Comparing the New Keynesian Phillips Curve with Time Series Models to Forecast Inflation♦

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Abstract

The New Keynesian Phillips Curve, as a structural model of inflation dynamics, has mostly been used to explain past inflation developments, but has not yet been used for forecasting purposes. We propose a method of forecasting HICP inflation in Austria based on the present-value formulation of the hybrid New Keynesian Phillips Curve. To evaluate the forecasting performance of this model we compare it with forecasts generated from time series models for different forecast horizons. As state-of-the art time series models widely used in inflation forecasting we employ a Bayesian VAR and a simple autoregressive model. We find that the New Keynesian Phillips Curve delivers relatively more accurate forecasts for longer horizons (more than 3 months) but they are outperformed by the time series models for all horizons. This is consistent with the finding in the literature that structural models can seriously compete with time series models only for longer horizons.

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I. Introduction

Forecasting inflation is an important task for a central bank since the rate of inflation is commonly regarded as the most important indicator of monetary policy. Some central banks, in particular those pursuing direct inflation targeting, even attribute the inflation forecast a crucial role in their monetary policy strategy. The literature on inflation forecasting has been growing rapidly in recent years as more and more forecasting methods have been developed and applied to forecast inflation. These are mostly time series models (e.g. factor models, autoregressive models, transfer function models) as well as more structural models (such as structural VARs or traditional Phillips curve equations). This paper attempts to employ a widely used theoretical model of inflation dynamics, the New Keynesian Phillips Curve, for forecasting purposes and compares its forecasting performance with those of state-of-the-art time series models.

The New Keynesian Phillips Curve (NKPC) is currently the most widely accepted theory of inflation dynamics in modern macroeconomics. It is derived from a New Keynesian model characterized by monopolistic competition and short-run price rigidity and represents (in its reduced-form formulation) inflation as a function of expected inflation and firms' marginal cost. The baseline NKPC was developed in the late 1990s by Galí and Gertler (1999) and others (e.g. Sbordone, 2002).[1] Depending on the specification and with an appropriate empirical proxy for marginal cost, it was generally found to be successful in tracking inflation dynamics in a number of large industrial economies over the last 20 to 30 years (see Galí and Gertler, 1999, for the US, Galí et al., 2001, and McAdam and Willman, 2004, for the euro area, and Jondeau and Le Bihan, 2005, for the UK and major euro area countries). Despite its empirical success to explain past inflation, it has until now never been used for forecasting purposes. This might be due to the fact that it contains expected future inflation which implies that a stand has to be taken on the formation of inflation expectations. If expectations are rational, the NKPC can be expressed as the discounted sum of present and future marginal costs, an expression which is hard to evaluate empirically.

In this paper we develop a method of projecting inflation forward that is based on the present-value formulation of the NKPC inspired by Galí and Gertler (1999) and Galí et al. (2001). Since

[1] A brief survey of the literature on the New Keynesian Phillips Curve can be found in Rumler (2006b).

the NKPC is estimated for Austria which is a fairly open economy, the NKPC model is extended to include also open-economy aspects that might be especially relevant for Austria. Forecasts are generated from three different specifications of the NKPC, which differ to the degree the open-economy aspects are incorporated.

The forecasts stemming from the NKPC are compared to the forecasts of a Bayesian Vector Autoregressive model (BVAR) and a univariate autoregressive (AR) model. To systematically evaluate the forecasting performance of the different models, we generate multi-step out-of-sample forecasts in a recursive procedure from which the root mean square errors (RMSE) are computed. Additionally, to test for significant differences in predictive accuracy we use a modified version of the Diebold-Mariano according to Harvey et al. (1997).

We find that the AR model delivers the lowest RMSE for the 1-quarter and the 4-quarters-ahead forecast horizons and the BVAR delivers the lowest RMSE for the 8-quarters-ahead horizon. Although the time series models show a lower RMSE than the forecasts generated from the NKPC for all horizons considered, their forecast – in the particular case the AR forecast – is only significantly better than the NKPC forecast for the 1-quarter-ahead horizon. Thus, our exercise shows that time series models perform better than the NKPC only for forecast horizons exceeding 3 months. Since longer horizons are more relevant for monetary policy than the very short run, our results suggest some potential of NKPC models.

This paper is structured as follows: Chapter 2 briefly introduces the specifications of the New Keynesian Phillips Curve model which are estimated for Austria and presents the forecasts generated from these specifications. In chapter 3 the forecasts of the Bayesian VAR and the AR model are presented and chapter 4 contains the evaluation and comparison of the forecasting performance of the different models. Chapter 5 concludes the paper.

