INFLATION AND WELFARE
COMMENT ON ROBERT E. LUCAS, JR.

Hans-Werner Sinn

# Comment

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## 1 The basic problem

Robert Lucas modestly calls his paper a 'summary' of the literature on the welfare cost of inflation, but in fact it is more than that. It is a synthesis of various theoretical approaches combined with an attempt to estimate the magnitude of the welfare loss.

Lucas basically follows Bailey's (1956) definition of the welfare cost of inflation. He defines 'the welfare cost of inflation as the area under the inverse demand function – the consumer surplus – that could be gained by reducing the [nominal] interest rate ... to zero'. Figure 4.11 illustrates this concept. The demand for real money balances is a decreasing function of the nominal rate of interest because people choose their real money balances in order to equate their marginal benefit in terms of liquidity services with their marginal opportunity cost. The marginal opportunity cost of real balances is given by the nominal rather than the real rate of interest, because inflation is a burden on both money balances and interest-bearing bonds and will therefore not affect the portfolio decision. Given the real rate of interest, the nominal rate can be reduced by lowering the rate of inflation, possibly even to negative values. If the rate of deflation equals the real rate of interest, the nominal rate of interest is zero, and money demand is at the Friedman (1969) optimum. The marginal benefit from money holding then equals its marginal social cost, which is about zero, since it is merely determined by the negligible cost of printing the money. Integrating the marginal benefits from money holding over the entire range where they are positive, starting with the balances held under the existing inflation–interest combination, gives the total benefit from a transition to a deflation rate that equals the real rate of interest or, equivalently, gives the welfare cost of inflation.
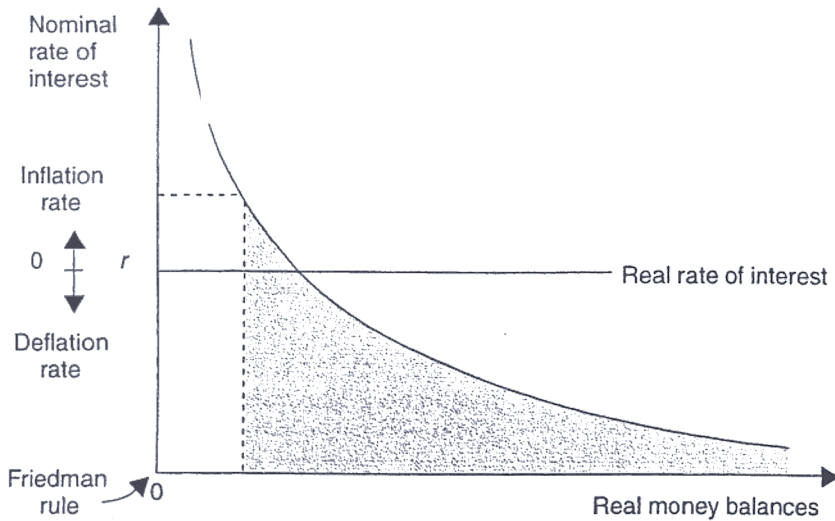
*Figure 4.11* The welfare cost of inflation

Definitions are always arbitrary, so they should not be criticized. It is, however, important to note that the welfare cost of inflation according to the Bailey–Lucas definition is not the welfare cost of raising the price level beyond some initial level, but rather of not letting it shrink at an annual rate that equals the economy's real rate of interest. In Figure 4.11, this means that the welfare cost is measured by the total shaded area under the curve, and not just by the part of this area above the real rate of interest marker.

Robert Lucas does not confine himself to the partial-analytic model of Bailey, but also studies more sophisticated intertemporal general equilibrium approaches. In particular, he interprets the money-demand curve in terms of Sidrauski's (1967a, 1967b) model, where money is an argument in the utility function, and the McCallum–Goodfriend (1987) model, where money balances serve the purpose of reducing Allais–Baumol–Tobin type transactions costs. Interpreting a rich set of money-demand data that stretch from 1900 to 1994 on the basis of these models, he estimates the welfare cost of inflation at an interest rate of 6 per cent to be about 1.2 per cent of GDP.

