S. House of Representatives over the 1896–1964 period.

25 Historically, the original price indices were narrowly based on internationally traded commodities (e.g., spices and grains).

26 It is particularly interesting to note that many of the important prices in our wealth price index, e.g., land and security prices, are not covered under the recent wage-price controls.
VI. CAN THE ISOUTILITY PRICE INDEX BE MEASURED?

Our imprecise statements indicate what we think should ideally be (1) the modification in present measurements of the impact of monetary polity on the rate of inflation using an asset and service price index and (2) how they would influence monetary theory and policy. Although the direction of effect seems obvious to us, our conjecture that presently employed numbers yield misleading conclusions can be verified only by the construction of a superior index number (i.e., it takes a number to beat a number).

The desired constant utility price index, however, is difficult (expensive) to make operational. As we have already noted, without future contracts in all commodities, the explicit futures prices and quantities needed for construction of a wealth price index are unavailable. Current prices of assets of different life lengths provide a theoretical substitute since they embody present prices of expected future service flows. But both the asset prices and asset quantities necessary for this index are extremely expensive to determine. We must have prices of a very broad spectrum of assets on which we presently have very little information. Our data must include prices of generally nonmarketable assets, such as human capital, and of assets of varying durability, so that we are able to produce the exact optimum current and future consumption service flows by adjusting the asset mix. We may not be able to determine all these prices with any reasonable expenditure of resources, but surprisingly little reliable information exists on current prices of assets and given the assumed importance of these prices in the transmission of monetary impulses, some effort in this direction would seem to be clearly economic. Collection of transaction price data on land, commercial and residential structures, producer and consumer durables and other tangible and financial assets and the construction of a crude quarterly wealth price index would probably be worthwhile.27

Determination of the asset quantity vectors is also extremely difficult. As we have already noted, the assets actually held by an individual cannot be used as an index of the individual's desired future consumption. Some way of determining the composition of the individual's desired intertemporal consumption services, i.e., of specifying his utility function or fixing particular constant asset weights must therefore be devised. In addition, a more complete specification of the constraints on the individual's intertemporal transactions is also necessary to determine the relevant asset weights. An individual may, for example, demand a particular time stream of housing services under conditions of costless perfect futures or asset markets, but

27Stigler's price statistics committee [38, part 1, app. C, pp. 95-99] makes a similar proposal. Considering the resources expended on the collection of price data on, for example, current food prices, which are such a small element in the relevantly defined utility vector, a reallocation of funds would seem to have a payoff in terms of providing a relevant answer to the question of determining price level induced changes in consumer welfare. Carl Snyder's [34] attempt to measure "the general price level" (defined essentially as the P in the equation of exchange) included realty values, security prices, and equipment and machinery prices in addition to the standard cost-of-living items was a movement in the correct direction.
due to transactions costs actually buy and sell houses over time and consume a housing service flow that does not coincide with this "ideal" service flow.

And finally, even if asset prices and quantities were available, we would have significant problems in the interpretation of asset price changes. A change in the market value of an asset may reflect (i) a change in the price of an unchanged future service flow from the asset, (ii) a shift in preferences for this asset's service relative to other assets, (iii) a shift in preferences for present consumption relative to future consumption, or (iv) a change in the anticipated magnitude of service flow from the asset. Any or all of these changes are likely to be occurring simultaneously and therefore the cause of a change in a particular asset price is difficult to determine. Changes (ii) and (iii) represent a shift in tastes while (iv) represents a change in asset quality; however, they are not conceptually different from the problems encountered in constructing the presently used indices. Changes in the preference or utility maps are ruled out in the presently used consumption service cost-of-living indices. And the quality change problem whereby a change in the price of a given service flow must be distinguished from changes in the service flow, is also present in current indices and has already been handled in an innovative way for transactions prices of used cars (cf., Cagan [6]).

