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Inflation as a Global Phenomenon—Some Implications for Policy Analysis and Forecasting*

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Abstract

We evaluate the performance of inflation forecasts based on the open-economy Phillips curve by exploiting the spatial pattern of international propagation of inflation. We model these spatial linkages using global inflation and either domestic slack or oil price fluctuations, motivated by a novel interpretation of the forecasting implications of the workhorse open-economy New Keynesian model (Martínez-García and Wynne (2010), Kabukcuoglu and Martínez-García (2014)). We find that incorporating spatial interactions yields significantly more accurate forecasts of local inflation in 14 advanced countries (including the U.S.) than a simple autoregressive model that captures only the temporal dimension of the inflation dynamics.

JEL Classification: C21; C23; C53; F41; F62.

KEY WORDS: Inflation Dynamics; Open-Economy Phillips Curve; Forecasting.

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1 Introduction

> "Forewarned, forearmed: to be prepared is half the victory!"
>
> Don Quixote by Miguel de Cervantes (1547-1616)

The Phillips curve, which postulates a short-run relationship between inflation and aggregate economic activity, has been widely used in forecasting and for explaining the dynamics of inflation. Not surprisingly, Phillips curve-based forecasting models have featured prominently in macroeconomic research, on monetary policy debates and in the formation of public and private expectations about future inflation. However, an important strand of the literature that began with Atkeson and Ohanian (2001) has documented the declining accuracy of Phillips curve-based forecasts of inflation during the Great Moderation period and has challenged the practical relevance of the Phillips curve itself.

Atkeson and Ohanian (2001) find that Phillips curve-based forecasts of U.S. inflation have become less accurate relative to those obtained from naïve specifications, judging by conventional metrics of forecasting performance such as the mean squared forecast error (MSFE). An extensive survey by Stock and Watson (2008) suggests that Phillips curve-based forecasts, and related univariate models, produce accurate forecasts only occasionally. Moreover, the weak forecasting performance observed with reduced-form forecasting models based on the Phillips curve relationship is found also when pursuing more structural approaches (see, e.g., Edge and Gürkaynak (2010)).

Based on this literature, we believe it is important to investigate the potential misspecification of the conventional Phillips curve-based forecasting models. We focus on the misspecification arising from globalization—i.e., from the greater integration of the world economy through trade in goods, capital and labor—taking into account explicitly the cross-country, spatial dimension connecting the dynamics of local inflation with developments in the rest of the world. Related to that, we believe it is key to also investigate whether and how correcting for it can be helpful for forecasting inflation.

In particular, we aim to evaluate how the spatial dimension of international inflation helps understand and forecast local inflation. We are motivated, on the one hand, by the ongoing debate among policymakers over the role of globalization (Bernanke (2007), Fisher (2005), Fisher (2006)); on the other hand, by the existing theoretical and empirical literature on the global slack hypothesis which posits that it is global, and not solely domestic, economic slack what drives local inflation (Martínez-García and Wynne (2010), Martínez-García (2015)). In other words, we adopt a framework—proposed by Kabukcuoglu and Martínez-García (2014)—that extends the Phillips curve to an open-economy-setting for forecasting.

Our analysis is grounded on the theoretical underpinnings of the global slack hypothesis and aims to investigate the spatial linkages of the open-economy Phillips curve model—to tie inflation to global measures of inflation *and* to incorporate a richer characterization of international spillovers than currently considered in the literature. To our knowledge, the existing literature studying inflation forecasting has not fully recognized and incorporated the spatial effects on local inflation imposed by the open-economy Phillips curve in the existing forecasting models. This gap in the literature is an additional reason to reconsider the problem of forecasting inflation from an open-economy perspective and assessing the forecasting gains that can be attained.

We forecast inflation taking into account the spatial linkages explicitly for the U.S. (and across a sample of 14 countries, including the U.S., which are representative of the major advanced economies) and evaluate the performance of such forecasting models based on the open-economy Phillips curve against a simple autoregressive process for inflation. In this paper, we show that the interconnectedness that arises in theory can be incorporated directly into a univariate, open-economy Phillips curve-based model for inflation forecasting that includes global inflation and domestic slack or, alternatively, global inflation and some measure of oil price fluctuations. With those theoretical predictions in mind, the spatial effects are incorporated into each country model with global inflation; then, we extend the model with global inflation to explore two complementary perspectives on inflation forecasting suggested by theory:[1]

- First, we combine global inflation and a measure of economic activity—domestic slack, global slack (including the Kilian (2009) index)—as indicated by our open-economy theoretical model. We consider both headline and core CPI inflation measures and use statistically-based (first-differenced and HP-filtered) output gap series, based on industrial production (IP) and real GDP.
- Second, we evaluate the predictive performance of global inflation and oil prices to broadly capture fluctuations in terms of trade. We construct model which uses the West Texas Intermediate (WTI) oil price series (first-differenced and HP-filtered) to forecast inflation.[2]

We conduct pseudo out-of-sample forecasts for a pair of inflation measures at horizons varying between 1-quarter to 12-quarters ahead. In particular, we use headline CPI and core CPI (all items ex. food and energy). Our benchmark estimation and forecast periods are 1984:Q1-1996:Q4 and 1997:Q1-2015:Q1, respectively. In any given country forecasting model, the goal is to understand how taking into account international linkages and spatial effects in the global macroeconomy contribute to forecasting accuracy. Therefore, we evaluate and compare the following forecasting models for the U.S. and 13 other advanced economies:

1. A univariate forecasting model: autoregressive (AR) process of inflation (our comparison benchmark).
2. A univariate forecasting model motivated by the closed-economy and open-economy New Keynesian Phillips curves, constructed with an autoregressive distributed lag (ADL) model of (i) lagged inflation and domestic slack, and (ii) lagged inflation and global slack derived from IP or real GDP data or lagged inflation and WTI oil price fluctuations.
3. A univariate autoregressive distributed lag (ADL) model using lagged inflation and global inflation alone based on data from a large group of advanced economies, with no other explanatory variables for forecasting. We consider different weighting schemes to account for the relative proximity across countries based on bilateral distance, geography, population size or economic ties.
4. A univariate autoregressive distributed lag (ADL) model using lagged inflation together with: (i) global inflation plus domestic slack, (ii) global inflation plus global slack, and (iii) global inflation

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[1] The data sources are described in great detail in Grossman et al. (2014). Data availability varies across slack and inflation series. Hence, only a subset of the 40 countries covered in the database of Grossman et al. (2014) is included in each of our empirical evaluations. Details on which countries are included in each exercise can be found in the Appendix A.

[2] The predictive content of oil prices might be exploited under an open-economy Phillips curve relationship that ties inflation to global economic activity. The mechanism we suggest here is also a novel explanation in the literature that captures a terms-of-trade channel of inflation through the open-economy Phillips curve. Moreover, we should note that global economic activity is known to be closely linked to movements in oil prices (see, for example, Kilian (2009), Plante and Yücel (2011)) and headline inflation, in particular, is often argued to reflect the movements of oil prices—at least in the short- and medium-run (Neely (2015)).

plus WTI oil price fluctuations. The slack measures are based on IP and real GDP data. As also indicated before, we consider different aggregation schemes for both global inflation and global slack to capture different notions of relative proximity across countries.

Our metric to assess forecasting accuracy is the mean squared forecast error (MSFE) of a given model against that of the benchmark AR model. We follow Clark and McCracken (2005) to calculate the critical values for the F-test statistic whenever possible, and extend their test to nested models with more than one regressor (see Appendix B). We conduct our comparison exercise across models for the U.S. and also extend our analysis to a sample of 14 advanced countries (including the U.S.) to show that our results are robust on a wide range of country experiences, and supportive of models 3 and 4. Hence, our results are consistent with the theory of inflation forecasting we develop in the paper through the lens of the open-economy New Keynesian model.

1.1 Related Literature

Kabukcuoglu and Martínez-García (2014) analyze the theoretical underpinnings of the global slack hypothesis and present supportive empirical evidence of its role during the Great Moderation period.[3] Their findings also suggest that exploiting conventional measures of global economic slack to validate the global slack hypothesis cannot be done without difficulty, since the quality and availability of output measures varies significantly across countries. Moreover, estimating the unobservable potential output of the economy is not a simple task either and generally leads to a joint testing problem given that failing to detect a relationship between inflation and global slack can be due to misspecification of the output potential rather than evidence to invalidate the open-economy Phillips curve relationship posited by theory.

As a result, the evidence for the global slack hypothesis appears as largely mixed. On the one hand, Binyamini and Razin (2007), and Martínez-García and Wynne (2010) looking at the New Keynesian theoretical model and Borio and Filardo (2007) and Eickmeier and Pijnenburg (2013) exploring the empirical evidence are generally supportive of the global slack hypothesis. On the other hand, Ball (2006), Ihrig et al. (2007), Pain et al. (2006), Milani (2010) and Milani (2012) find weak or no evidence for the global slack hypothesis. However, all these studies base their analysis on the existing measures of global slack which are unobserved and difficult to pin down precisely in the data.