Lucas does not believe in this estimate however, since, as he points out, it relies uncomfortably on the shape of the money-demand function in

the range of very low interest rates where no empirical evidence is available. If the functional forms of the money-demand schedule resulting from the theoretical models are bad approximations of the true demand schedule in the range of small interest rates, the true welfare loss from inflation may differ significantly from the 1.2 per cent figure.

## 2 The role of transactions costs

The money-demand schedules resulting from the Sidrauski model or the McCallum-Goodfriend model have the property of approaching the abscissa asymptotically as the stock of money balances goes to infinity. This is certainly not a plausible property.

Lucas points to the fact that Mulligan and Sala-i-Martin (1996) found that a surprising 60 per cent of American households in 1989 held no financial assets besides cash and cheque accounts. He attributes this observation to the presence of a significant transactions cost that renders a policy of diversifying portfolios inefficient, and concludes that this cost makes the money-demand function inelastic beyond a certain stock of money balances.

His argument is based on the Allais–Baumol–Tobin model. In that model, costly trips to the bank are necessary to convert interest-bearing assets into liquid money balances, and the lower the rate of interest, the longer the time-span between trips to the bank, the larger the amount of money withdrawn per trip, and the larger the average amount of money held. Lucas argues that the time-span cannot be increased indefinitely by reducing the rate of interest to zero, because a certain minimum number of trips to the bank will always be necessary for other purposes, and that the time spent on this minimum number of trips is the transactions cost that explains the low degree of asset diversification among American households.

While I find the assumption of a certain minimum number of trips to the bank to be realistic, I do not see how it could explain the lack of portfolio diversification. If people go to the bank in any case, they should have little difficulty in optimizing their asset portfolios and holding a variety of different assets. Transactions costs that limit portfolio diversification appear to be commission charges, consulting fees, uncertainty premia and similar items that reduce the net benefit from holding interest-bearing assets. Such costs do not make the money-demand curve more inelastic; on the contrary, they make it more elastic. These are the kinds of costs that Keynesian theory postulates with the liquidity trap in the money-demand function.

In fact, the non-observability of low interest rates suggests the existence of such a liquidity trap. If the money-demand function were inelastic for small rates of interest, as Lucas claims, occasionally we should observe extremely low interest rates when the economy is in a deep recession. However, if the curve is perfectly elastic at a certain interest level, we can never observe interest rates below this level.

Figure 4.12 makes clear what the alternative views on the shape of the money-demand function for low interest rates imply. From the empirical data on money demand as reported in Lucas's Figure 4.9, it is obvious that the nominal interest rate has a floor at about 0.75 per cent. Using a variant of the McCallum–Goodfriend model with different household types and the assumption of a minimal number of trips to the bank, Lucas estimates a vertical branch[1] of the money-demand function at a money–GPD ratio of 0.44, so that the area to the right of this branch no longer contributes to the welfare loss from inflation. Including this area, the estimated welfare loss would be 1.2 per cent of GDP. Excluding it, the loss is only 0.6 per cent of GDP.[2] The Keynesian interpretation of the empirical interest floor at a rate of 0.75 per cent is that at this level there is a liquidity trap that adds a horizontal branch to the money demand function: since the cost of holding bonds is 0.75 per cent of their value, no one would ever hold bonds if their rate of return were equal to, or less than, 0.75 per cent.

To further clarify the difference between the Keynesian view and Lucas's view, consider the Allais–Baumol–Tobin function $T(M, Y)$ with $T_M \leq 0$ and $T_Y > 0$, where $T$ is the cost of the trips to the bank, $M$ the stock of real money balances and $Y$ the transactions volume (income). According to Lucas, people choose their money balances in order to equate the marginal saving in the cost of visiting the banks with the nominal rate of interest $(r)$,

$$T_M(M, Y) = r \qquad \text{(Lucas) (1)}$$

The marginal cost of bank visits is a declining function of real balances with a positive second derivative, $T_{MM} > 0$. As $M$ approaches some critical level $M^*$, $T_{MM}$ even approaches infinity. In other words, the marginal benefit from money holding, $-T_M$, falls sharply to zero when $M$ approaches $M^*$.