II. Forecasts from the New Keynesian Phillips Curve

II.1 The open economy New Keynesian Phillips Curve

The version of the NKPC which is estimated and used to derive the forecasts in this paper is an open-economy extension of the hybrid New Keynesian Phillips Curve. The hybrid NKPC was introduced by Galí and Gertler (1999) and it is hybrid in the sense that it contains past inflation as well as future inflation and marginal cost as explanatory variables. Thus, it displays features of the traditional as well as of the new Phillips Curve. The open-economy extension was developed and is discussed at length in Rumler (2006a). The baseline closed-economy NKPC is extended by the introduction of international trade as well as intermediate inputs in production. Specifically, two factors of production in addition to domestic labor are assumed to enter the production function of the representative firm: imported and domestic intermediate inputs. This allows import prices and the prices of intermediate inputs to affect firms' marginal costs and ultimately inflation. The resulting NKPC for this open-economy model is

$$\pi_t = E_t \frac{\theta\beta}{\Delta}\pi_{t+1} + \frac{\omega}{\Delta}\pi_{t-1} + \frac{(1-\theta)(1-\omega)(1-\theta\beta)}{[\varepsilon(\phi-1)+1]\Delta}[mc_t], \tag{1}$$

where θ represents the Calvo probability that a firm adjusts its price in a given period, β is the steady-state discount factor, ω is the fraction of firms following a backward-looking rule of thumb in price setting, ε is the elasticity of demand, and $\Delta = \theta + \omega[1-\theta(1-\beta)]$. So far, the expression in (1) looks like the standard NKPC in structural form which is extensively used in the literature. The only difference between the open-economy NKPC and the standard model is the marginal cost expression (in square brackets), which now contains a number of additional variables:

$$mc_t = \left[\begin{array}{l} \hat{s}_{nt} - (\phi-1)\dfrac{\bar{s}_{m^d}+\bar{s}_{m^f}}{1+(1-\phi)\left(\bar{s}_{m^d}+\bar{s}_{m^f}\right)}\hat{y}_t + \dfrac{\bar{s}_{m^f}}{1+(1-\phi)\left(\bar{s}_{m^d}+\bar{s}_{m^f}\right)}\left(\hat{p}_t^d - \hat{p}_t^f\right) - \\ \left[(1-\rho)\dfrac{\bar{s}_{m^d}}{\bar{s}_n+\bar{s}_{m^d}+\bar{s}_{m^f}} + \rho\dfrac{\bar{s}_{m^d}}{1+(1-\phi)\left(\bar{s}_{m^d}+\bar{s}_{m^f}\right)}\dfrac{\bar{s}_n}{\bar{s}_n+\bar{s}_{m^d}+\bar{s}_{m^f}}\right]\left(\hat{w}_t - \hat{p}_t^d\right) - \\ \left[(1-\rho)\dfrac{\bar{s}_{m^f}}{\bar{s}_n+\bar{s}_{m^d}+\bar{s}_{m^f}} + \rho\dfrac{\bar{s}_{m^f}}{1+(1-\phi)\left(\bar{s}_{m^d}+\bar{s}_{m^f}\right)}\dfrac{\bar{s}_n}{\bar{s}_n+\bar{s}_{m^d}+\bar{s}_{m^f}}\right]\left(\hat{w}_t - \hat{p}_t^f\right) \end{array}\right], \tag{2}$$

with s_n, s_{m^d} and s_{m^f} representing the shares of: labor (n), domestic intermediate inputs (m^d) and imported intermediate inputs (m^f) in total domestic production, ρ representing the elasticity of substitution between the input factors, and $\phi = \frac{(\varepsilon - 1)\left(1 + \bar{s}_{m^d} + \bar{s}_{m^f}\right)}{\varepsilon\left(\bar{s}_n + \bar{s}_{m^d} + \bar{s}_{m^f}\right)}$. The variables w, p^d and p^f, in turn, represent the prices of the input factors labor (wages), domestic and imported intermediate inputs. Hatted variables denote deviations from the steady state, and barred variables represent steady-state values.

Equation (2) shows that, unlike in the standard model, marginal cost in the extended model is not just a function of real unit labor cost, s_n, but also of the relative prices of the three production factors: the relative price of domestic labor and of domestic intermediate inputs (the real wage), $w - p^d$, of domestic labor and imported intermediate inputs, $w - p^f$, and of domestic and imported intermediate inputs (the terms of trade), $p^d - p^f$. The weights with which the relative prices enter marginal cost are determined by the steady-state shares of the three factors of production and the elasticity of substitution between them.[2]

Hence, this general formulation of the open-economy NKPC nests the existing formulation of the Phillips curve model for the closed economy and for the open economy without domestic intermediate inputs. If the share of domestic intermediate inputs in production is set at $s_{m^d} = 0$, we obtain the open-economy Phillips curve model of Leith and Malley (2003); if we additionally set the share of imported intermediate inputs at $s_{m^f} = 0$, the model collapses to the standard closed-economy NKPC.

II.2 Estimation Results and Forecasting with the NKPC

Our empirical strategy to generate forecasts from the NKPC starts with the estimation of the structural parameters of the NKPC presented in equations (1) and (2) using Austrian data from 1980Q1 to 1999Q4. As the model contains future inflation as an explanatory variable, we estimate the equation with GMM, which is frequently used in the literature for this type of model

[2] For the derivation of the open-economy NKPC see Rumler (2006a).