Kabukcuoglu and Martínez-García (2014) argue that the inconclusive evidence on the global slack hypothesis may simply arises from inaccurate measures of slack, and does not necessarily invalidate the open-economy Phillips curve relationship. In fact, they go on to show that a number of variables—inferred from the workhorse open-economy New Keynesian model—can be found that are easier to measure in practice and can proxy for global slack fluctuations such as U.S. real effective exchange rate, terms of trade, money supply growth and credit growth. Such global slack proxies can be used to construct an open-economy Phillips-curve-based model that outperforms a naïve forecasting model (an autoregressive process of infla-

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[3] The key theoretical insight for modelling inflation dynamics comes from Kabukcuoglu and Martínez-García (2014) which uses the workhorse open-economy New Keynesian model of Martínez-García and Wynne (2010) as a stepping stone to explore the plausibility of the open-economy Phillips curve to explain inflation dynamics. Kabukcuoglu and Martínez-García (2014) go further and argue that structural changes (good luck, improved monetary policy and globalization) may have contributed to some extent to explain the varying dynamics of inflation implied by the New Keynesian model and show that even open-economies may experience shifts in the forecasting performance of models based on the open-economy Phillips curve whenever, for instance, the volatility of shocks changes or monetary policy becomes more anti-inflationary.

tion). It can also generate more accurate forecasts than those based on a closed-economy Phillips curve that relies on domestic economic slack measures alone.

Our paper builds on the work of Kabukcuoglu and Martínez-García (2014) by deriving the key forecasting implications of the open-economy New Keynesian model and articulating both the theoretical as well as the empirical case for using global inflation as a centerpiece for forecasting local inflation consistently with the open-economy Phillips curve (the global slack hypothesis). In its focus on global inflation, our paper is also closely related to another strand of literature that emphasizes the role of the common (global) component of inflation. Ciccarelli and Mojon (2010), Mumtaz and Surico (2012), Mumtaz et al. (2011), Monacelli and Sala (2009), and Neely and Rapach (2011) document the importance of this common component of inflation in the comovements of national inflation rates, by using dynamic factor models.

Building on that empirical evidence, Ciccarelli and Mojon (2010) and Ferroni and Mojon (2014) assess empirically the strong forecasting ability of global inflation for domestic inflation. In a recent paper, Duncan and Martínez-García (2015) provide a theoretical motivation for the relative success of global inflation in forecasting domestic inflation, by considering forecasts under a finite-order VAR approximation of the workhorse open-economy New Keynesian model of Martínez-García and Wynne (2010). Duncan and Martínez-García (2015) document more accurate results based on their Bayesian VAR than those attained with conventional forecasting models (including those based on global inflation alone).

Our paper complements the paper of Duncan and Martínez-García (2015) by exploiting the forecasting implications of the workhorse New Keynesian model specified in Martínez-García and Wynne (2010) to posit a univariate forecasting model that is consistent with theory and explains how measures of global inflation can improve forecasting accuracy, but generally do not suffice to produce efficient forecasts of local inflation—in the sense that these forecasts cannot be improved with additional information. In that sense, we show that measures of domestic slack, oil price fluctuations or, more generally, terms of trade fluctuations can theoretically contribute to attain further gains in forecasting accuracy.

We find based on our empirical results that fully accounting for the global linkages at play in determining inflation dynamics can be very important for inflation forecasting. Our forecast model in the current study has the virtue of simplicity and parsimony—it is a single-equation specification based on the equilibrium open-economy Phillips curve relationship, whereas Duncan and Martínez-García (2015) use the full open-economy New Keynesian model approximated with a finite-order VAR to forecast inflation.

We argue that the univariate model with global inflation suggested by Ciccarelli and Mojon (2010) and Ferroni and Mojon (2014) can in theory be improved for forecasting, but the main gains in forecasting accuracy still arise from adding global inflation as a predictor in part due to the fact that domestic slack or terms of trade gap are unobserved and have to be approximated with statistically-filtered output and oil price series. While we do not dismiss the possibility of a full model such as the finite-order VAR proposed in Duncan and Martínez-García (2015) yielding accuracy gains in forecasting inflation, our paper shows that simpler univariate models can deliver substantial improvements without the added complexity whenever the importance of global linkages in the inflation dynamics is explicitly incorporated through the forecasting regressors of the model.

Our study also relates to another stand of the empirical literature that explores the spatial dimension of inflation for forecasting but from a bottom-up approach. From this alternative perspective, researchers consider the economic linkages among regions within a country to forecast national aggregates. For instance, Marques et al. (2014) study local inflation dynamics incorporating the spatial dimension across the regions of Chile, Nagayasu (2014) does it for Japan, and similarly Yesilyurt and Elhorst (2014) for Turkey. These papers look at geographically-disagreggated data to make inferences on the empirical properties of local inflation. Our paper emphasizes the spatial dimension too, but proposes a top-down approach instead that exploits global inflation to successfully generate more accurate local inflation forecasts.

Finally, in our paper we also contribute to the international macro literature on a number of conceptual points. We argue that the weak forecastability of inflation under closed-economy Phillips curve-based models can be overcome to some extent through the open-economy specification of the New Keynesian model. Our findings, therefore, provide theoretical and empirical support on the importance of global measures in forecasting inflation. Our paper also provides further empirical validation for the view that the Phillips curve is alive and well, as argued by Kabukcuoglu and Martínez-García (2014).

2 A Theoretical Perspective on Forecasting

Building on the workhorse open-economy New Keynesian model synthesized by Martínez-García and Wynne (2010), Kabukcuoglu and Martínez-García (2014) propose a novel approach to relate global developments to domestic inflation using a decomposition method originally advocated by Aoki (1981) and Martínez-García (2015). The analysis can be naturally extended to an $N-$country model (see, e.g., Fukuda (1993)), but for simplicity we retain the stylized two-country setting investigated in Kabukcuoglu and Martínez-García (2014) taking as given that all international linkages between countries other than the domestic economy are already accounted for and subsumed in the specification of the rest-of-the-world aggregates. The full model as well as the model for the world economy are described in great detail in Kabukcuoglu and Martínez-García (2014).

Kabukcuoglu and Martínez-García (2014) argue that a time t forecast of domestic inflation h-quarters-ahead, $\widehat{\pi}_{t+h}$, that is efficient—in the sense that it cannot be improved with additional information—can be achieved by combining two separate forecasts for global inflation, $\widehat{\pi}^W_{t+h}$, and for the inflation differential between the domestic economy and the rest of the world, $\widehat{\pi}^R_{t+h}$, as follows,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}\right) = \mathbb{E}_t\left(\widehat{\pi}^W_{t+h}\right) + \frac{1}{2}\mathbb{E}_t\left(\widehat{\pi}^R_{t+h}\right). \tag{1}$$

This decomposition implies that an efficient forecast for domestic inflation that is consistent with the open-economy New Keynesian model can be constructed by parts combining forecasts for global inflation and the inflation differential.

An important takeaway from the open-economy New Keynesian model is that domestic as well as foreign slack—where slack is defined as the difference between the level of output and that of its potential in logs—play a central role in forecasting inflation. Kabukcuoglu and Martínez-García (2014) note that domestic marginal costs will not necessarily rise even when the domestic economy is operating above potential, if the country is open to the rest of the world. In other words, unlike in the standard closed-economy model, increases in marginal costs depend not just on domestic but also on rest-of-the-world conditions; accordingly, domestic cost pressures arise from a combination of both domestic and foreign slack. Domestic firms then have some scope to pass those marginal cost increases along to their domestic and foreign consumers in the form of higher prices for their goods.

The basic New Keynesian insight is that domestic and foreign slack are related to those cost pressures at home and abroad and, therefore, can help us gauge domestic inflation. Based on the implications of the open-economy New Keynesian model, Kabukcuoglu and Martínez-García (2014) go a step further and show that no variable other than global slack, $\widehat{x}_t^W$, should help improve the forecast of changes in global inflation while no variable other than the difference between domestic and rest-of-the-world slack, $\widehat{x}_t^R$, should help improve the forecast of changes in the inflation differential. Hence, theory suggests that an efficient forecast of domestic inflation can be achieved based on the following model-consistent forecasting specification,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h} - \widehat{\pi}_t\right) = -\theta^W \widehat{x}_t^W - \frac{1}{2}\theta^R \widehat{x}_t^R, \tag{2}$$

where θ^W and θ^R are composite coefficients of the deep structural parameters of the model (as indicated in Kabukcuoglu and Martínez-García (2014)).[4] Furthermore, the forecasting equation in (50) can also be expressed as follows,

$$\begin{aligned}\mathbb{E}_t\left(\widehat{\pi}_{t+h} - \widehat{\pi}_t\right) &= -\theta^W\left(\frac{1}{2}\widehat{x}_t + \frac{1}{2}\widehat{x}_t^*\right) - \frac{1}{2}\theta^R\left(\widehat{x}_t - \widehat{x}_t^*\right) \\ &= -\frac{1}{2}\left(\theta^W + \theta^R\right)\widehat{x}_t - \frac{1}{2}\left(\theta^W - \theta^R\right)\widehat{x}_t^*. \end{aligned} \tag{3}$$

suggesting that expected changes in domestic inflation over the next h-periods can be efficiently forecasted with a weighted measure of Home and Foreign slack (i.e., $\widehat{x}_t$ and $\widehat{x}_t^*$ respectively).

