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Fundamental inflation uncertainty

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Abstract

We develop a method of quantifying the uncertainty surrounding the estimates of the fundamental inflation implied by the New Keynesian Phillips Curve (NKPC). The uncertainty is represented as a *band* around the fundamental inflation, and encompasses the sampling uncertainty of both the estimates of the structural parameters and the estimates of the VAR used to form a projection of real marginal costs. An empirical application on UK and US data confirms that fundamental inflation tracks actual inflation reasonably well in both countries. For the United Kingdom the confidence band is sufficiently narrow, relative to the sample variance of inflation, to identify a number of periods where the predictions of the NKPC do not fully capture movements in actual inflation. In contrast, considerable uncertainty surrounds the estimates of fundamental inflation for the United States.

Key words: Sampling uncertainty, New Keynesian Phillips Curve, fundamental inflation, two-step minimum distance.

JEL classification: E38, E52.

Summary

The Phillips curve, which relates inflation to some measure of real activity, plays an important role in modern economic theory. The relationship is also important for policymakers, as it serves as a useful description of the short-run inflation dynamics. In modern New Keynesian models, the Phillips curve is explicitly derived from the pricing decisions of firms, that set their prices as a mark-up over costs. At the aggregate level, the baseline New Keynesian Phillips Curve relates current inflation to lagged and expected future inflation, and some measure of real activity, and the coefficients on the different terms will depend on factors such as such as the degree of pricing power of firms, and how often firms reset their prices.

A large amount of research has focused on assessing the ability of the New Keynesian Phillips Curve (NKPC) to predict a path for inflation that is consistent with the actual data. To test whether the NKPC model is able to predict movements in actual inflation, the model-based measure of inflation is often represented as the present value of current, and expected future, costs. This representation is typically referred to as fundamental inflation. It has been shown that the fundamental inflation predicted by the NKPC tracks actual inflation fairly well using US data. One difficulty with this result, however, is that the assessment of the empirical performance of the model is often qualitative and mainly based on graphical inspection of fundamental and actual inflation. That is, the fit of the model is not evaluated statistically.

In this paper, we note that the fundamental inflation predicted by the NKPC is only a point estimate, and that its measurement is associated with uncertainties. These uncertainties arise since fundamental inflation is derived using estimates of the parameters in the NKPC, and of expectations of future costs. The object of this paper is to supplement the fundamental inflation measure with information on the uncertainties associated with its measurement. We represent these uncertainties in the form of a confidence band around the measure of fundamental inflation. This gives us an an upper and a lower limit for fundamental inflation predicted by the NKPC. By inspecting whether actual inflation falls within the bands predicted by the NKPC we can assess whether, in a given period, it is able to account for the movements in actual inflation.

On the empirical side, we present an application of our method to UK and US data. We confirm that the fundamental inflation predicted by the NKPC tracks actual inflation reasonably well for

both countries. The UK measure of fundamental inflation uncertainty implies quite a narrow band and suggests that there are a number of periods where the model is not capable of accounting for movements in actual inflation. By contrast, we find that for the United States, fundamental inflation is more uncertain, casting some doubt on the empirical success of the NKPC.

1 Introduction

The Phillips curve relationship plays an important role in modern macroeconomic theory. Recent contributions in the literature have shown that such a relationship can be derived from first principles and can effectively characterise the transmission mechanism of monetary policy. A large amount of research has focused on assessing the ability of specific models featuring monopolistic competition and sticky prices to predict a path for inflation consistent with the actual data.

In the standard New Keynesian Phillips Curve (NKPC), inflation is often represented as the present value of the weighted infinite sum of current and future real marginal costs. This representation is typically referred to as *fundamental inflation*. A number of contributions, including Sbordone (2002) and Sbordone (2005), Galí and Gertler (1999) and Cogley and Sbordone (2004), find that the fundamental inflation derived from a relatively forward-looking model tracks actual inflation fairly well on US data.(1) A difficulty with these results is that they do not convey *sampling uncertainty*. The assessment of the empirical performance of the model is, in fact, often qualitative and mainly based on graphical inspection of fundamental and actual inflation.

The object of this paper is to supplement the fundamental inflation measure with information on the uncertainties associated with its measurement. To do so, the paper develops a method to quantify uncertainty around the fundamental inflation predicted by a New Keynesian Phillips Curve. Fundamental inflation is a function of the estimates of the NKPC and the estimates of an unrestricted VAR, which is used to form a projection of future real marginal costs. A bootstrap procedure based on the VAR innovations is used to generate artificial series of inflation and real marginal costs, and the NKPC is then re-estimated using the artificial series. This procedure exploits both the definition of fundamental inflation and the sampling uncertainty embodied in the VAR to deliver a graphical representation of the uncertainty surrounding the estimates of the NKPC in the form of a band.