According to the Keynesian interpretation, on the other hand, $T(M, Y)$ is well behaved, but, instead of Equation (1), the marginal condition for an optimal choice of real money balances is:

$$T_M(M, Y) = r - k \qquad \text{(Keynes) (2)}$$

where *k* is the transactions cost of holding the bonds. When there are transactions costs of holding bonds, people will choose their money balances to equate their marginal benefit to the nominal rate of interest net of these transactions costs.

This has significant implications for the size of the welfare cost, although it does not confirm the increase in this cost that the horizontal branch of the money-demand curve might at first sight suggest. In Figure 4.12, only the vertical distance between the money demand curve and the value of 0.75 per cent is the marginal benefit from money-holding, and the Friedman optimum where this marginal benefit is zero is reached at a money–GDP ratio of about 0.44. The integral over the marginal benefit up to the Friedman optimum, which in general should be the measure of the welfare cost of inflation, is the area Lucas estimates minus the hatched rectangle shown in Figure 4.12. With a nominal interest rate of 6 per cent, Lucas's data imply that money demand is 0.21 per cent of GDP. Thus the welfare loss of inflation that Lucas calculates needs to be reduced by an amount equal to $(0.44 - 0.21) \cdot 0.75$ per cent, which is about 0.17 per cent. Subtracting this from Lucas's figure (0.6 per cent) gives a welfare loss from inflation equal to 0.43 per cent of GDP.
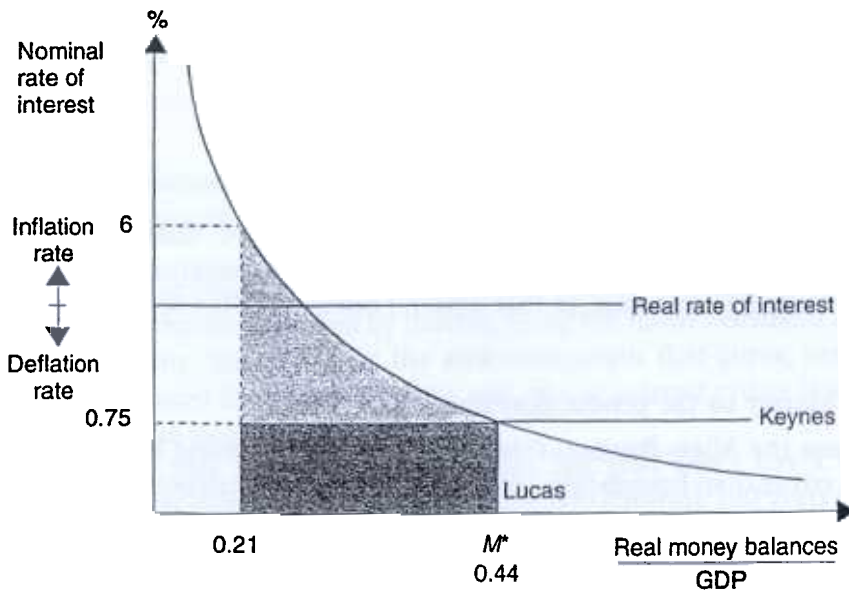


*Figure 4.12*  Two alternative views on the money demand at low interest rates

## 3  Taxation of interest income

One reason why the nominal rate of interest does not measure the marginal benefit from money-holding is that the transactions cost of holding bonds has to be taken into account in an optimal portfolio decision. Another reason is the tax burden that bond holders have to bear.

In most countries, including the USA, interest income is subject to income tax. Abstracting from the transactions cost of bond holding, one should therefore expect the marginal benefit from money holding to be equal to the net-of-tax nominal rate of interest rather than the nominal interest rate as such. If $\tau$ is the income tax rate, the marginal condition for an optimal choice of real money balances becomes:

$$T_M(M, Y) = (1 - \tau)r \tag{3}$$

It follows that only the fraction $(1 - \tau)$ of the area under the money demand curve can be equated with the welfare cost of inflation. With $\tau = 0.5$, this in itself would mean that the welfare cost is only 50 per cent of what Robert Lucas has measured.