(Galí et al., 2005). Since we do not a priori know which of the nested versions of the NKPC outlined above performs best, the model is estimated for all three specifications: the specification for the closed economy (SP1), for the open economy without domestic intermediate inputs (SP2) and for the general open economy specification shown in equation 2 (SP3). Because our focus is on forecasting inflation, we use the year-on-year change of the Austrian quarterly HICP as the dependent variable in the regressions instead of the GDP deflator which is used in most of the literature (see the data description in the Appendix for the definitions of the other variables).

Table 1 summarizes the estimation results of the structural parameters of the extended NKPC in (1) and (2) for the specifications SP1, SP2 and SP3. The columns contain the estimated coefficients for the share of firms that keep prices fixed in a given period (which can be interpreted as the degree of structural price rigidity), $\hat{\theta}$, for the firms' discount factor, $\hat{\beta}$, for the share of firms that follow a backward-looking rule of thumb (indicating the degree of intrinsic inflation persistence), $\hat{\omega}$, and for the elasticity of substitution between input factors, $\hat{\rho}$. The (Newey-West corrected) standard errors of the coefficient estimators are given in parentheses.

Table 1: Estimation of the Structural Parameters of Model Specifications SP1, SP2 and SP3 for the Extended New Keynesian Phillips Curve for Austria

Dependent variable: yoy rate of inflation according to the quarterly HICP

	$\hat{\theta}$	$\hat{\beta}$	$\hat{\omega}$	$\hat{\rho}$
SP1	0.47 (0.05)	0.99 (0.01)	0.17 (0.07)	–
SP2	0.47 (0.05)	0.98 (0.01)	0.32 (0.06)	3.35 (0.98)
SP3	0.50 (0.04)	0.96 (0.01)	0.35 (0.06)	4.05 (0.92)

Instrumental variables: inflation rate lags 2-6, wage inflation lags 1-4, commodity price inflation lags 1-4, real unit labor costs lags 1-4, ratio of wages to import prices lags 1-4.

Notes: Estimation method is GMM. Estimation period is 1980Q1-1999Q4.

All parameters look very reasonable: Under all specifications about 50% of the Austrian firms leave their prices unchanged during a given quarter. This implies an average price duration of about 6 months, which is substantially lower than a mean duration of 11 months derived from micro CPI data (see Baumgartner et al., 2005).The steady-state discount factor of firms' profits shows a value lower but close to 1 as expected from theory. The share of backward-looking firms differs according to the specification and varies between 17% and 35%. A comparison of the parameters for Austria with other euro area countries can be found in Rumler (2006a).[3]

From these estimations we construct a forecast for each of the three specifications. It is not possible to generate a forecast directly from the NKPC as it contains expected inflation for which we usually have no reliable data. Therefore, we propose an "indirect" method to generate a forecast making use of the present-value formulation of the NKPC. To our knowledge, this is the first attempt in the literature to use the NKPC for inflation forecasting. The starting point is the concept of the fundamental rate of inflation as introduced by Galí and Gertler (1999), which ultimately goes back to Campbell and Shiller (1987). To arrive at fundamental inflation, the NKPC (which is a difference equation) is solved explicitly for current inflation. The solution yields inflation as a function of the discounted sum of present and future marginal costs. Thus, fundamental inflation is the rate of inflation implied from the present-value formulation of the NKPC. In the case of the hybrid NKPC the present-value representation is

$$\pi_t = \delta_1 \pi_{t-1} + \left(\frac{\lambda}{\delta_2 \gamma_f}\right) \sum_{s=0}^{\infty} \left(\frac{1}{\delta_2}\right)^s E_t\left[mc_{t+s}\right], \tag{3}$$

where $\delta_1 = \dfrac{1-\sqrt{1-4\gamma_f \gamma_b}}{2\gamma_f}$ and $\delta_2 = \dfrac{1+\sqrt{1-4\gamma_f \gamma_b}}{2\gamma_f}$ are the stable and unstable roots of the above second-order difference equation. The parameters γ_f, γ_b and λ are the coefficients of the reduced-form hybrid NKPC

$$\pi_t = \gamma_f E_t(\pi_{t+1}) + \gamma_b \pi_{t-1} + \kappa(mc_t), \tag{4}$$

which are calculated from the estimated structural parameters. Computing fundamental inflation according to equation (4) requires multi-period forecasts of marginal cost. Campbell and Shiller (1987) propose to generate them from a bivariate VAR of inflation and marginal cost. Thus, fundamental inflation can be calculated as

$$\pi_t^* = \delta_1 \pi_{t-1} + \left(\frac{\lambda}{\delta_2 \gamma_f}\right) e_1' \left(1 - \frac{1}{\delta_2} A\right)^{-1} Z_t \tag{5}$$

[3] The parameters in Table 1 cannot be directly compared to the results for other countries in Rumler (2006a) or in other papers because they are based on changes in the HICP as opposed to the GDP deflator as the dependent variable. From Rumler (2006a) it emerges that the degree of price rigidity in Austria estimated from the NKPC roughly corresponds to the average of the euro area countries.

where A is the companion matrix of a VAR(1) on $Z_t = [mc_t, \pi_t]'$ and e_1' is a selection vector that singles out the forecast of marginal cost.