(1) On the other hand, Linde (2005) and Rudd and Whelan (2005) question the importance of the forward-looking component of the NKPC arguing, on the basis of a FIML method and a closed-form solution for fundamental inflation, that expected inflation is of little economic and statistical importance in explaining US inflation dynamics. Galí, Gertler and Lopez-Salido (2005), however, point out some problems with this critique.

Our method is closely related to Kurmann (2005), who computes statistical intervals for the correlation coefficient and the ratio of the standard deviation of fundamental and actual inflation. It is worth noting however that, unlike Kurmann (2005), we do not treat the estimates of the NKPC as fixed. Rather, for each artificial series of inflation and real marginal cost implied by the draws of the VAR innovations, we compute the point estimates of the NKPC.(2) This method also provides us with a measure of uncertainty around the structural parameters. A main advantage of our method relative to earlier contributions is its ability to identify the periods where the model does not fully capture the actual inflation dynamics. Moreover, the graphical representation provides the reader with a straightforward and appealing interpretation, which is useful for the purpose of communication and presentation.

On the empirical side, we present an application of our method to UK and US data using the two-stage minimum distance estimator (2SMD) proposed by Sbordone (2002). We confirm that the fundamental inflation predicted by the NKPC tracks actual inflation reasonably well for both countries. The UK measure of fundamental inflation uncertainty implies, however, quite a narrow band and suggests that there are a number of periods where the model is not capable of accounting for movements in actual inflation. For the United States, we find that fundamental inflation is surrounded by considerable uncertainty so as to cast some doubts on the empirical success of the NKPC.(3)

Section 2 lays out a framework for obtaining a measure of fundamental inflation. Section 3 discusses the method to obtain a measure of uncertainty surrounding fundamental inflation. Section 4 estimates the model using US and UK data and discusses the results. Section 5 concludes.

2 A measure of fundamental inflation

The following hybrid specification of the NKPC is estimated,

$$\pi_t = \gamma^b \pi_{t-1} + \gamma^f \mathrm{E}_t \pi_{t+1} + \kappa\, s_t \qquad \textbf{(1)}$$

(2) A similar method is discussed by Sbordone (2005). Favero (2006) uses a similar approach to account for uncertainty about fundamental prices as implied by a present-value model.
(3) However, it should be made clear that this is not a formal rejection of the model, as these confidence bands are not constructed under the null that the model is correct.

where π_t is inflation, s_t the log-deviation of average real marginal cost from its steady state and $E_t[\cdot]$ denotes expectations, conditional on information available in period t. Parameters γ^b and γ^f are the weights on the backward and forward-looking components of inflation, and functions of the underlying structural parameters of the model. To give a structural interpretation to the parameters, we follow Christiano, Eichenbaum and Evans (2005) and assume that firms that are not allowed to change their prices in a given period are nevertheless allowed to index their prices to past inflation, and they do so by a fraction ρ, where $0 \leq \rho \leq 1$. The coefficients in **(1)** are in this case related to the structural parameters by $\gamma^b = \rho(1+\beta\rho)^{-1}$, $\gamma^f = \beta(1+\beta\rho)^{-1}$ and $\kappa = \varsigma(1+\beta\rho)^{-1}$ where β is a discount factor and ς is the slope coefficient in the purely forward-looking NKPC.

Solving **(1)** forward gives inflation as a function of lagged inflation, and current and expected future real marginal cost:

$$\pi_t = \xi_1 \pi_{t-1} + \frac{\kappa}{\xi_2 \gamma^f} \sum_{\tau=0}^{\infty} \xi_2^{-\tau} \mathrm{E}_t[s_{t+\tau}] \qquad \textbf{(2)}$$

where $\xi_1 \leq 1$ denotes the stable and $\xi_2 \geq 1$ the unstable root associated with **(1)**. Fundamental inflation is defined as the level of inflation predicted by **(2)**, conditional on estimated κ, and on a path for the expected value of future real marginal cost. To obtain an expression for this path, we follow the VAR projection method. Assume that all period t information about current and future values of real marginal cost can be summarised by a vector of variables Z_t, with dynamics well described by a VAR process, expressed in companion form as

$$Z_t = AZ_{t-1} + e_t \qquad \textbf{(3)}$$

Fundamental inflation, π_t^f, can then be expressed as

$$\pi_t^f = \xi_1 \pi_{t-1} + \frac{\kappa}{\xi_2 \gamma^f} h \left[I - (1/\xi_2)A\right]^{-1} Z_t \qquad \textbf{(4)}$$

where we have used that $\mathrm{E}_t[s_{t+\tau}|Z_t] = hA^{\tau}Z_t$; h is a vector which singles out the forecast of real marginal cost.