We can assume—as Kabukcuoglu and Martínez-García (2014) and most of the literature implicitly does—that central banks set their monetary policy rule to align nominal interest rates with the natural rate of interest and the central bank's inflation target, responding to deviations of actual inflation from the target and to the slack accumulated in the economy whenever those situations arise. Disturbances to the policy rule modeled as i.i.d. shocks are aimed at capturing non-persistent and unanticipated changes in monetary policy. In such a monetary policy environment, Kabukcuoglu and Martínez-García (2014) show that an equilibrium trade-off naturally emerges in the open-economy New Keynesian model relating global inflation in deviations from a global trend, $\widehat{\pi}_t^W - \overline{\pi}_t^W$, to global slack, $\widehat{x}_t^W$, i.e.,

$$\widehat{\pi}_t^W - \overline{\pi}_t^W = \theta^W \widehat{x}_t^W, \tag{4}$$

where the composite coefficient θ^W, as noted earlier, depends on the deep structural parameters of the model.

The theoretical relationship in (4) arises from the solution of the workhorse model explored in Kabukcuoglu and Martínez-García (2014), but the principle underlying the result is more general and applicable to a large class of open-economy New Keynesian models. The workhorse model simply illustrates in a mathematically tractable manner that if there exists a Phillips curve relationship linking global inflation and global slack, then global inflation should have information content about the unobserved global slack that can be

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[4] Forecasting future inflation using the output gap measures alone would not be accurate since differential inflation potentially has a stochastic trend while slack measures are stationary; one needs to include among the regressors some variable with a similar stochastic trend to that of inflation. Current inflation itself has the same stochastic trend, so including it to forecast future differential inflation takes care of the trend component without the need to include any other regressors to attempt to track the stochastic trend. That is why the forecasting equation presented here (and all subsequent variants) are expressed in terms of changes in the domestic inflation rate.

exploited for forecasting. In fact, in this case the forecasting equation in (50) combined with the Phillips-curve-type relationship noted in (4) imply that,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}-\widehat{\pi}_t\right)=-\left(\widehat{\pi}_t^W-\overline{\pi}_t^W\right)-\frac{1}{2}\theta^R\widehat{x}_t^R. \tag{5}$$

This forecasting equation suggests that global inflation in deviations should help forecast changes in domestic inflation, and contributes to partly account for the international linkages across countries suggested by theory.

Forecasting equation (54) also indicates that global inflation alone does not suffice to generate an efficient forecast of domestic inflation. These forecasts might be improved if we augment the model with a reliable measure of the slack differential between the domestic and rest-of-the-world economies, $\widehat{x}_t^R$. Given that, we argue that the open-economy New Keynesian model provides a theoretical basis for the growing empirical literature on inflation forecasting that relies on global inflation (see, e.g., Ciccarelli and Mojon (2010) and Ferroni and Mojon (2014)). However, we also note that our theory suggests there is additional scope to improve forecasting accuracy by incorporating a good measure of differential slack as well.

For that reason, we propose two potential extensions of the forecasting model specification given in (54) motivated by theory. First, we recognize that the inflation differential in the open-economy New Keynesian model may arise from movements in the terms of trade. Martínez-García and Wynne (2010) show that differential slack can be proxied by the terms of trade gap, $\widehat{tot}_t-\widehat{\overline{tot}}_t$, as follows,

$$\widehat{x}_t^R=\frac{1}{\kappa}\left(\widehat{tot}_t-\widehat{\overline{tot}}_t\right), \tag{6}$$

where κ is a composite coefficient of the deep structural parameters of the model. Hence, the forecasting equation in (54) can alternatively be expressed as,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}-\widehat{\pi}_t\right)=-\left(\widehat{\pi}_t^W-\overline{\pi}_t^W\right)-\frac{1}{2}\frac{\theta^R}{\kappa}\left(\widehat{tot}_t-\widehat{\overline{tot}}_t\right). \tag{7}$$

Oil prices are often viewed as driving terms of trade movements that are originated in global markets and reflect the balance of global demand and supply. In that sense, we consider using oil price data to proxy for the unobserved terms of trade gap to exploit the model-consistent forecasting equation in (56) to predict domestic inflation.

Second, the forecasting equation in (50) can also be re-expressed as follows,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}-\widehat{\pi}_t\right)=-\left(\theta^W-\theta^R\right)\widehat{x}_t^W-\theta^R\widehat{x}_t, \tag{8}$$

where $\widehat{x}_t$ stands for domestic slack. Combining this alternative specification of the forecasting equation with the theoretical relationship between global slack and global inflation indicated in (4), we obtain that,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}-\widehat{\pi}_t\right)=-\left(\frac{\theta^W-\theta^R}{\theta^W}\right)\left(\widehat{\pi}_t^W-\overline{\pi}_t^W\right)-\theta^R\widehat{x}_t. \tag{9}$$

This specification motivates us to consider different measures of filtered output (or slack) together with global inflation for forecasting domestic inflation.

Forecasting equation (58) shows that once we incorporate global inflation into the forecasting model, the only measure of slack that in theory should matter is domestic slack. In other words, once the spatial dimension is incorporated to the model with an appropriate measure of global inflation, adding domestic slack suffices to attain an efficient forecast without the need to use instead a harder-to-obtain measure of rest-of-the-world slack. In our experiments, nonetheless, we consider the practical value of replacing domestic slack in the forecasting model (58) with some measure of global slack to capture unmodelled international linkages and further improve forecasting accuracy.

Our empirical approach assesses these univariate inflation forecasting models inferred from theory comparing them against specifications that abstract entirely from the international (spatial) linkages exploited by global inflation and highlighted by theory. We keep the simpler autoregressive model as our benchmark for evaluating forecasting accuracy. We forecast inflation based on an autoregressive distributed lag (ADL) model that incorporates global inflation and also all other relevant open-economy Phillips-curve predictors—such as different measures of slack and oil price changes—and compare those forecasts against a naïve autoregressive model which predicts future domestic inflation based on past realizations of domestic inflation alone. We find that most of the improvement in forecasting accuracy can be attributed to global inflation.

Finally, our empirical results are consistent with the theory and show that accounting for the international and spatial dimensions of inflation is helpful to forecast domestic inflation. This is what we expect based on the forecasting implications of the workhorse open-economy New Keynesian model discussed here and based on the earlier contributions of Martínez-García and Wynne (2010) and Kabukcuoglu and Martínez-García (2014). The importance of the spatial dimension is clear in our stylized framework—the theoretical insight obtained from the workhorse model extends more generally to a large class of widely-used open-economy New Keynesian models with richer dynamic structures. We proxy for this by also modelling a temporal dimension into the structure of the forecasting model to capture the richer dynamics in the data using a conventional procedure to optimally choose the appropriate number of lags (Schwarz Information Criterion, SIC). We then focus our attention in assessing the forecasting improvement that comes from global inflation alone and the value-added of augmented models which include some measure of slack or oil price movements as suggested by the model-consistent forecasting equations in (56) and (58).

3 Empirical Analysis

3.1 Data

We use inflation data based on the headline consumer price index (CPI) and core CPI (CPI ex. food and energy). The inflation rate is calculated in terms of annualized log-differences on the quarterly series of each of the price indexes that we consider (headline CPI and core CPI). Our database also includes a number of forecasting regressors such as slack measures based on real GDP and industrial production (IP) data. Slack is proxied with the detrended real GDP and IP series of each country. Detrending is performed using a 1-sided HP filter (based on the Kalman filter approach described by Stock and Watson (1999b)) and also first-differencing in logs. Data on headline and core CPI as well as real GDP and IP series are obtained from the Dallas Fed's Database of Global Economic Indicators (DGEI).[5]

We perform inflation forecasts using global slack measures too based on the weighted average of the detrended country-level real GDP and IP series. As an alternative measure of global economic slack, we use the Kilian (2009) index of global economic conditions obtained from Lutz Kilian's website. We also perform inflation forecasts with oil price data using the West Texas Intermediate Crude Oil series obtained through the St. Louis Fed's FRED database. We use quarterly series for the 1984:Q1-2015:Q1 period. We use the 1-sided HP filter and first-differencing in logs with the oil series as well.[6]

We forecast local inflation for a group of 14 countries: Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, the United Kingdom and the United States. In the paper, we report our detailed findings for the U.S. and a summary of the evidence for this group of 14 advanced economies. When we construct the global inflation and slack measures, however, we take advantage of the broader country coverage in DGEI and consider a larger group of countries for which there is data available in DGEI. The countries included in the calculations of the global aggregates are selected depending on the consistency of data available on each inflation and output series from a larger group that includes 29 countries (including some emerging economies as well). These countries are Australia, Austria, Belgium, Canada, Chile, China, Colombia, France, Germany, Greece, Hungary, India, Indonesia, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Philippines, Poland, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, the United Kingdom and the United States. See Appendix A for details on the country composition for each forecasting exercise. We use quarterly data for the 1984:Q1-2015:Q1 period and the countries that have shorter time series are dropped from the sample when constructing the aggregates.