In the paper by Galí and Gertler (1999) and in a number of successive contributions fundamental inflation has been mainly used to assess the empirical fit of the NKPC by comparing it to actual inflation. In this paper we propose to extend this methodology to generate a forecast of fundamental inflation which we interpret as the inflation forecast implied by the NKPC. This requires only a small additional step: We lead expression (5) by one period and make use of the fact, which was used in the construction of (5), that the one-period-ahead forecast of *Z* is $\hat{Z}_{t+1} = AZ_t$. Thus, we can express next-period fundamental inflation only using current variables. This forecast of fundamental inflation for *t+1* based on information of period *t* can be used to calculate a forecast for the next period *t+2* and so on iteratively for *t+3*, … *t+h*. The generalization of this principle yields a *h*-step forecast of the fundamental rate of inflation which we interpret as the inflation forecast implied by the (present-value formulation of the) NKPC:

$$\hat{\pi}^*_{t+h} = \delta_1 \pi^*_{t+h-1} + \left(\frac{\lambda}{\delta_2 \gamma_f} \right) e_1' \left(1 - \frac{1}{\delta_2} A \right)^{-1} A^h Z_t . \qquad (6)$$

In order to evaluate the forecasting performance over different horizons we generate forecasts according to this procedure for 1-quarter, 4-quarters and 8-quarters-ahead over the period 2000Q1 to 2006Q4. Figures 1 to 3 show the forecasts derived from the three specifications of the NKPC for each horizon along with actual inflation. These figures give some indication that for each horizon the open-economy model without domestic intermediate inputs (SP2) delivers the best forecast among the Phillips Curve specifications, but this will be analyzed formally in section IV.

Figure 1: 1-Quarter-Ahead Inflation Forecasts based on the NKPC and Actual Inflation

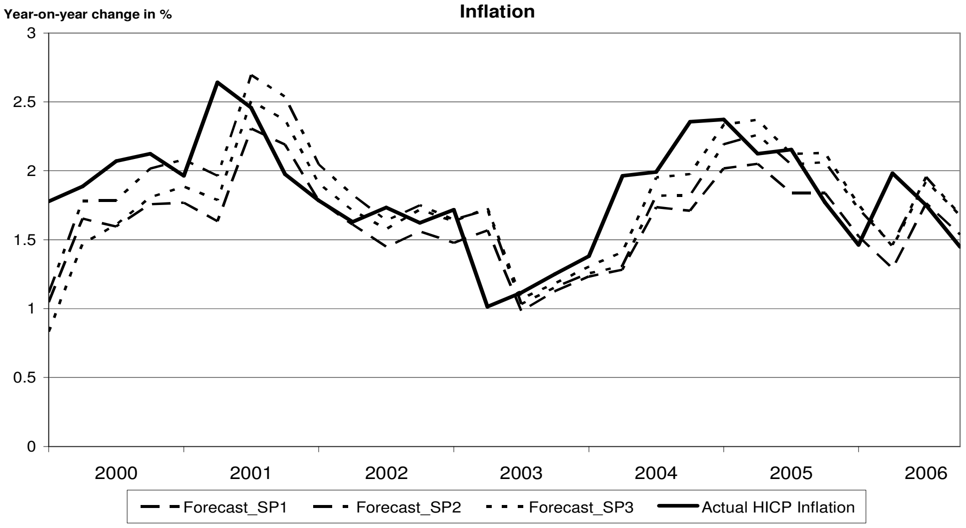


Figure 2: 4-Quarters-Ahead Inflation Forecasts based on the NKPC and Actual Inflation