For example, consider changes in common stock prices. The prices of common stock are included in our index because whether an asset such as a house is owned by a single proprietor or owned by him as a corporation should have no effect on the price of the house as manifest in the price of the stock. If the corporation represented not just the house but, as is typically the case, the services of a manager who rented and maintained the house, then the stock price would reflect also the manager's specific talents. Changes in the price of common stock would reflect changing prices of two things: the house services and the manager's talents specific to this activity. So much the better, for we have included human and nonhuman assets; the physical service flow being priced now has a second dimension, the flow of human services, and that may change just as a house may deteriorate. Stock prices contain no more conceptual problems than do the prices of any assets—or for that matter of current service flows in which one has to separate quantity changes and quality changes from price changes.

Although some of the conceptual problems in constructing a wealth price index are similar to those encountered in presently used flow price indexes, the practical problems in the interpretation of asset price movements are more difficult. What would one do, for example, with the drop in common stock prices of 1969-70? Did it reflect claims to reduced real future services (a decrease in quality), or lower prices of unchanged flows of future services (a deflation), or a shift in demand towards more present consumption relative to future consumption due to higher real rates of interest (brought about by "tight" monetary policy or by increased uncertainty leading to an increase in the rate of time preference), or perhaps a

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28This is not to say that there is in principle no computable index, for there is. One needs to know the equivalent utility vectors under the shifted preference map. But the base weighted indices (and all other for that matter) no longer can be interpreted as they are now. The difficulty posed by shifting preferences is no greater than for the present incomplete indices.
combination of all of these forces? For business corporation stocks, the price decrease reflects, at least in part, reduced or deferred outputs of future services. Fewer future cars will be produced or more will be deferred. The stockholder may think of anticipated future money earnings; they have fallen not necessarily because future, i.e. forward, prices (not futures) are expected to fall but possibly because of reduced anticipated profitability—much as if a tree would be expected to yield fewer apples as less fertilizer is applied in the coming years with lower demand expected for apples. If, however, all prices were expected to be lower in the future, the reduced earnings reflected in lower present stock prices would be truly a reduced price level of unchanged real claims. We conjecture both factors were present in the stock price fall—a reduction in present prices of given future services and a reduction in the future anticipated output and earnings relative to what it was before.29 In other words, real future services are reduced and also the present price of a unit of future service has decreased. It is the latter we want to measure.

We can attempt to approximate the division of an asset price change into these two components by estimating changes in real rates of interest. A rise in the real rate would indicate a fall in future prices relative to current service prices. But we observe only nominal interest rates, which reflect the anticipated future rate of inflation. Market estimates of changes in the currently expected rate of change of future prices can be obtained by examining the ratio of stock prices of net monetary neutral firms to bond prices.30 Alternatively, we could examine the movement of money interest rates relative to forward price spreads, quoted on commodity exchanges. The usefulness of these suggestions for obtaining market measures of anticipated inflation can only be determined by further empirical work.

The empirical problems involved are enormous. But whatever efforts may be made in this direction and whatever the results, we believe it is an error to assign all of the change in common stock and other asset prices to changes in anticipated future service flows with no change in present prices of such future flows... which is what is implicitly done now in commonly used price indices that ignore asset prices.

It may be cheaper to make empirical judgments about quality and quantity changes of current than for future service flows. But what has been added is essentially a significantly larger number of items that should be priced; and weights for assets in the “typical” man’s portfolio of possession of claims must be ascertained. This is not a new theoretical problem—it is an enlargement of an existing task. And we believe that the marginal cost of improving a price index along these lines is less than the marginal gains of improved monetary and fiscal policy consequent to less misleading indicators of inflation.

29 These two factors are related. Since the prices of primary factors (especially labor) purchased by a firm are generally the most rigid, an unexpected decrease in the prices of future services sold by the firm will reduce future anticipated earnings.

30 Movements in the stock price to bond price ratio will not, however, represent solely a changing price anticipations effect. If the change in the anticipated rate of change of prices alters the demand for and quantity of real cash balances and hence the savings function, real interest rates will change. Stock prices of net monetary neutral firms will therefore not remain unchanged but will move in the same direction as the anticipated rate of price change movement.
LITERATURE CITED


