How uncertain are the welfare costs of inflation?

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Inflation makes it costly to hold non-interest-bearing cash and reserves. For a long time economists have known that this cost could be eliminated if monetary policy acted to bring about a steady state of zero nominal interest rates, where there is no penalty to holding cash. (In such a regime, inflation would be equal to the negative of the real interest rate, the rate that equalises the return to holding cash and a risk-free real asset.) Since then a number of researchers have sought to quantify how much time (and utility) is thrown away as nominal interest rates rise above zero. But why all this effort, when the 'optimal' inflation rate has been worked out? The interest stems from the apparent consensus in modern monetary regimes that policy should aim at a positive rate of inflation. Those regimes are predicated on the notion of setting the costs of staying away from the 'Friedman rule' on the one hand against the costs of lowering inflation further on the other. These costs of lowering inflation are highly uncertain and difficult to model coherently, but could be important. Leaving aside measurement problems, researchers have examined whether low inflation could cause problems if nominal wages or prices are downwardly rigid. And they have also sought to quantify the costs of monetary policy becoming impotent as nominal rates hit the zero bound in regimes of very low inflation. Models tractable enough to calculate the costs of inflation are typically simplified to the point where the economic behaviours that could generate these 'benefits' of positive inflation are not included. So the interest in calculating the welfare cost of positive inflation is a pragmatic one. Absent an all-singing, all-dancing model that includes a zero bound and downward nominal frictions, take a monetary general equilibrium model, calculate the costs of positive inflation, and balance these in an informal way against the 'benefits'.

This paper adds to the literature on quantifying the costs side of the inflation 'balance sheet'. It makes two distinct contributions. First, it offers a UK calibration of some of the general equilibrium costs of inflation that complements the efforts of Bakhshi *et al* (1999) and Chadha *et al* (1998), which take partial-equilibrium approaches. The estimate is a 'general equilibrium' one in the sense that, following Wolman (1997), it takes as its benchmark a model of money demand due to McCallum and Goodfriend (1987), who argued that individuals hold cash in order to economise on shopping time.

This approach to calculating the welfare costs of inflation is distinct from an older literature that stretches from Bailey (1956), Sidrauski (1967), through Lucas (1994) and most recently to Chadha *et al* (1998). The intuition behind those papers was that just as you can use the area under the demand curve for apples to calculate the consumer surplus that accrues from apple consumption when the market clears at a certain price, so you can do the same with money. If money is a consumption good then you can compare the area under the demand curve for money when nominal rates are *x* per cent with when they are zero, and thereby derive a measure of the benefit of reducing steady-state nominal interest rates. In the shopping-time model, money is modelled not as directly utility-providing but as enabling consumers to translate work into consumption more efficiently. So the fact that our paper offers a 'general equilibrium' estimate of the welfare cost of inflation comes from the chosen shopping-time model that tells us that inflation has consequences for consumption and leisure decisions, whereas the 'money gives you utility all by itself' approach says that it does not.

Our 'general equilibrium welfare cost of inflation' comes, following Wolman (1997), from applying a shopping-time money demand function to UK data and combining it with a model of consumption and leisure choice.

The second contribution of our paper is that we look at the uncertainties surrounding those welfare costs of positive inflation that we capture. One dimension of this is to look at how uncertainties surrounding our shopping-time parameter estimates translate into uncertainties in the welfare calculation. The intuition we seek to confirm is that the more ill-determined are the parameters of the estimated money demand equation, the greater will be the uncertainty about the welfare costs of inflation. Another dimension of uncertainty is whether or not real money balances tend to a finite number at zero nominal interest rates. Wolman (1997) develops a test of satiation interpretable within the shopping-time model that we implement for UK data. We also explore how powerful these tests are when there are few—if any—observations at very low nominal interest rates. Intuitively, if there are no observations near zero nominal rates, then we cannot observe whether real balances tend to a finite number or not. Simulations using our model support this intuition.