The weighting scheme is crucial to incorporate all relevant international linkages into the aggregates used in our univariate forecasting models. Based on theory, we should construct the weights for our forecasting model aggregates based on either trade linkages or economic size. However, weighting can also be based on other metrics of proximity across countries such as geographic distance. An alternative (and simpler) weighting scheme can be based on equal weights, as suggested in the work of D'Agostino and Surico (2009) among others.

The choice of the weighting scheme can be important to capture unmodelled aspects of the interconnectedness across countries that are not captured by the stylized workhorse open-economy New Keynesian model that motivates our paper. Hence, the selection of an appropriate weighting scheme is of great practical importance for forecasting—not surprisingly such choices have featured prominently in the literature on forecast combination. For instance, Stock and Watson (2004) document that equal weighting generally yields among the best forecasting outcomes across different forecasting specifications when the exact weights are otherwise uncertain. Therefore, we find important to use various alternative weighting schemes (even atheoretical ones such as equal weights) and to evaluate their forecasting ability according to their performance in practice.

To be precise, we use six different weighting schemes:[7] (i) equal weights, (ii) weights based on contiguity

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[5] The Federal Reserve Bank of Dallas' DGEI database can be accessed at: http://www.dallasfed.org/institute/dgei/index.cfm

[6] The Kilian (2009) index can be accessed at: http://www-personal.umich.edu/~lkilian/reaupdate.txt, while the oil price series are obtained by combining these two series from the St. Louis Fed's FRED database: https://research.stlouisfed.org/fred2/series/MCOILWTICO, https://research.stlouisfed.org/fred2/series/OILPRICE

[7] The weights used in the construction of any global aggregate for a given country-specific forecasting model are adjusted to sum up to 1. A country's own weight is non-zero in all weighting schemes except for the contiguity measure since, by definition, a country does not have a border with itself. The GeoDist database can be accessed at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6, and further details can be found in Appendix A.

data describing whether each pair of countries shares a common border or not from the GeoDist database (see Mayer and Zignago (2011)), (iii) weights constructed from the inverse of the square of the geographic distance between country pairs using data from the GeoDist database (see Mayer and Zignago (2011)), (iv) weights constructed from the inverse of the square of the geographic distance weighted by population between country pairs from the GeoDist database (see Mayer and Zignago (2011)), (v) trade weights based on trade (imports plus exports) shares in the world in 2010 (obtained at annual frequency from the IMF), and (vi) trade weights based on the average trade (imports plus exports) shares in the world over the period 1984-2014 (using the annual IMF series).

3.2 Forecast Models

We define $\pi_{i,t}$ as the inflation rate of country i at quarter t, for $i = 1, ..., N$ and $t = 1, ..., T$. For a given quarterly forecast horizon h ranging from 1-quarter ahead to 12-quarters ahead and a given country $i = 1, ..., N$, we denote the country i inflation forecast h-quarters ahead that uses all information up to quarter t as $\pi^{k}_{i,t+h|t}$ obtained under a given forecasting model indexed by k. In the paper, N is set to be equal to the 14 for which we have all relevant data for our forecasting performance comparison, as indicated before. We compute the h-quarter ahead (annualized) inflation rate for country i as $\pi_{i,t+h} = \frac{400}{h} \times \left[\ln \left(\frac{P_{i,t+h}}{P_{i,t}} \right) \right]$. For our forecast evaluation exercise, we consider the following competing (but nested) model specifications:

First, we introduce as our baseline a simple autoregressive (AR) model to predict inflation (with no spatial dimension or economic predictors), i.e.,

$$\pi^{1}_{i,t+h|t} = c^{1}_{i} + \textstyle\sum_{s=0}^{p} \gamma^{1}_{i,s} \pi_{i,t-s} + \epsilon^{1}_{i,t+h}, \text{ for country } i \text{ and horizon } h, \qquad \text{(Model 1)}$$

which forecasts future inflation solely with the distributed lag of earlier inflation rates $\pi_{i,t}$. The forecasting error $\epsilon^{1}_{i,t+h}$ is assumed i.i.d. with $N\left(0, \sigma^{2}\right)$. We refer to this as the naïve forecasting model. The optimal number of lags p is selected based on the Schwarz Information Criterion (SIC). To keep the model parsimonious and since we work with quarterly series, the maximum possible lags allowed is set at four. This naïve forecasting model serves as the benchmark against which we compare the accuracy of our alternative open-economy Phillips curve-based forecasting models. We use the lag length selected under this benchmark with all other models to keep them nested.

We use a number of different weighting schemes to construct global measures in all subsequent forecasting models (Model 2, Model 3 and Model 4). We denote the weights used to construct the global slack measure for forecasting inflation in country i as w^{y}_{ij}, for all $j = 1, ..., M$ where M corresponds to the sample of at most 29 countries for which we can draw data to construct our aggregates (as noted in the previous subsection). For the measure of global inflation relevant for country i's forecasts, we consider weights w^{π}_{ij} which are the consistent with the weights for global slack across all entries except for a country's own weight which is set equal to zero (i.e., $w^{\pi}_{ii} = 0$). Accordingly, all other weights are re-scaled to maintain the principle that they should sum up to 1. Hence, aggregate inflation is essentially a rest-of-the-world inflation measure.

The second model we evaluate is an open-economy Phillips curve specification. In particular, here we are motivated by the theoretical insights provided by Martínez-García and Wynne (2010) and Kabukcuoglu and Martínez-García (2014) to study the global output linkages in forecasting domestic inflation, i.e.,

$$\pi^2_{i,t+h|t} = c^2_i + \sum_{s=0}^{p} \gamma^2_{i,s}\pi_{i,t-s} + \sum_{s=0}^{q} \psi^2_{i,s} y^*_{i,t-s} + \epsilon^2_{i,t+h}, \text{ for country } i \text{ and horizon } h, \qquad \text{(Model 2)}$$

where the forecasting error $\epsilon^2_{i,t+h}$ is assumed i.i.d. with $N\left(0, \sigma^2\right)$. The specification of Model 2 is referred to as an economic model unlike that of Model 1, under the terminology of Stock and Watson (2003), because it incorporates additional explanatory variables for forecasting domestic inflation.[8] In this economic model, for each home country indexed by i, we use the distributed lag of earlier inflation rates, $\pi_{i,t}$, and the distributed lag of the explanatory variable, $y^*_{i,t}$, in order to forecast h-quarters ahead inflation.

Model 2 enables us to evaluate the forecasting performance of WTI oil prices or standard closed-economy Phillips curve regressors such as domestic slack. It also allows us to consider the role of global slack for domestic inflation forecasting as well whenever we define $y^*_{i,t}$ as the weighted average of the domestic and foreign slack measures, i.e. whenever we define $y^*_{i,t}$ as $\sum_{j=1}^{M} w^y_{ij} y_{j,t}$. The distributed lag specification introduces richer dynamics, but otherwise captures the equilibrium relationship between domestic inflation and global slack implied by the workhorse open-economy New Keynesian model featuring a forward-looking open-economy Phillips curve (as shown in the previous section). We use the SIC to select the optimal number of lags q with the maximum possible lags allowed set at four. The optimal lag length for local inflation p is determined by Model 1. Hence, the specification of Model 2 incorporates explanatory variables into the forecasting framework laid out in Model 1 and both models are nested for comparison purposes.

Domestic slack measures introduce a conventional closed-economy Phillips curve-based regressor into the specification and, therefore, we can compare its performance against that achieved using open-economy Phillips curve-based regressors instead. Global slack measures, in particular, are the natural predictors that conceptually arise from the open-economy New Keynesian model and help us assess empirically the role of global forces in driving domestic inflation. Global slack explicitly recognizes that most economies in the world have become more integrated through trade and financial linkages with each other and factors that into one single weighted indicator for forecasting. Finally, oil prices can be viewed in the context of this model as an alternative (price-based) indicator that captures the same global economic forces as global slack and can therefore be similarly useful for domestic inflation forecasting under the open-economy New Keynesian framework.

The other two model specifications considered in this paper also constitute economic models in the sense of Stock and Watson (2003). They aim to incorporate the forecasting predictions of the open-economy New Keynesian model into a more tractable empirical model that relies on global inflation. We assess the contribution of Model 3 and Model 4 to improve inflation forecasting and, in doing so, evaluate the significance of the spatial dimension highlighted by theory for inflation forecasting.