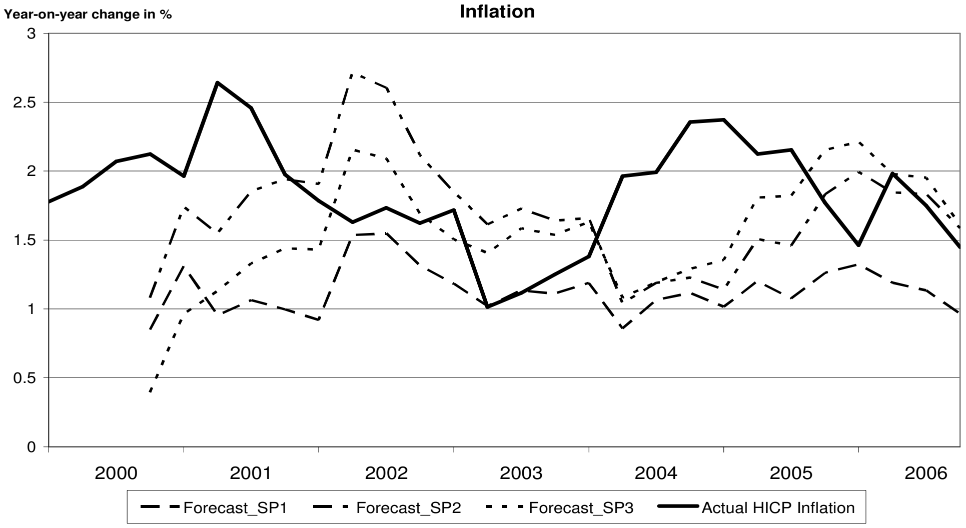
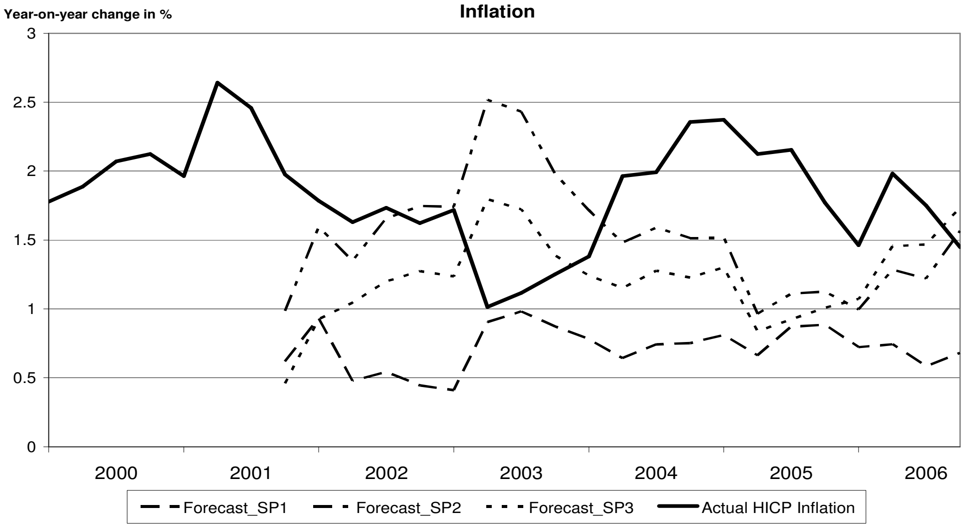


Figure 3: 8-Quarters-Ahead Inflation Forecasts based on the NKPC and Actual Inflation



III. Forecasts from Time Series Models

In order to compare the forecasting performance of the NKPC, we estimate a VAR model to forecast Austrian inflation using Bayesian techniques. This type of model has the advantage over an AR or a classical VAR in that, while taking advantage of multivariate analysis, it avoids the problem of over-fitting by putting prior constraints to reduce the amount of information needed to estimate the model. In other words, Bayesian VARs allow for more degrees of freedom by incorporating prior beliefs to the initial estimation.[4] There is a rather long tradition of using this type of model to forecast inflation.[5]

Using a similar data set as in the first part of the paper (quarterly data up to 1999) we estimate a Bayesian VAR with 4 variables. We assume that inflation is driven by aggregate demand and supply shocks. Thus, we include the HICP, a measure of economic activity (real GDP) and two variables that represent supply shocks (wages, proxied by compensation per employee, and the oil price) in our particular model. With these variables we build a vector autoregressive system with three lags which we estimate using Bayesian priors. In particular, we use a Minnesota prior with the following hyperparameters: overall tightness 0.1, decay parameter 0.8 and a symmetric weighting matrix with values at 0.5. These "inexact" priors are rather standard in the literature for forecasting purposes.[6]