A combination of the tax and transactions cost effects would substantially reduce the welfare cost of inflation. For example, with a 50 per cent tax rate and a tax-deductibility of the cost of bond holding, the welfare loss from inflation in the sense of deviating from the modified Friedman optimum by allowing for a nominal interest rate of 6 per cent, would then be only 0.215 per cent. This is a small number by any standard.

## 4  Other reasons for a welfare loss

While the Bailey–Lucas type of welfare cost from inflation seems negligible, there are other types of welfare cost from inflation that could potentially be important. In this section I briefly sketch a few of them.

### 4.1  Money in the production function

Suppose the Allais–Baumol–Tobin type of money demand is exerted by firms rather than households, so that real money balances become a factor of production.

A simple formulation of the production function could be:

$$Y \quad f(K, L) - T[M, f(K, L)] \tag{4}$$

where $f(K, L)$ is the usual production function with capital and labour as arguments, and $T$ is the cost of trips to the bank in terms of absorbing labour and capital which otherwise could have been used for production. A profit-maximizing firm will, as before, choose its money balances to equate the marginal benefit from money holding, in terms of reducing the cost of the trips to the bank, to the nominal rate of interest:

$$-T_M(M, f) = r \tag{5}$$

In addition, it will employ capital up to the point where its marginal product net of the cost of making the bank trips is equal to the real rate of interest, $r - \pi$, where $\pi$ is the inflation rate:

$$f_K(1 - T_f) = r - \pi \tag{6}$$

In this formulation, the trips to the bank drive a wedge between the marginal product of capital and the real rate of interest. This is similar to a tax wedge and implies that inflation generates distortions similar to tax distortions. Assuming that $T_{fM} < 0$ and $T_{MM} > 0$, it can easily be shown from Equations (5) and (6) that an increase in the inflation rate reduces the stock of real money balances for any given values of $K$ and $L$:

$$\frac{dM}{d\pi} = \frac{1}{T_{fM} - T_{MM}} < 0 \tag{7}$$

Because of Equation (5), this implies that the real rate of interest declines with an increase in inflation:

$$\frac{d(r - \pi)}{d\pi} = f_K \frac{T_{fM}}{T_{MM} - T_{fM}} < 0 \tag{8}$$

In an open economy, this will tend to drive out capital to other countries,[3] and in an economy with capital accumulation it will reduce the rate of growth.

These distortions may be more severe than the ones analyzed by Lucas, but they cannot be measured by moving along the money-demand curve and calculating the change in the area underneath that curve, because they are induced by a decline in the real rate of interest rather than an increase in the nominal one.

Of course, this denies the Fisher effect, but that effect has a weak empirical basis in any case. In an extensive study covering 120 years of US history, Lawrence Summers (1983) has provided overwhelming evidence that inflation does not translate into a higher nominal interest rate on a one-to-one basis.

## 4.2 The nominality principle

Another reason for inflationary welfare costs is the nominality principle: the fact that credit contracts, wage contracts, tax laws and other rules that define financial payments are typically set up in nominal rather than real terms. After all, money, and not commodities, is the unit of account in a modern economy.

Unforeseen, and even *foreseen*, inflation will under these circumstances be able to generate real distortions because the real meaning of a nominal contract will change with the price level. For example, a fixed nominal wage may be above the marginal product of labour at the beginning of the contract period and below it at the end, generating welfare-reducing distortions in either case.

In principle, the distortions can be avoided by frequent adjustment of the rules of payment, but this involves menu costs that could be substantial. Similarly, an indexation could induce prohibitive information costs.

In fact, the periods during which financial payment rules are fixed despite inflation can be substantial. In some countries, fixed interest credit contracts extend over twenty years or more, and in most countries tax laws are revised after decades rather than years.