In Model 3, we consider forecasting changes in domestic inflation with global inflation in the spirit of the forecasting equation (54), assuming the trend component of global inflation is well approximated with a constant intercept. In particular, we introduce a spatio-temporal autoregressive distributed lag (ADL) model that incorporates not just the effect of those global spatial interdependencies on domestic inflation

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[8] See also Stock and Watson (1999a), Stock and Watson (1999b) and Stock and Watson (2008).

but also the temporal dimension that helps better capture the dynamics of domestic inflation, i.e.,

$$\begin{aligned} \pi^3_{i,t+h|t} \quad &= \quad c^3_i + \textstyle\sum_{s=0}^{p} \gamma^3_{i,s}\pi_{i,t-s} + \sum_{s=0}^{r} \lambda^3_{i,s}\pi^*_{i,t-s} \\ &\quad\quad +\epsilon^3_{i,t+h}, \text{ for country } i \text{ and horizon } h, \end{aligned} \tag{Model 3}$$

where $\epsilon^3_{i,t+h}$ is i.i.d. with $N\left(0,\sigma^2\right)$. We define $\pi^*_{i,t}$ as the weighted average of the rest-of-the-world inflation, i.e. we define $\pi^*_{i,t}$ as $\sum_{j=1}^{M} w^{\pi}_{ij}\pi_{j,t-s}$. The right-hand side of Model 3 augments that of Model 1 with the introduction of a spatial term and its lags reflecting global inflation, $\pi^*_{i,t}$, with coefficients $\lambda^3_{i,s}$ for all $s = 0,...,r$. Needless to say, Model 3 reduces to Model 1 if we set $\lambda^3_{i,s} = 0$ for all $s = 0,...,r$. We use the SIC to select the optimal number of lags r, taking as given the lag length p determined based on SIC in Model 1.

This forecasting model incorporates a given spatial dimension of global inflation through the weights w^{π}_{ij}. These weights are exogenously given and can be specified by the econometrician to capture in empirically-relevant ways the interconnectedness and spatial correlation between inflation across countries. Model 3, as noted before, captures one important factor in forecasting domestic inflation—that is, global inflation. However, global inflation alone does not suffice to efficiently forecast domestic inflation as indicated in the discussion of forecasting equation (50) under the suggested global inflation forecasting models set in equations (56) and (58). An efficient forecast would therefore require us to use: (i) global inflation and domestic slack, or (ii) global inflation and WTI oil prices (since oil prices have similar information content to that of terms of trade).

Hence, we also consider Model 4 which nests with Model 3 but incorporates additional predictors in line with the model-consistent forecasting equations (56) and (58). More specifically, we extend Model 3 by introducing a spatio-temporal autoregressive distributed lag (ADL) model that incorporates cross-country interdependencies through global inflation, $\pi^*_{i,t}$, but also with additional economic regressors, $y^*_{i,t}$, on the forecasting equation, i.e.,

$$\begin{aligned} \pi^4_{i,t+h|t} \quad &= \quad c^4_i + \textstyle\sum_{s=0}^{p} \gamma^4_{i,s}\pi_{i,t-s} + \sum_{s=0}^{z} \lambda^4_{i,s}\pi^*_{i,t-s} \\ &\quad\quad + \textstyle\sum_{s=1}^{n} \psi^4_{i,s}y^*_{i,t-s} + \epsilon^4_{i,t+h}, \text{ for country } i \text{ and horizon } h, \end{aligned} \tag{Model 4}$$

where $\epsilon^4_{i,t+h}$ is i.i.d. with $N\left(0,\sigma^2\right)$. The right-hand side of Model 4 augments that of Model 3 with the introduction of an additional economic regressor, $y^*_{i,t}$, with coefficients $\psi^4_{i,s}$ for all $s = 1,...,n$, to capture the contribution to generate efficient inflation forecasts arising from the addition of domestic slack or WTI oil prices to the model (as suggested by theory). We construct the weighted aggregate $y^*_{i,t}$ along the same lines as for Model 2 and, similarly, we calculate $\pi^*_{i,t}$ as described in Model 3. In Model 4, we also use the SIC to select the optimal number of lags z and n with the maximum possible lags allowed for each variable set at four, taking as given the optimal p determined based on the SIC procedure applied to Model 1. Needless to say, Model 4 reduces to Model 1 if we set $\lambda^4_{i,s} = 0$ for all $s = 0,...,z$ and $\psi^4_{i,s} = 0$ for all $s = 1,...,n$; Model 4 reduces to Model 2 if we set $\lambda^4_{i,s} = 0$ for all $s = 0,...,z$; and Model 4 reduces to Model 3 if we set $\psi^4_{i,s} = 0$ for all $s = 1,...,n$.

Model 4, which takes into account the spatio-temporal dimensions of the open-economy Phillips curve relationship for forecasting inflation for each country $i = 1,...,N$, is simply an autoregressive distributed lag (ADL) model of domestic inflation in country i, rest-of-the-world (aggregate) inflation, and some additional economic regressor (either some measure of slack or WTI oil prices). In our specification of Model

4, we consider domestic slack measures based on theory but also look at global slack measures as an alternative economic explanatory variable in $y^*_{i,t}$. We also repeat this exercise with the Kilian (2009) index of global economic conditions. In forecasting domestic inflation, global inflation and domestic slack are the theoretically-relevant measures under the forecasting equation (58) described in the previous section. However, global slack measures or even the Kilian (2009) index may capture spatial interconnections in global economic activity along dimensions that remain unmodelled in the workhorse open-economy New Keynesian framework and, therefore, might still prove to be valuable in practice for forecasting domestic inflation.

The fact that all our models (Model 2, Model 3 and Model 4) are nested into the autoregressive (AR) specification of Model 1 enables us to use well-established techniques to estimate these models as well as to test for the statistical significance of our results. In what follows, we describe our forecasting comparison strategy and inference in detail. For more details, the interested reader is referred to Appendix B (see also Clark and McCracken (2005) and Kabukcuoglu and Martínez-García (2014)).

3.2.1 Forecast Scheme

We perform inflation forecast comparisons based on the multi-step pseudo out-of-sample forecasting approach with recursive samples. Therefore, at any given date t, we forecast inflation at date $t+h$ using all available data up to date t for any given horizon $h = 1, ..., 12$. All specifications described in Model 1, Model 2, Model 3 and Model 4 can be estimated by OLS.

We assess the multi-step pseudo out-of-sample forecasting performance of Model 2, Model 3 and Model 4 relative to that of a naïve univariate autoregressive process (Model 1) at any given forecasting horizon h. Our forecast evaluation metric, the relative Mean Squared Forecasting Error (MSFE), is defined as the ratio of the MSFE of an economic model (Model 2, Model 3 or Model 4) relative to the MSFE of the benchmark autoregressive model (Model 1).

Let $\underline{T}$ denote the starting date of the data series and $\overline{T}$ denote the end date. The initial estimation sample for the pseudo out-of-sample procedure starts at $\underline{T}$ and ends in $t_0 < \overline{T}$. We start by using all data up to date t_0 to forecast inflation at date $t_0 + h$ for a given forecasting horizon h. Then, we add one additional observation to the estimation sample, re-estimate the parameters of the forecasting model with that extra observation and obtain an $h-$quarter ahead forecast of inflation for date $t_0 + 1 + h$. The $h-$step recursive inflation forecast continues by adding one additional observation at a time until period $\overline{T} - h$ generating a total of $\overline{T} - h - t_0 + 1$ forecasts.

For all models $k = 1, ..., 4$, for each country $i = 1, ..., N$, and for any given horizon $h = 1, ..., 12$, this iterative procedure yields a sequence of forecasting errors, $\left\{\widehat{\epsilon}^k_{i,t+h}\right\}_{t=t_0}^{\overline{T}-h}$, which we use to construct the MSFE of each model k and country i at each horizon h from date t_0 to $\overline{T} - h$ as follows,

$$MSFE^k_{i,h} = \frac{1}{\overline{T} - h - t_0 + 1} \sum_{t=t_0}^{\overline{T}-h} \left(\widehat{\epsilon}^k_{i,t+h}\right)^2. \tag{10}$$

If the relative MSFE is greater than 1, this implies that the naïve forecast (Model 1) is more accurate than a given economic model (Model 2, Model 3 or Model 4). Then we test if the values less than one are statistically significant or not.

3.2.2 Inference and Samples

In our benchmark experiments where we forecast headline CPI and core CPI inflation under the four nested models described before, the estimation sample begins in 1984:Q1 and ends in 1996:Q4 and the pseudo out-of-sample forecasting period begins in 1997:Q1 and ends in 2015:Q1. This leaves us with an estimation sample of 52 quarters and a pseudo out-of-sample forecasting sample of 73 quarters.