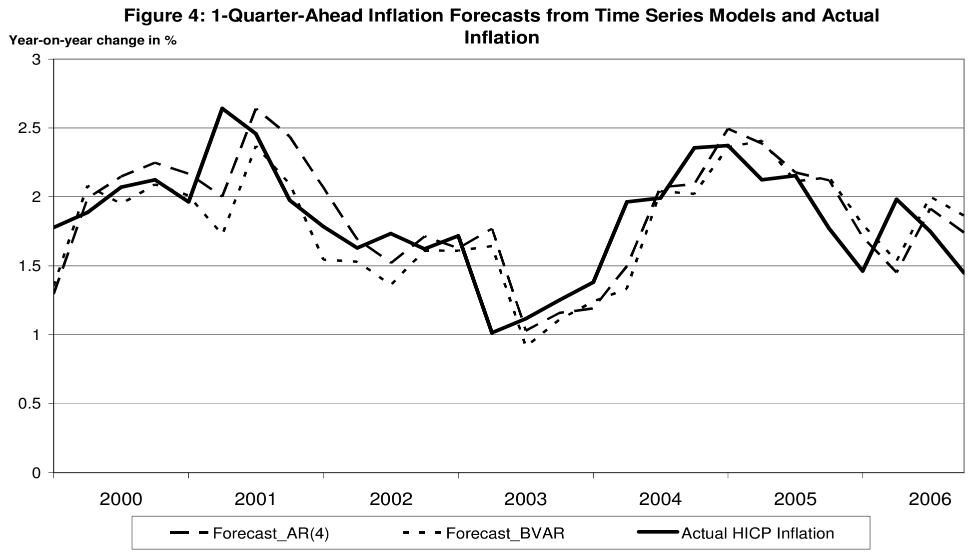
As the third model type that is used in the forecast comparison we employ a univariate time series model. Univariate autoregressive models have been widely and successfully used for forecasts of macroeconomic variables that are characterized by a high degree of persistence, such as inflation. Therefore, the forecast based on the AR model serves as a benchmark against which the forecasting performance of the other models is evaluated. Equivalently to the NKPC model, we estimate the BVAR and the AR(4) model for quarterly Austrian HICP inflation for the period 1981Q1-1999Q4 and construct 1-step, 4-steps and 8-steps-ahead forecasts for the period 2000Q1-

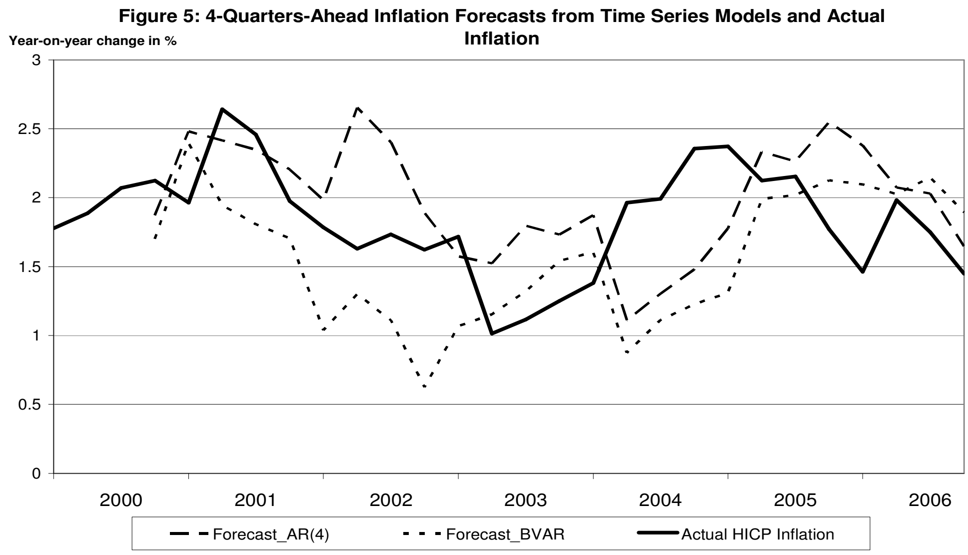
[4] See Robertson and Tallmann (1999) for a very intuitive explanation of BVAR models.

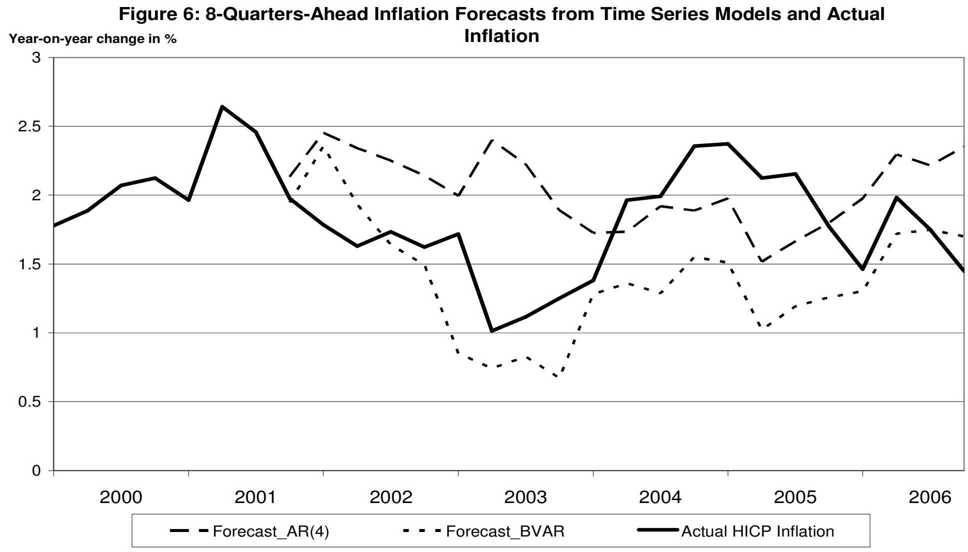
[5] See Kenny et al. (1998) and the references therein, for examples of inflation forecasts using BVAR models or more recent papers such as Lack (2006) and Nobili (2005).