3 Quantifying uncertainty

This section presents a simple method to quantify the uncertainty around the fundamental inflation predicted by the NKPC. A key element of our procedure is the fact that the innovations of the unrestricted VAR are bootstrapped to generate artificial series of inflation and unit labour costs, which are used first to re-estimate the parameters in the VAR and then to re-estimate the parameters in the NKPC. It is worth emphasising that unlike previous contributions, which keep fixed the estimates of the NKPC across repetitions and therefore focus exclusively on the uncertainty of the VAR estimates, the method presented in this paper allows an assessment of the uncertainty around the NKPC estimates. Specifically, the confidence bands around fundamental inflation, captured by the 5th and the 95th percentiles of the distribution for fundamental inflation, are computed according to the following five steps:

1. Estimate on actual data an unrestricted VAR, $Z_t = \hat{A}Z_{t-1} + \hat{\varepsilon}_t$, where Z_t represents the information set available at time t used to capture the dynamics of real marginal cost, while $\hat{\varepsilon}_t$ represents innovations.
2. Bootstrap the VAR innovations $\hat{\varepsilon}_t$ and use the estimated parameter vector $\hat{A}$ from Step 1 to generate artificial series $\tilde{Z}_t$.
3. Estimate an unrestricted VAR on the artificial series, $\tilde{Z}_t = \tilde{A}\tilde{Z}_{t-1} + \tilde{\varepsilon}_t$ to obtain an estimate of $\tilde{A}$.
4. Find the values of parameters in the Phillips curve that minimise the distance between actual inflation and fundamental inflation computed using $\tilde{A}$ and $\tilde{Z}_t$ from Step 3.
5. Repeat Steps 1 to 4, 10,000 times and plot the 5th, the 50th and the 95th percentiles of the distribution of fundamental inflation together with actual inflation.

In our application to UK and US data, we specify in Step 1 a VAR of order three in inflation and, as a proxy for marginal cost, the labour share. The VAR is estimated using OLS under the assumption that both inflation and the labour share are stationary variables.[(4)] The practical implementation of Step 4 involves choosing an empirical strategy for estimating the NKPC parameters. Following a growing empirical literature, we illustrate our method in the context of the two-stage minimum distance estimator (2SMD) proposed by Sbordone (2002).[(5)]

(4) We follow Kilian (1998) in applying a bias correction to the VAR estimates. However, instead of following Kilian's suggestion of 'shrinking' the bias estimates in case they imply a non-stationary VAR, we simply discard those draws and return to the first step of the bootstrap algorithm.

(5) We find that the GMM estimates of the NKPC are associated with massive uncertainty around fundamental inflation in the form of very wide confidence bands. This reflects the instability of GMM estimates across the repetitions of our algorithm, and led us to focus on the two-stage minimum distance method. To increase the speed of estimation, we follow the method in Sbordone (2002), based on an an unweighted estimate of the VAR process, instead of the weighted estimator proposed by Sbordone (2005).

In the estimation, we imposed the following restrictions on the model: the parameters γ^f and γ^b in **(1)** are restricted to equal one, which holds approximately for β close to one. The grid search for γ^f is restricted to [0.01 0.99], and for the slope coefficient κ to [0.01 0.30].(6)

4 Empirical application

We estimate the NKPC for 1960:1-2004:3 for the United States, and for 1976:4-2003:4 for the United Kingdom. Following the literature, our measure of inflation is based on the GDP deflator.(7) The labour share is used as a proxy for unobservable real marginal cost. For the United Kingdom, we use a measure of the private sector labour share to proxy real marginal cost, following Batini, Jackson and Nickell (2005), and augment the labour share measure to account for open-economy aspects.(8) A detailed description of the data is included in Appendix A.

4.1 US estimates

Table A shows the point estimates of the structural parameters in the NKPC for the United States, together with the 50th, the 5th and the 95th percentiles from the bootstrapped procedure. The point estimate of the backward-looking component in the NKPC is 0.32, slightly higher than the 50th percentile of 0.27. The corresponding estimates of the slope coefficient are 0.05 and 0.03. These estimates fall within the range previously reported in the literature (eg Sbordone (2005)). Chart 1 at the end of the paper shows fundamental inflation obtained using the 2SMD method, as captured by the 50th percentile of the bootstrapped series, together with the 5th and the 95th percentiles and actual inflation.

The chart suggests that the fundamental inflation predicted by the NKPC tracks actual inflation reasonably well for the United States. We notice however that fundamental inflation is surrounded by a high degree of uncertainty. Although actual inflation rarely falls outside the confidence band implied by the model, the width of the band suggests that some caution should be used in interpreting the NKPC as a first good approximation of US inflation. This is in line with Kurmann

(6) The restrictions are imposed to increase the speed of estimation. Under the assumption that $\gamma^f + \gamma^b = 1$, the roots in **(4)** satisfy $x_1 = \rho$, $x_2 = 1$. For stability, we therefore need that $A < 1$ in **(3)**.