When we compare the performance of any given economic model (Model 2, Model 3 or Model 4) with respect to that of Model 1, we first set the lag length of inflation in Model 1 based on SIC, and use this selection as an input for any of the economic models that we consider. Hence, the lag length of domestic inflation is determined in Model 1, and is used as input for the lag length of domestic inflation in the extended economic models (Model 2, Model 3 and Model 4). The lag length of additional variable(s) in Model 2, Model 3 and Model 4 is set independently based on SIC. As a result, each extended economic model is nested into Model 1.

For empirical inferences with nested models such as Model 1 and either Model 2 or Model 3, that differ solely in one of the right-hand side regressors (and its corresponding lags), an appropriate methodology is that of Clark and McCracken (2005). Clark and McCracken (2005) suggest using a bootstrap algorithm to calculate the critical values for the F-statistics needed for hypothesis testing in those cases. Kabukcuoglu and Martínez-García (2014) expand this methodology further to compare the forecasting performance of models that differ in more than one explanatory variable (for example, Model 4) relative to the benchmark set by a univariate autoregressive process (Model 1). The details of the procedure are described in Appendix B.

In all cases, we obtain a one-sided test under the null hypothesis that the economic model that we are assessing (Model 2, Model 3 or Model 4) does not yield more accurate inflation forecasts than the naïve autoregressive process that we use as our benchmark (Model 1), i.e. we test the null hypothesis that $MSFE_1 \leq MSFE_k$ against the alternative that $MSFE_1 > MSFE_k$ for any given economic model $k = 2, ..., 4$.[9] Throughout the paper, we report the MSFE of the benchmark model (Model 1) and the relative MSFEs of a particular economic model (Model 2, Model 3 or Model 4) against that benchmark. We report the p-values of the F-test at 1%, 5% and 10% whenever appropriate.

3.3 Empirical Results

3.3.1 *U.S. Inflation Forecasts*

In Tables A1-A6 in Appendix C, we report the forecasting performance of Model 2, Model 3 and Model 4 (relative to Model 1) with U.S. data using an estimation sample between 1984:Q1 and 1996:Q4 and a pseudo out-of-sample forecasting sample between 1997:Q1 and 2015:Q1.[10] For Model 1 (Table A1, panels a and b), we report the absolute MSFE of the forecasts based on an autoregressive process (Model 1) of headline CPI and core CPI inflation, respectively. All remaining entries in Tables A1-A6 report relative MSFEs of Model 2, Model 3 and Model 4 with respect to this benchmark. We report results for 1, 4, 6, 8, 10 and 12-quarters ahead inflation forecasts. The results can be summarized as follows:

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[9] The null hypothesis is expressed as 'the relative MSFE is greater than or equal to 1.'

[10] See Appendix A for details on the data used in the forecasting exercise.

1. In forecasts under Model 2 (see Table A1), we obtain weak and mixed results across our two inflation measures for the different explanatory variables that we consider. The HP-filtered WTI oil price series does not help yield more accurate forecasts of headline CPI inflation, but first-differenced WTI appears to help forecast headline inflation at long horizons more accurately than the benchmark. No measure of domestic slack helps forecast U.S. inflation, although there is some evidence of statistically significant improvements in forecasting accuracy based on global slack using first-differencing of log real GDP under the Model 2 specification. Core CPI inflation, which excludes food and energy prices, cannot be forecasted more accurately (relative to Model 1) with any of the oil price measures that we consider here. In turn, domestic slack measures obtained by first-differencing log real GDP and log industrial production (IP) show occasionally some value for forecasting core CPI. Domestic slack measures obtained with HP-filtered real GDP or IP data have little value nonetheless. These result are essentially consistent with the existing literature, as expected. See, for example, Stock and Watson (2003).

2. We further analyze the information content of global economic activity for inflation forecasting under Model 2, using the Kilian (2009) index as well as global slack measures constructed after HP-filtering or log-first-differencing the real GDP or IP data using six different weighting schemes (see Table A2). The Kilian (2009) index does not perform well in this specification, while other global slack measures help improve forecasts of core CPI occasionally. First-differenced log real GDP has some value for forecasting headline CPI inflation too. In turn, our IP-based global slack measures exhibit better forecasting performance for core CPI under most weighting schemes. These result are in line with the findings reported by Kabukcuoglu and Martínez-García (2014).

3. In Model 3 (whose results appear in Table A3), we model spatial interlinkages by taking into account the role of global inflation alone. We obtain a high performance for forecasting both headline and core inflation under that specification with robust findings across all weighting schemes. All results are more accurate than those of the benchmark autoregressive process of Model 1 (with statistical significance at the 10% level and better in most cases). This model clearly outperforms Model 1 and it is a lot more successful than Model 2 (as could be expected from the evidence reported by Ciccarelli and Mojon (2010), Ferroni and Mojon (2014) or Duncan and Martínez-García (2015)). This result is consistent with the global slack hypothesis (and the open-economy Phillips curve) that motivates the specification of Model 2 with global slack, but it also shows that the open-economy New Keynesian theory developed earlier can be helpful in practice to address the empirical limitations that arise from data availability and quality problems for measuring slack accurately for forecasting. Therefore, the alternative specifications suggested by theory making global inflation their centerpiece appear more reliable and useful for forecasting inflation than specifications that rely on poorly-measured global slack.

4. Finally, in Model 4 we evaluate inflation forecasts that fully capture the spatial linkages highlighted by theory to construct and efficient forecast beyond global inflation. These forecasts are based on: (i) oil prices and global inflation (see Table A4) , (ii) the Kilian (2009) index and global inflation (see Table A4), (iii) domestic slack and global inflation (see Table A5), and (iv) global slack and global inflation (see Table A6). Under the Model 4 specification, the most accurate forecasts of headline CPI inflation

tion are those we obtain with a combination of global inflation and WTI oil prices (particularly after log-first-differencing the series). For core CPI inflation, domestic and global slack measures appear to outperform other measures when combined with global inflation and yield comparable results to each other. This suggests that domestic slack measures together with global inflation provide a theoretically-grounded and empirically successful forecasting model for U.S. inflation that cannot be significantly and systematically improved by using global slack measures instead. The Kilian (2009) index of global economic activity exhibits a role in forecasting both headline and core CPI inflation—albeit not as strong as that of the oil price and slack measures that we evaluate in the same exercise.

5. When all models are compared, our conclusion is that Model 3 works very well—with high forecast accuracy and robust results across different aggregation schemes, global inflation helps forecast both headline and core CPI inflation and generally performs better than the benchmark (Model 4) and than Model 2. The performance of the model-consistent specifications under Model 4 follows that of Model 3 closely, but we must recognize that imperfect measures of domestic and global slack introduce an additional source of noise in our inflation forecasts. In any event, our results for Model 4 are broadly supportive of the theory laid out by the open-economy New Keynesian model. However, the performance comparison between Model 3 and Model 4 indicates that most of the gains achieved in forecasting accuracy should be attributed primarily to the contribution of global inflation.

3.3.2 *Inflation Forecasts in Advanced Economies*

We obtain a set of results also for a group of 14 advanced economies (including the U.S.) and, in general, our findings across this panel of countries are consistent with the evidence discussed for the U.S. on the accuracy of inflation forecasting:

1. The performance of Model 2 (Table A7) in inflation forecasting across advanced economies is fairly poor. Hence we confirm in these results that Atkeson and Ohanian (2001)'s findings for the U.S. are pervasive among a wide group of advanced countries. In other words, the lack of forecastability of inflation under a (closed-economy) Phillips curve-based model specification noted by Atkeson and Ohanian (2001) is not a phenomenon specific to the U.S., but a general pattern that we detect across many different countries. With first-differenced log IP data and WTI oil prices we get some forecasting accuracy improvements occasionally. However, adding global slack (based on IP or GDP measures) in the forecasting model improves accuracy slightly (Tables A7-A8), with first-differenced log real GDP data exhibiting relatively better results for a small group of countries. There is some supportive evidence for the ability of first-differenced oil prices to forecast CPI inflation for a small group of countries as well. The Kilian (2009) index does not appear to help forecast inflation in a large group of countries.

2. Model 3 (Table A9) exhibits very strong results for forecasting inflation. Theory, as described by Model 4, predicts that there is still some accuracy gains which can be attained by augmenting the forecasting specification in Model 3 with either a measure of terms of trade gap (proxied with WTI oil prices) or domestic slack (Tables A7-A8). We find that WTI oil prices in log-first-differences perform better than HP-filtered in this sense and also improve the forecasting accuracy on headline inflation of a model that uses global inflation alone. Furthermore, we also find that in general the model with

domestic slack performs better than alternatives that incorporate a spatial dimension in output gaps (such as different measures of global slack) for forecasting. There is also a clear pattern emerging across countries where log-first-differencing an output series applied to computing slack seems to yield more accurate forecasts than HP-filtering the real GDP or IP series. Finally, the specification of Model 4 with domestic slack based on IP data or WTI oil prices in log-first-differences together with global inflation perform rather well, consistent with the theory. This is true in spite of the potential measurement error involved in the specification of Model 4 because neither the terms of trade gap nor domestic slack *per se* are observable.