[6] Specifications with other priors and especially with more exact weighting parameters were also estimated. However, there was no or only a negligible gain in forecasting performance compared to our specification.

2006Q4. The resulting forecasts are shown in Figures 4 to 6 for each forecast horizon. A quick visual comparison between Figures 1 to 3 and Figures 4 to 6 gives some indication that the time series models (in Figures 4 to 6) yield a better forecasting performance than the three specifications of the NKPC.







IV. Forecast Evaluation

For the evaluation of the performance of the different models over various forecast horizons we construct series of 1-step, 4-step and 8-step-ahead out-of-sample forecasts. Specifically, we estimate the models for the period 1981Q1 to 1999Q4, generate 1-period, 4-periods and 8-periods-ahead forecasts, move one quarter forward and calculate new 1-period, 4-periods and 8-periods-ahead forecasts, and so on. This procedure continues until the last 1-period, 4-periods and 8-periods-ahead forecast has reached the end of the validation period, i.e. 2006Q4. By stacking the last forecast values of each forecast we obtain series of 1-step, 4-step and 8-step-ahead forecasts which are then used to compute forecast error statistics and test statistics.[7]

We first assess the forecasting performance of the NKPC models, the BVAR and the AR(4) model by comparing the root mean square errors (RMSE) of the forecasts of the corresponding models and of the naïve forecast (assuming a flat forecast profile over the forecast horizon). The naïve forecast is frequently used as a benchmark in the literature on forecast evaluation, as it has been found to be hard to outperform by other models in the medium to long term for many macroeconomic variables, among them also inflation. The results are shown in Table 2.

[7] In case of the 1-step-ahead forecasts this gives us 28 observations for comparison and evaluation of the forecasts, in case of the 4-step-ahead forecasts 25 observations and in the case of the 8-step-ahead forecasts 21 observations.

Table 2: Root Mean Square Forecasting Error (RMSE) for Inflation Forecasts based on the New Keynesian Phillips Curve, BVAR, AR(4) Models and the Naïve Forecast by Forecasting Horizon (calculated over the period 2000Q1-2006Q6)

Models	RMSE 1-quarter-ahead	RMSE 4-quarters-ahead	RMSE 8-quarters-ahead
NKPC SP1	0.39	0.85	1.11
NKPC SP2	0.35	0.67	0.74
NKPC SP3	0.38	0.73	0.79
BVAR	0.33	0.61	**0.56**
AR(4)	**0.31**	**0.54**	0.61
Naïve	0.33	0.63	0.72

From the table we can see that – for the evaluation period considered (2000Q1-2006Q4) – none of the specifications of the NKPC is able to outperform the time series models nor the naïve forecast in terms of predictive accuracy for all three forecast horizons.[8] The simple AR model is the best-performing model for the 1-quarter and 4-quarters horizons, while the BVAR shows the best performance for the 8-quarters horizon. Among the NKPC specifications the open-economy specification SP2 (with imported but without domestic intermediate inputs in the production function) delivers the relatively best predictive performance for all three horizons. In general, we notice increasing forecast errors with the length of the forecast horizon, with the notable exception of the BVAR which delivers a smaller forecast error for the 8-quarters-ahead forecasts than 4-quarters-ahead. Also, the variation of the RMSE among the different models grows with the forecast horizon, with only small differences in forecast performance for the 1-quarter horizon and more pronounced differences for the 4- und 8-quarters horizons.

In addition to the analysis of the RMSE, we also perform a formal test to check if the differences in predictive accuracy among models are also statistical significant. For that purpose we employ a modified version of the Diebold-Mariano test proposed by Harvey et al. (1997).[9] The modification tries to correct for the poor size property of the Diebold-Mariano test in small samples. The modified Diebold-Mariano test is applied to test the null hypothesis of equal predictive accuracy between the best performing model according to the RMSE (the AR(4)

[8] This result is specific to the evaluation period considered. For a shorter alternative evaluation period ranging from 2003Q1 to 2006Q4 we found that the NKPC (SP3) performs slightly better than the BVAR for the 1-quarter and the 4-quarters-ahead forecasts, but never better than the AR(4) forecasts.

[9] The definition of the test statistic along with information on its distribution can be found in Moser et a. (2007).

model for 1-step and 4-steps-ahead and the BVAR for 8-steps-ahead) and the other models (except the naïve forecast). Since we are mainly interested in finding significant differences in forecasting performance between the NKPC and the other models, we only consider the best-performing specification of the NKPC, i.e. SP2, in Table 3.[10] When interpreting the results, however, we have to bear in mind that the calculation of the test statistics is based on a maximum of 28 quarterly observations, which is at the lower end of delivering reliable results.