(7) The reason for focusing on GDP deflator inflation is that the NKPC is essentially a theory for domestically generated inflation, for which GDP deflator inflation is a reasonable proxy.

(8) Controlling for movements in the real exchange rate has been found to be important for the UK (Balakrishnan and Lopez-Salido (2002)). We here follow the approach of Galí and Monacelli (2005), as discussed in Appendix A.

(2005), who shows that the correlation between actual and fundamental inflation for the United States is very imprecisely estimated.

4.2 UK estimates

The UK estimates are reported in Table A, and Chart 2 plots fundamental and actual inflation series together with the 5th and the 95th percentiles from the bootstrapped series. The point estimate of the backward-looking term in the NKPC is lower than for the United States, at around 0.16. This is also slightly lower than has been reported in previous studies, possibly reflecting the different sample period used. The point estimate of the slope coefficient is around 0.22, which is higher than has been found in previous work.[(9)]

Chart 2 shows that fundamental inflation, as captured by the 50th percentile of the bootstrapped series, tracks actual inflation less satisfactorily for the United Kingdom than for the United States. In particular, fundamental inflation tends to underpredict actual inflation, and discrepancies between the fundamental and actual inflation series are more pronounced in the United Kingdom than in the United States.

On the other hand, confidence bounds (captured by the distance between the 5th and the 95th percentiles for the bootstrapped series) are narrower than in the United States, and therefore also more informative. The narrow confidence bound help identifying special factors that may have contributed to the inability of the NKPC to fit inflation during some of the periods. For example, as discussed by Batini and Nelson (2005) and Nelson and Nikolov (2004), there was a shift in UK monetary policy around 1979, which may have contributed to the subsequent fall in inflation.[(10)] Although there may have been other factors contributing to the high inflation during the 1970s, the shift in policy may help explain the inability of the fixed-coefficient NKPC to fit actual inflation at the beginning of the sample.[(11)] The second half of the 1980s is another period when the NKPC is not able to account for the rise in inflation. Since the adoption of inflation targeting in 1992, the

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(9) See eg Batini *et al* (2005) and Balakrishnan and Lopez-Salido (2002).

(10) Batini and Nelson (2005) show that the policy response to inflation was very weak before 1979. Indeed, an estimated Taylor rule does not fulfil the Taylor principle (a response to inflation above unity) over the period 1970-78. By contrast, monetary policy has been associated with a response to inflation above unity during the post-1979 period.

(11) Other, more temporary, factors that may also have played a role in generating high inflation in the United Kingdom during the 1970s include the oil price shock and the incomes policies of periods of the 1970s (Batini and Nelson (2005)).

economic environment appears to be more stable, with a better fit between fundamental and actual inflation, and with a lower level of uncertainty about fundamental inflation. The 1990s in the United Kingdom have indeed been characterised by low and stable inflation and a robust output growth.

4.3 Discussion

The empirical exercise shows that, although the fit between actual and fundamental inflation is better for the United States than for the United Kingdom, there is a higher degree of uncertainty surrounding fundamental inflation for the United States than for the United Kingdom, over the periods considered. This is also clear from Chart 3, where we have plotted the width of the confidence bands, as captured by the distance between the 5th and 95th percentile of the distribution for fundamental inflation, and normalised this measure by the variance of actual inflation, for the United Kingdom and the United States.[(12)] The chart shows that the level of uncertainty associated with fundamental inflation is markedly higher for the United States than for the United Kingdom. To understand this result, it is useful to derive an approximate analytical expression for the variance of π_t^f, as is done in Appendix B. There we show that the variance of π_t^f is a positive function of the estimated parameters in the VAR. In particular, the degree of inflation and labour share persistence will positively affect the degree of uncertainty surrounding the NKPC.

There is little persistence in the labour share, on both the UK and the US data. Inflation, however, is significantly more persistent for the United States than for the United Kingdom as measured by the sum of the autoregressive coefficients in the VAR. The empirical application suggests that this may result in high uncertainty about fundamental inflation, and that this may be of a material issue for the United States, but less so for the United Kingdom.[(13)] We also find that, when beginning the US sample in 1976 to make the sample periods for the two countries comparable, the confidence bands around US fundamental inflation become even larger (Chart 4). This is intuitive since the 1960s was a period when both volatility and persistence of inflation were low, compared to the later period.

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(12) We normalise by the variance of inflation to make the measures comparable across countries. A normalisation by the mean of inflation gives a similar picture.

(13) A related issue is that the NKPC approach followed here assumes that steady-state inflation is equal to zero. Cogley and Sbordone (2004) show that, if steady-state inflation is varying over time, and the model ignores this drift, this may result in an artificially high level of persistence in inflation.

Following Kurmann (2005), we also construct confidence intervals around fundamental inflation when we only consider the uncertainty associated with the estimated VAR coefficients, but not with the parameters in the NKPC. As shown by Chart 5 for the United States, by treating the estimates of the parameters in the NKPC as fixed, the degree of uncertainty surrounding the NKPC is underestimated.