3. A simpler model with global inflation only (Model 3) can perform similar to the theoretically-consistent specifications of Model 4, but global inflation misses the important economic connections that exist with domestic economic activity or international relative prices that the theory highlights based on the open-economy Phillips curve. This suggests that, perhaps, the benchmark to beat in future research on inflation forecasting may very well look more like Model 3 than Model 1. Model 3 could become a tougher yardstick for judging whether an economic model for forecasting does add value or not going forward. In any event, the comparison of Model 3 and Model 4 confirms to us the following: Between the two channels to explain inflation dynamics that arise in theory—global inflation and some measures of economic activity (measured by domestic slack or WTI oil prices)—global inflation appears to be the major factor contributing to improved forecasting accuracy across countries, according to our findings.

4. We show, in general, that using equal weights performs better than using other alternatives weighting schemes to capture the spatial interactions of the model. Whenever the interactions are complex and not fully known or understood, a simple matrix of equal weights may be the best aggregation scheme for any given variable, country and forecasting horizon. Our findings show that, indeed, it does quite well across a variety of forecasting models, forecasting variables and horizons, and country experiences. In this sense, it is simple and robust across a great deal of heterogeneous forecasting exercises and, accordingly, quite useful for forecasting. This is also another important finding of our paper.

Our empirical results confirm that conventional measures of domestic or global slack do not help improve much our forecast of local inflation, and shows this is a stylized fact in the U.S. and many other advanced economies. Model 3 and Model 4 provide interesting results: clearly, accounting for the global inflation channel is quite powerful for improving forecasting accuracy. This alone can help improve the forecasts of domestic inflation at statistically significant levels across many different horizons and country experiences. Also, some weighting schemes yield superior results than others. Interestingly, we find that a simple weighting scheme (equal weights) does better or as well as other more complex aggregation schemes across many of our forecasting exercises.

A word of caution on the value of the additional economic regressors in Model 4: First-differenced log WTI oil prices together with global inflation come closest to Model 3 in terms of forecast performance for headline CPI inflation; some domestic slack measures together with global inflation appear quite competitive when forecasting both headline and core CPI inflation too. These result appears to be valid for the U.S. as well as for a large number of other advanced countries. However, WTI oil prices are a proxy for the unobserved terms of trade gap and it is difficult to determine how much our forecast might be affected by the measurement error we introduce when using a statistically-filtered series in place of the unobserved one (the terms of trade gap in this case). Domestic slack can also be a useful explanatory variable in conjunction with global inflation for forecasting domestic inflation, but is unobservable too. The measurement errors associated with approximating slack using statistically-filtered real GDP or IP data, as in the case of WTI oil prices, can be a problem for the resulting forecasts as well. Hence, although our findings are broadly positive, we expect that further improvement can be achieved with more accurately estimated slack or terms of trade gap measures.

Finally, we believe that our results support the theory laid out in the workhorse open-economy New Keynesian model and also highlight the difficulties of forecasting with imperfectly observable macro series and limited data—both issues raised and extensively discussed also in Kabukcuoglu and Martínez-García (2014).

4 Conclusion

The seminal work of Atkeson and Ohanian (2001) documented a break in the (closed-economy) Phillips curve during the Great Moderation period. This economic relationship between domestic inflation and domestic economic activity no longer seemed to work as a tool for inflation forecasting. Declining forecasting accuracy can be an issue not only with reduced-form forecasting models of inflation, but also with the Dynamic Stochastic General Equilibrium (DSGE) models which have become commonplace for policy analysis and forecasting (as indicated by Edge and Gürkaynak (2010)). Focusing on the strand of literature that followed the work of Atkeson and Ohanian (2001), in this paper we find novel theoretical and empirical support for the validity of the global slack hypothesis based on its predictions about inflation forecasting. We show that the Phillips curve is alive and well for forecasting, after all—so long as one considers an open-economy Phillips curve model rather than the standard closed-economy specifications prevalent in the literature as strongly argued by Kabukcuoglu and Martínez-García (2014).

The major contribution of our paper, however, is to show that fully incorporating the spatial dimension of these international linkages is very important to improve the forecasting accuracy of the open-economy Phillips curve model. Our interpretation of how these findings on the spatial interconnectedness are linked to global inflation, through the lens of the open-economy New Keynesian model, has not been considered before. Our quantitative analysis using tests of forecasting accuracy reveals the importance of modelling the spatio-temporal dynamics of inflation more fully. The evidence provided in the paper indicates that specifying the spatio-temporal model appropriately in order to recognize the rich dynamics over time of the data and the complexity of linkages across countries—especially in regards to the inflation variable itself—is crucial to improve our forecasting models of inflation across many advanced economies and for the U.S.

Our strong empirical results are consistent with the view that global forces must be taken into account in order to effectively understand the dynamics of domestic inflation in open-economies. We show that a successful model to forecast domestic inflation can be improved by modelling the international linkages of the domestic economy. It also, in our view, suggests the global inflation models which have been gaining some notoriety in the literature (see, e.g., Ciccarelli and Mojon (2010)) are a step in the right direction and could become over time the benchmark to beat in forecasting inflation.

Our final point is related to the choice of weighting schemes in order to define the spatial linkages in the data. In our opinion, alternative weighting schemes to fully incorporate the extent of trade and financial linkages may be a fruitful avenue of future research. We have considered different measures that are fairly standard to proxy for the extent to which different countries are open to trade and we have also considered other variables to proxy for trade costs (and distance) across countries. However, none of them generally does consistently better than using equal weights. Hence, more research may be needed on the optimal selection of weights. An interpretation of our results could be that, if we do not know exactly what the proper weighting scheme should be, then equal weights seem to be a robust alternative because it does well under varying forecasting horizons, models and country experiences.

Appendix

A Data Description

This section gives details for the data used.

Abbreviations

BLS = U.S. Bureau of Labor Statistics; DGEI= Database of Global Economic Indicators; IMF = International Monetary Fund; SA=Seasonally adjusted. All series are quarterly unless indicated otherwise.

1 U.S. inflation series

We use series staring in 1984:Q1 and ending in 2015:Q1 (SA, 2010=100). CPI (all items) is available from the Bureau of Labor Statistics (BLS) going back to 1947:Q1, while core CPI (all items ex. food and energy) is available from the BLS goes back to 1957:Q1.

2 Global slack and global inflation measures

Series for the countries to construct global slack and rest of the world inflation are obtained from the database of global economic indicators (DGEI) of the Federal Reserve Bank of Dallas (see the details in Grossman et al. (2014)). Weighted averages of filtered quarterly Industrial Production and real GDP series (using either first-differencing in logs expressed in percentages or a 1-sided HP-filter) for the period 1984:Q1-2015:Q1 are used as global slack measures.[11] Annualized log differences of quarterly CPI and core CPI series in percentages are used in constructing the inflation measures. Country coverage varies with data availability. The list of countries used in each sample is given below.

Table A2 Panels (c) and (g): Australia, Austria, Belgium, Canada, Chile, France, Germany, Greece, Hungary, India, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

Table A2 Panels (d) and (h): Australia, Austria, Belgium, Canada, Chile, France, Germany, Italy, Japan, Korea, Mexico, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

Table A2 Panels (e) and (i): Australia, Austria, Belgium, Canada, China, Colombia, France, Germany, Indonesia, Italy, Japan, Korea, Mexico, Netherlands, Philippines, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

Table A2 Panels (f) and (j): Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Mexico, Netherlands, Spain, Sweden, Switzerland, United States, United Kingdom.

Table A3 Panel (a): Australia, Austria, Belgium, Canada, Chile, France, Germany, Greece, Hungary, India, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

Table A3 Panel (b): Australia, Austria, Belgium, Canada, Chile, France, Germany, Italy, Japan, Korea, Mexico, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

Table A4 Panels (a) and (c): Australia, Austria, Belgium, Canada, China, Colombia, France, Germany, Indonesia, Italy, Japan, Korea, Mexico, Netherlands, Philippines, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

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[11] The HP filter is applied as described inStock and Watson (1999b). This is a one-sided HP filter.

Table A4 Panels (b) and (d): Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Mexico, Netherlands, Spain, Sweden, Switzerland, United States, United Kingdom.

Tables A5 and A6 Panels (a) and (e): Australia, Austria, Belgium, Canada, Chile, France, Germany, Greece, Hungary, India, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

Tables A5 and A6 Panels (b) and (f): Australia, Austria, Belgium, Canada, Chile, France, Germany, Italy, Japan, Korea, Mexico, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

Tables A5 and A6 Panels (c) and (g): Australia, Austria, Belgium, Canada, China, Colombia, France, Germany, Indonesia, Italy, Japan, Korea, Mexico, Netherlands, Philippines, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom.