Table 3: Comparing the Forecasting Performance of the New Keynesian Phillips Curve, BVAR and AR(4) Models by means of the Modified Diebold-Mariano Test

Forecast comparisons	mod. DM statistic 1-quarter-ahead	mod. DM statistic 4-quarters-ahead	mod. DM statistic 8-quarters-ahead
AR(4) vs. NKPC	1.81*	1.62	1.30
AR(4) vs. BVAR	0.69	0.84	
BVAR vs. NKPC	0.50	1.00	1.43
BVAR vs. AR(4)			0.30

Notes: Evaluation period is 2000Q1-2006Q4. *, ** and *** indicates rejection of the null of equal predictive accuracy at the 10%, 5% and 1% significance levels, respectively.

According to Table 3 the forecast derived from the AR(4) model is significantly more accurate (at the 10% level) than the forecast based on the NKPC only for the 1-quarter forecast horizon. All other comparisons of the forecasting performance between the different models do not show a significant difference – even if the absolute differences in RMSE are larger than for the short horizon. Thus, for the longer horizons (4-quarters and 8-quarters-ahead) the best specification of the NKPC – despite its higher RMSE – does not show a significantly worse forecast performance than the time series models.

To sum up, for a forecast horizon up to one year a simple AR model delivers the best forecast of the models considered, while for the longer horizon of 2 years the BVAR outperforms the other two models. The forecasts derived from the New Keynesian Phillips Curve cannot outperform the time series models and the naïve forecast for any horizon. But the competing forecasts are not

[10] We performed modified Diebold-Mariano tests between all pairs of models. Apart from the results reported in the table, we found significant differences between the poorest performing specification of the NKPC and the best model for each horizon. The results are available upon request.

significantly better than the NKPC forecast except for the 1-quarter-ahead horizon in the case of the AR forecast.

V. Conclusions

The New Keynesian Phillips Curve is currently the most widely accepted theory of inflation dynamics in modern macroeconomics. Until now it has been used in a number of studies to explain inflation developments and to estimate the structural parameters of the price setting process, but has never been used for forecasting purposes. The main contribution of this paper is that we develop a method of generating a forecast of inflation from the New Keynesian Phillips Curve. Starting from the concept of fundamental inflation we extend the methodology by expressing current fundamental inflation only with lagged variables. Iteratively we construct a series of multi-step forecasts of fundamental inflation which we interpret as the inflation forecasts implied by the NKPC. We evaluate the performance of these forecasts by comparing them systematically with the forecasts generated from a Bayesian VAR, an AR model and the naïve forecast for 1-quarter, 4-quarters and 8-quarters horizons.

The evaluation of the forecasting quality of the NKPC, the Bayesian VAR and the AR model shows that the NKPC model cannot beat the forecasts derived from the time series models and the naïve forecast, neither over a short nor over a longer-term forecast horizon. This confirms the results in the forecasting literature that forecasts based on structural models, such as the NKPC, cannot seriously compete with time series models for shorter forecast horizons. However, we also find that none of the time-series methods used can significantly outperform the best performing specification of the NKPC (SP2), except at a very short horizon (1 quarter). This implies that not only the in-sample fit of the NKPC but also its forecasting performance can be significantly improved by using the open economy specification of the NKPC developed in Rumler (2006a).

One reason for the relative inferior performance of the NKPC model could be the relatively complex construction of the inflation forecast of the NKPC, which is based on an auxiliary forecast of future marginal cost using a bivariate VAR model. Thus, the quality of the inflation forecast depends crucially on the quality of the auxiliary forecast of future marginal cost. The forecast of the marginal cost, in turn, is based on a very simple method whose quality cannot be verified, as the discounted sum of present and future marginal costs is not observable. A possible future extension of our research could therefore be to improve the auxiliary forecast of marginal cost by applying more sophisticated methods.

However, even if the NKPC does no better job in forecasting inflation than time series models, it may still be used complementary to these models as it is a structural model of inflation determination. The advantage of structural models in forecasting is that they allow an economic interpretation of the main factors driving the forecast to be made. In our version of the NKPC variations in inflation can be traced back to changes in (the expectation of future) marginal costs which are, in turn, determined by the cost of labor and the prices of domestic as well as imported intermediate inputs.

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Appendix

Data Description

The year-on-year log change of the Austrian HICP at quarterly frequency is used as the inflation variable in all estimations. For the estimation of the NKPC real unit labor cost, s_n, is defined as the nominal total compensation to employees divided by nominal GDP, and s_{m^d} as well as s_{m^f} are the ratios of domestically produced and imported intermediate goods to nominal GDP. y denotes real GDP, domestic nominal wages per employee are used for w, and the domestic GDP deflator and the import deflator are used as proxies for p^d and p^f, respectively. HICP inflation, real GDP, nominal compensation per employee and oil prices are used in the Bayesian VAR. All data (except oil prices) stem from the Austrian System of National Accounts (ESA 79 until 1988, ESA 95 from 1988); input/output tables available for the sample period were used to separate intermediate inputs into domestic and imported shares.