5 Conclusions

This paper develops a method to quantify uncertainty around the fundamental inflation predicted by a New Keynesian Phillips Curve. The procedure is based on the definition of fundamental inflation and the sampling uncertainty embodied in the VAR forming a projection of real marginal cost. The method delivers a graphical representation of uncertainty in the form of a bound around fundamental inflation.

On the empirical side, we illustrate our method using UK and US data. We confirm that the fundamental inflation predicted by the NKPC tracks actual inflation reasonably well for both countries. The measure of fundamental inflation uncertainty for the United Kingdom is associated with quite narrow bands, so that we can identify a number of periods where additional factors, relative to the NKPC, may have driven movements in actual inflation. The estimates for the United States imply, in contrast, considerable uncertainty around fundamental inflation.

Appendix A: The data

Inflation series: Quarterly GDP deflator for the United Kingdom and the United States are obtained from the Office for National Statistics and the FRED II database at St. Louis Fed, respectively. Inflation is measured as the first log difference, multiplied by 400, of the GDP deflator.

Labour share data: For the United States non-farm business sector nominal unit labour cost data (from the FRED II database at St. Louis Fed). For the United Kingdom, nominal unit labour cost data are an updated version of the labour share data used by Batini, Jackson and Nickell (2002). These are deflated with the respective GDP deflators and demeaned to obtain proxies for real marginal cost measures.

Real exchange rate data: In a small open economy real marginal cost is influenced by external factors. To capture this, the standard closed economy marginal cost (proxied by the labour income share and denoted by s_t) can be adjusted with the real exchange rate as follows,

$$s_t^{open} = s_t + \psi q_t \qquad \textbf{(5)}$$

where ψ is a positive function of the degree of openness, and q_t is the real exchange rate (variables are expressed in terms of log deviations from steady state).[(14)] For the United Kingdom, we use the open-economy measure above as a proxy for the labour share s_t in **(1)**. Prior to the bootstrapping procedure, we get an estimate of ψ by estimating **(4)**, where s_t is given by **(5)**, using 2SLS. The estimated parameter $\hat{\psi}$ is thereafter kept fixed in the bootstrapping procedure. We use an index of the real effective exchange rate, taken from the IMF, to proxy variable q_t.

Appendix B: The variance of fundamental inflation

Assume for simplicity a purely forward-looking NKPC, with $\gamma^f = 1$. Fundamental inflation in this case fulfils

$$\pi_t^f = \kappa h_\pi \left[I - \beta A\right]^{-1} Z_t \qquad \textbf{(6)}$$

(14) See Galí and Monacelli (2005) for a derivation. For a discussion about open economies and inflation, see eg Temple (2002).

Assume the discount factor is known with certainty and denote π_t^f in **(6)** by κ, A, Z_t. Using the delta-method, we obtain

$$Var\left(\pi_t^f\right) \approx F_x \Omega F_x\prime$$

where F_x is a vector of the derivatives of F with respect to κ, A and Z_t and Ω is the variance-covariance matrix for κ, A and Z_t . Vector $F_x = [F_\kappa, F_A, F_Z]$, where the entries satisfy

$$\begin{aligned} F_\kappa &= h_\pi \left[I - \beta A\right]^{-1} Z_t \\ F_A &= \kappa \beta h_\pi \left[I - \beta A\right]^{-1} \left(\left[I - \beta A\right]^{-1}\right)' Z_t \\ F_Z &= \kappa h_\pi \left[I - \beta A\right]^{-1} \end{aligned} \quad \textbf{(7)}$$

Assume that the covariance terms are zero. Both F_κ, F_A and F_Z are increasing in A. From this follows that $\partial Var\left(\pi_t^f\right)/\partial A > 0$.

Table A: Estimation results

	United States				United Kingdom			
	Point	Percentile			Point	Percentile		
	estimate	50th	5th	95th	estimate	50th	5th	95th
κ	0.05	0.03	0.01	0.12	0.22	0.10	0.01	0.28
γ^b	0.32	0.27	0.02	0.50	0.16	0.09	0.02	0.47

Notes: Estimated using two-stage minimum distance estimator.