Among potential distortions, those resulting from historical cost accounting seem particularly important. The tax law fixes depreciation rules for real assets invested by firms on the basis of their historical purchasing value rather than their current reproduction cost. When there is inflation, this means that the real depreciation over the lifetime of an asset will always be below 100 per cent of the asset's real value. Even when the tax law allows for accelerated depreciation, this typically will discriminate the investment process and induce both a slowdown of economic growth and an expulsion of capital to other countries.[4]

The government's extra revenue from historical cost accounting is about ten times the revenue from the inflation tax on money-holding.[5] It would not be surprising if the real economic distortions created by historical cost accounting were also much bigger than the Bailey–Lucas type of inflationary welfare loss.

## 4.3 Uncertainty

More inflation means not only a more rapid change in the price level, but also a larger variance of the future price level, if only because zero is a neutral focusing point for monetary policy that exhibits some commitment value. A central bank which announces an inflation goal of 0 per cent will deviate by fewer percentage points from its goal than one

that announces a goal of 12 per cent. It is difficult to explain why this is so; there may be deeper psychological reasons. Nevertheless, to me it seems to be an obvious fact of life.

If more inflation also means more inflationary risk, inflation is bad because it destroys the long-term capital market. Buyers and lenders will then mutually demand risk premia in their contracts which limit the scope for welfare-improving contracts as such. This may be a serious impediment to investment and growth, because it will limit the possibility of financing long-term investment projects.

The risk problem may be one of the reasons why, in the United States, for example, hardly any long-term housing loans with fixed interest rates are taken up, while in Germany, which traditionally has been a low-inflation country, contracts with repayment periods of up to thirty years are not unusual. The absence of long-term fixed-interest housing loans may have had adverse implications for the durability of the American housing stock – something which would be worth investigating further.

Apart from that, the price level uncertainty may have severe distributional consequences that might even threaten the stability of society itself. Germany's experience in the 1920s should be a warning. German inflation expropriated the middle class and deprived the German society of one of the pillars on which its political system was built. The political implications in 1933, and the resulting welfare loss for the whole world, have dwarfed all the other welfare losses that might possibly result from inflation.

## 5   Welfare gains from inflation

My final point is to question the basic presumption that inflation as such is bad. Lucas's normative starting point is the Friedman rule, where the price level declines at a rate given by the real rate of interest. Any lower deflation, and a fortiori a true inflation is bad.

The nominality principle and the risk argument I discussed in the previous two sections deny that view by implying that the optimal rate of inflation, or deflation, is zero. There is another argument that even suggests that a moderate rate of inflation is desirable. I do not mean the Phelps (1973) argument that some inflation may be useful to generate some inflation tax revenue for the government, which could then be used to lower distortive taxes. Lucas has rightly dismissed this argument as empirically insignificant. I mean instead the argument recently renewed by Truman Bewley (1998) in his Marshall lecture to the European Economic Association.

The argument refers to the downward stickiness of wages and prices, again an issue where economic theory has as yet not been able to offer a full explanation. Truman interviewed 300 firms to find out about their wage setting, hiring and dismissal rules. His conclusion from these interviews was that nominal wage cuts are typically not made within an existing employment relationship because they would be considered an insult and a sign of mistrust. If a wage cut is necessary, the only way to achieve it is to dismiss the existing employees and hire new ones at lower wages. This confirms the old observation of Keynes (1936) that workers resist a direct wage cut because they are afraid that this would worsen their relative income position, but they would not object strongly to an indirect wage cut brought by a general inflation because this would leave their relative income positions intact.

If the Bewley view is true, and if a market economy needs structural change accompanied by wage cuts in declining sectors, then some inflation would be useful. It would effectively make the wages flexible and facilitate structural change. I mention this argument for the sake of completeness, not in order to finish with a plea for an inflationary policy. The arguments I have put forward all have some merits, but it is difficult to make a judgement about their net effect. That applies also to Robert Lucas's arguments. They are correct, but not complete. Nothing is complete in this world.

## Notes

1 I have changed the axes of Lucas's Figure 4.9 so that I can draw the money-demand function in its usual form.
2 Part of the decline in the welfare loss is also attributable to a downward shift of the money-demand curve in the neighbourhood of the kink, which results from the differences in household wealth. The effect is nevertheless not essential for my discussion.
3 See Sinn (1991).
4 Sinn (1987, 1991).
5 Sinn (1983).

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