Chart 1: US fundamental inflation

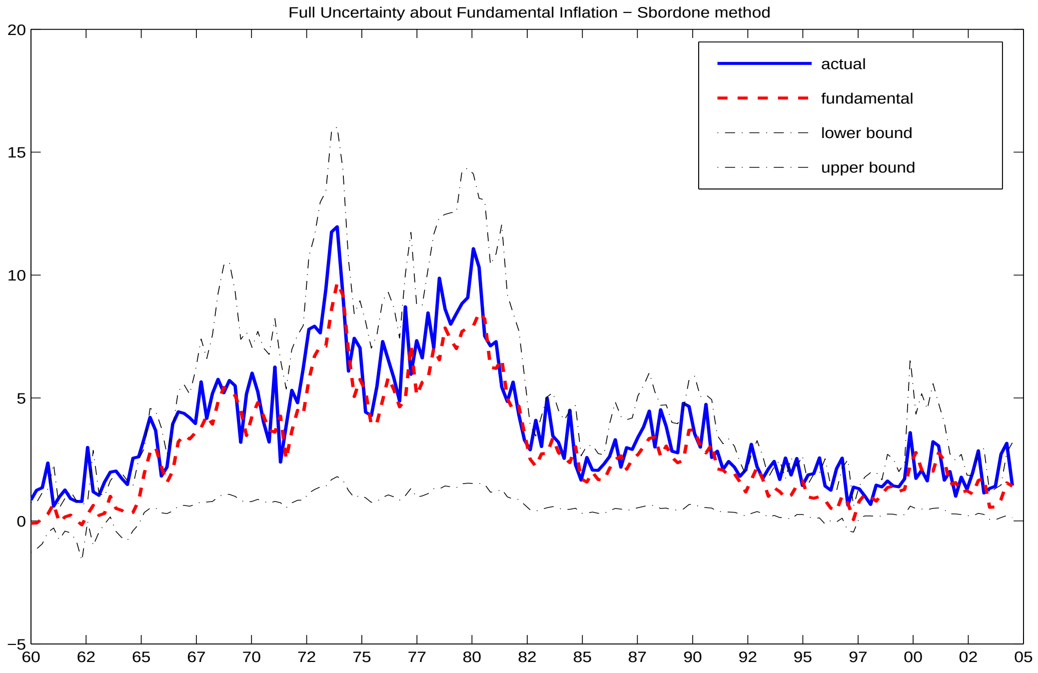


Chart 2: UK fundamental inflation

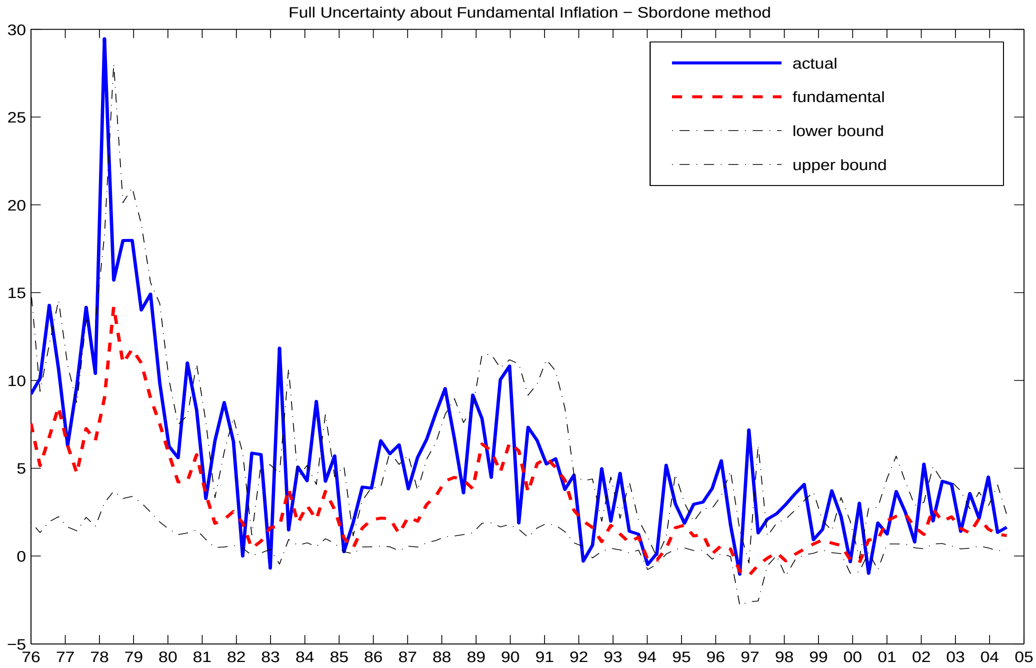


Chart 3: US and UK uncertainty

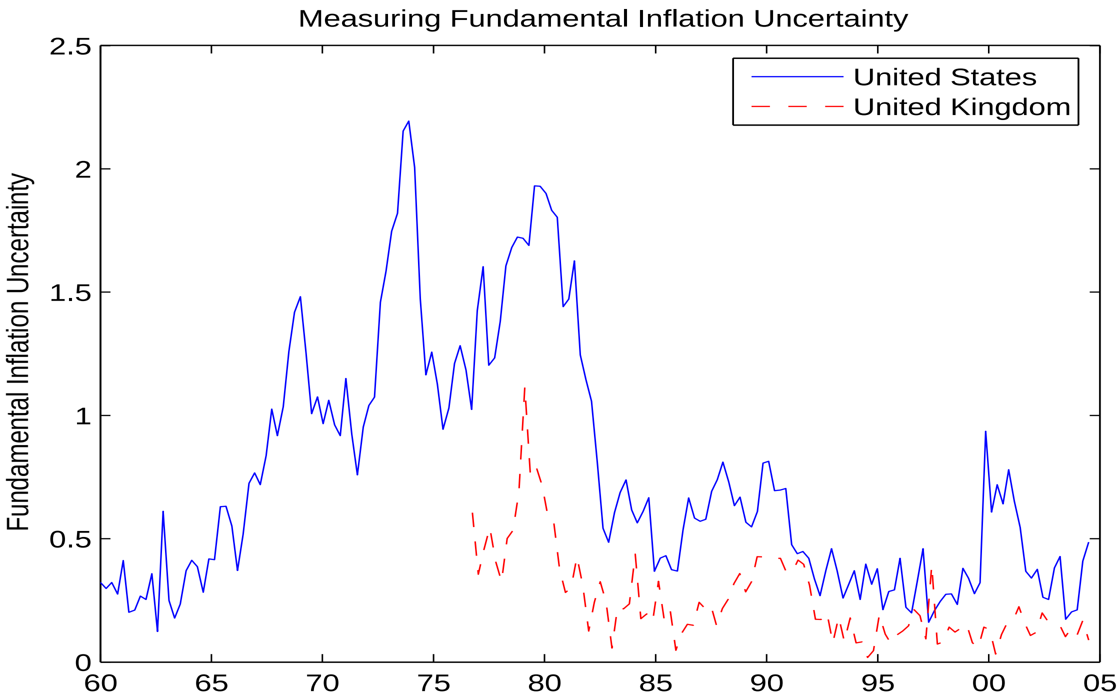


Chart 4: US fundamental inflation: short sample

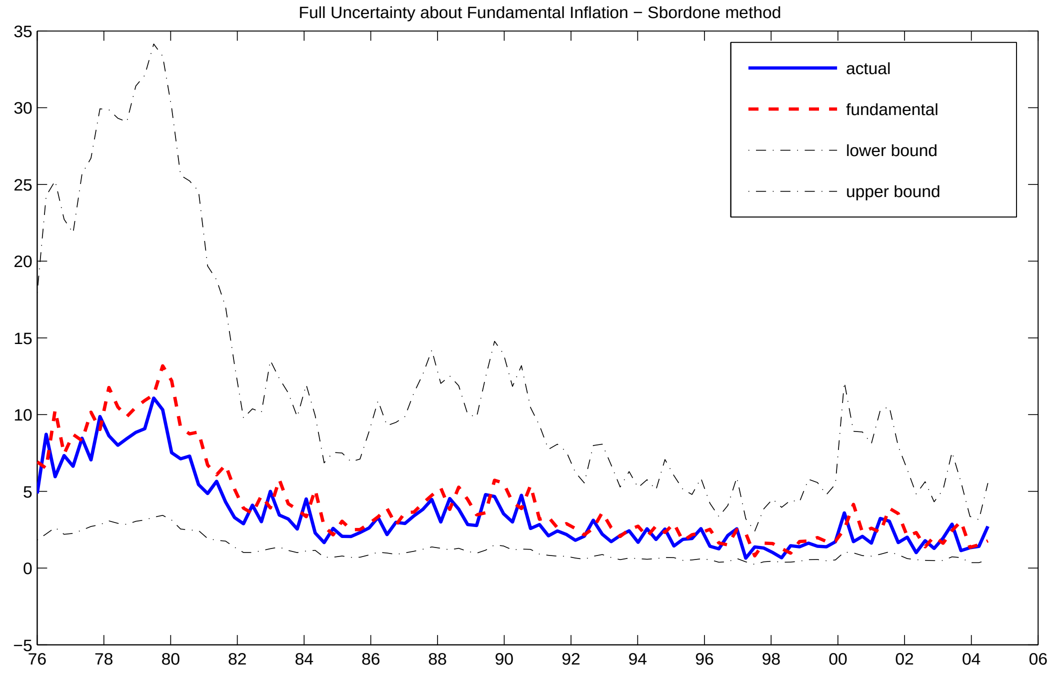
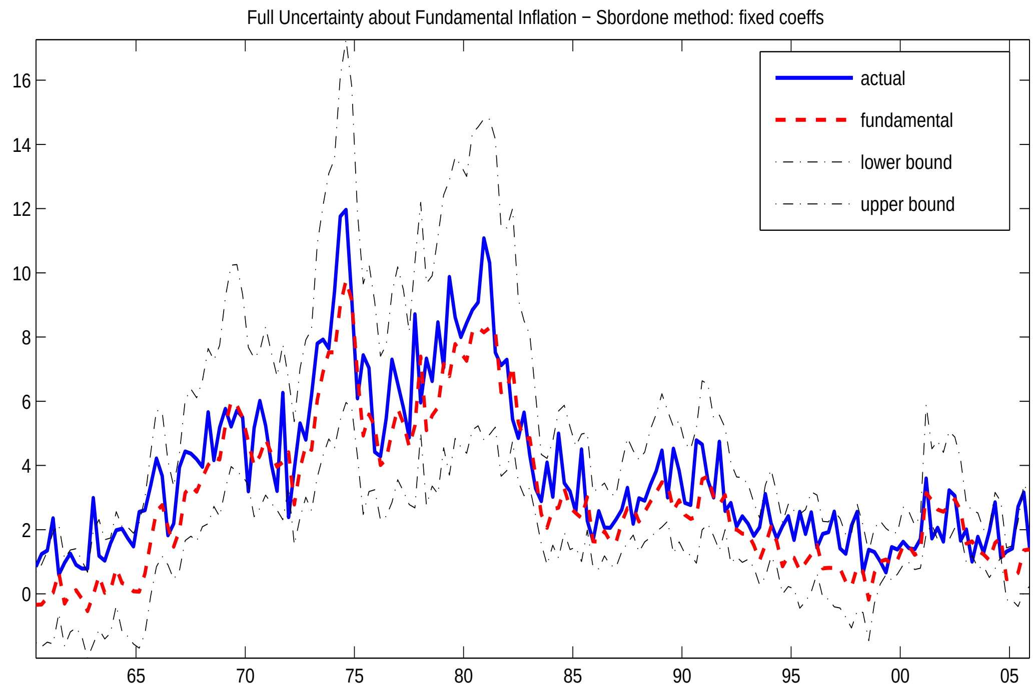


Chart 5: US fundamental uncertainty: fixed NKPC coefficients



References

Balakrishnan, R and Lopez-Salido, D (2002), 'Understanding UK inflation: the role of openness', *Bank of England Working Paper no. 164*.

Batini, N, Jackson, B and Nickell, S (2002), 'Inflation dynamics and the labour share in the UK', *Bank of England MPC Unit Discussion Paper no. 2*.

Batini, N, Jackson, B and Nickell, S (2005), 'An open economy New Keynesian Phillips curve for the UK', *Journal of Monetary Economics*, Vol. 52, pages 1,061–71.

Batini, N and Nelson, E (2005), 'The UK's rocky road to stability', The Federal Reserve Bank of St Louis, *Working Paper no. 2005-020A*.

Christiano, L, Eichenbaum, M and Evans, C (2005), 'Nominal rigidities and the dynamic effect of a shock to monetary policy', *Journal of Political Economy*, Vol. 113, pages 1–45.

Cogley, T and Sbordone, A (2004), 'A search for a structural Phillips Curve', Federal Reserve Bank of New York, *mimeo*.

Favero, C (2006), 'Taylor rules and the term structure', *Journal of Monetary Economics*, forthcoming.

Galí, J and Gertler, M (1999), 'Inflation dynamics: a structural econometric analysis', *Journal of Monetary Economics*, Vol. 44, pages 195–222.

Galí, J, Gertler, M and Lopez-Salido, D (2005), 'Robustness of the estimates of the hybrid New Keynesian Phillips Curve', *Journal of Monetary Economics*, Vol. 52, pages 1,107–18.

Galí, J and Monacelli, T (2005), 'Monetary policy and exchange rate volatility in small open economy', *Review of Economic Studies*, Vol. 72, pages 707–34.

Kilian, L (1998), 'Small-sample confidence intervals for impulse response function', *Review of Economics and Statistics*, Vol. 80, pages 218–30.

Kurmann, A (2005), 'Quantifying the uncertainty about the fit of a New Keynesian pricing model', *Journal of Monetary Economics*, Vol. 52, pages 1,119–34.

Linde, J (2005), 'Estimating New-Keynesian Phillips Curves: a full information maximum likelihood approach', *Journal of Monetary Economics*, Vol. 52, pages 1,135–49.

Nelson, E and Nikolov, K (2004), 'Monetary policy and stagflation in the U.K.', *Journal of Money, Credit and Banking*, Vol. 36, pages 293–318.

Rudd, J and Whelan, K (2005), 'Can rational expectations sticky-price models explain inflation dynamics?', *American Economic Review*, forthcoming.

Sbordone, A (2002), 'Prices and unit labour costs: a new test of price stickiness', *Journal of Monetary Economics*, Vol. 49, pages 265–92.

Sbordone, A (2005), 'Do expected future marginal costs drive inflation dynamics', *Journal of Monetary Economics*, Vol. 52, pages 1,183–97.

Temple, J (2002), 'Openess, inflation and the Phillips curve: a puzzle', *Journal of Money, Credit and Banking*, Vol. 34, pages 450–68.