Tables A5 and A6 Panels (d) and (h): Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Mexico, Netherlands, Spain, Sweden, Switzerland, United States, United Kingdom.

3 Kilian (2009)'s index of global economic conditions

Kilian (2009)'s index of global economic conditions is based on monthly series of dry cargo single voyage ocean freight rates. The series covers the period 1968:M1 till 2015:M1 and can be accessed at: http://www-personal.umich.edu/~lkilian/reaupdate.txt. The quarterly series that we use is averaged across the three months of each quarter.

4 Oil Prices

Oil price series are deflated by GDP deflator series. West Texas Intermediate Crude Oil 40 Deg. Beginning of Month ($/BBL), quarterly series obtained by averaging monthly series available for the period 1947Q1-2015Q1, from the FRED database: the West Texas Intermediate oil price per barrel (FRED codes: MCOILWTICO and OILPRICE). (SA, 2005=100)

5 Country weights

We use 6 measures of country weights in constructing global slack and rest of the world inflation measures. We use these weights to construct global measures for Model 2, Model 3 and Model 4. We denote the weights used to construct global slack measures for country i's forecasts as w_{ij}^{y}, for all $j = 1, ..., M$ where M corresponds to a sample of up to 29 countries for which we can draw data. The weights for rest-of-the-world inflation are consistent for all entries except for the home country (intra-national) weights. Weighted aggregates for inflation have the home country weight set to 0 and are essentially a rest-of-the-world inflation measure, by construction. In other words, for the measure of rest-of-the-world inflation relevant for country i's forecasts, we consider weights w_{ij}^{π} which set a country's own weight equal to zero (i.e., $w_{ii}^{\pi} = 0$) while other weights are re-scaled accordingly so they still sum up to 1 (i.e., $w_{ij}^{\pi} = \frac{w_{ij}^{y}}{1-w_{ii}^{y}}$ for any $j \neq i$).

1. Equal weights for country i's forecasts (for any $i = 1, ..., N$): $w_{ij}^{y} = \frac{1}{M}$, for all $j = 1, ..., M$ where M is the number of countries in the sample including the domestic economy.

2. Contiguity weights for country i's forecasts (for any $i = 1, ..., N$): The weights w_{ij}^{y} equal $\frac{1}{Z}$ if the home country i and country j share a border and 0 otherwise, for all $j = 1, ..., M$. Here, Z is given as the total number of countries that share a border with the home country.

3. Distance weights for country i's forecasts (for any $i = 1, ..., N$): These weights are based on geodesic distances that are calculated following the great circle formula, which uses latitudes and longitudes of the most important cities/agglomerations (in terms of population) to construct the *dist* variable obtained from the GeoDist dataset.[12] In particular, we use the inverse of the square of the bilateral distances between the home country i and country j, $\frac{1}{dist_{ij}^2}$, and construct the weights to be normalized to sum up to 1 as follows $w_{ij}^y = \frac{\frac{1}{dist_{ij}^2}}{\sum_{j=1}^{M} \frac{1}{dist_{ij}^2}}$ for all $j = 1, ..., M$.

4. Population-adjusted distance weights for country i's forecasts (for any $i = 1, ..., N$): These weights are constructed using the *distwces* measure, from the GeoDist dataset, based on city-level data to obtain the geographic distribution of population (in 2004) inside each country. The bilateral distances between the biggest cities of the two countries are calculated and the inter-city distances are weighted by the share of the city in the overall country's population. As in the distance-based weights proposed before, we use the inverse of the square of the distance between the home country i and country j, $\frac{1}{distwces_{ij}^2}$, and construct the weights to be normalized to sum up to 1 as follows $w_{ij}^y = \frac{\frac{1}{distwces_{ij}^2}}{\sum_{j=1}^{M} \frac{1}{distwces_{ij}^2}}$ for all $j = 1, ..., M$.

5 and 6. Trade weights for country i's forecasts (for any $i = 1, ..., N$): To construct the trade weights we use annual IMF series for every country $j = 1, ..., M$ of their imports from the world, imp_j, and their exports to the world, exp_j. With those series, we construct trade weights for any home country i as follows: $w_{ij}^y = \frac{\text{imp}_j + \text{exp}_j}{\sum_{i=1}^{M} \text{imp}_j + \text{exp}_j}$ for all $j = 1, ..., M$. This measure is based only on a country's share in world trade and does not reflect the actual bilateral trade linkages between country i and j, but only accounts for how open each country is to the rest of the world through trade. The weights obtained with this formula are the same for any country i forecast. The annual trade series are available for the entire $1980 - 2014$ period. We therefore consider two trade weight measures: trade weights based solely on data for 2010 and trade weights constructed with the average of the $1984 - 2014$ period.

Figures A1-A2 plot the country and global series for inflation and slack used in U.S. inflation forecasts.

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[12] For a detailed explanation for the GeoDist data, see Mayer and Zignago (2011)

B The Bootstrap Algorithm for 3-variable Forecasts

Here we describe how we apply the bootstrap algorithm to calculate the critical values for the F-test to evaluate the relative forecast accuracy of two nested forecasting models, where the augmented economic model has three variables but the benchmark has only one. Since Model 2, Model 3 and Model 4 can be represented as ADL models and each model is nested into Model 1, this becomes an appropriate methodology for our paper. As explained by Clark and McCracken (2005), in nested models the F-statistics relevant for the type of hypothesis testing that we conduct here have non-standard, asymptotic distributions and, hence, we need a bootstrap procedure to calculate the empirical critical values.

The procedure for augmented economic forecasting models with two-variable was introduced by Clark and McCracken (2005), and can be easily used in the inferences for Model 2 and Model 3 against Model 1. To evaluate the relative performance of Model 4 against Model 1, we apply the three-variable case extension of the Clark and McCracken (2005) procedure advocated by Kabukcuoglu and Martínez-García (2014). To forecast $h-$quarter ahead inflation for country $i = 1, ..., N$ and model $k = 4$, $\pi^k_{i,t+h|t}$, we evaluate the predictive ability of pairs of variables in the general form

$$\pi^k_{i,t+h|t} = \alpha_1 + \alpha^k_{21}(L)\,\pi_{i,t} + \alpha^k_{22}(L)\,\pi^*_{i,t} + \alpha^k_{23}(L)\,y^*_{i,t} + \epsilon^k_{i,t+h}, \tag{11}$$

where $\pi^*_{i,t}$ and $y^*_{i,t}$ denote: (i) rest-of-the-word inflation and oil price changes, (ii) rest-of-the-word inflation and domestic slack, or (iii) rest-of-the-word inflation and global slack.

We calculate the F-statistics to test the null hypothesis that the MSFE of the naïve forecasting model (Model 1) is higher than or equal to the MSFE of the augmented model above, i.e. we test the null hypothesis that $MSFE_1 \leq MSFE_k$ against the alternative that $MSFE_1 > MSFE_k$ for any given economic model $k = 2, ..., 4$. We calculate critical values based on a simple parametric bootstrap algorithm with 5000 replacements. The data-generating process (DGP) used with this parametric bootstrap algorithm involves the estimation of a $3-$equation VAR and uses the residuals to characterize the empirical distribution as in Clark and McCracken (2005). The first equation is an autoregressive process for inflation, $\pi_{i,t}$, which must hold true under the null that the benchmark model (Model 1) is appropriate to describe the dynamics of inflation and the better forecasting model. The remaining two equations are the equations for the predictors $\pi^*_{i,t}$ and $y^*_{i,t}$ where we include the distributed lags of all three variables

$$\begin{aligned}
\pi_{it} &= \beta_1 + \beta_2(L)\pi_{i,t} + e^{\pi}_{it}, \\
\pi^*_{i,t} &= \theta_1 + \theta_{11}(L)\pi_{i,t} + \theta_{12}(L)\pi^*_{i,t} + \theta_{13}(L)y^*_{i,t} + e^{\pi^*}_{it}, \\
y^*_{i,t} &= \gamma_1 + \gamma_{11}(L)\pi_{i,t} + \gamma_{12}(L)\pi^*_{i,t} + \gamma_{13}(L)y^*_{i,t} + e^{y^*}_{it}.
\end{aligned}$$

The lag length is limited to four for each variable and selected based on the Schwarz Information Criterion (SIC). The algorithm using SIC selects the lags independently for each equation and variable.

C Model-Consistent Inflation Forecasts

As in Martínez-García (2014) and Kabukcuoglu and Martínez-García (2014), we use the decomposition method into aggregates and differences advocated by Aoki (1981) (and Fukuda (1993)) to re-express the core linear rational expectations system for the workhorse open-economy New Keynesian model of Martínez-García and Wynne (2010) into two separate sub-systems. Productivity shocks enter into the dynamics of the model only through their impact on the dynamics of the Home and Foreign natural (real) rates, $\widehat{\overline{r}}_t$ and $\widehat{\overline{r}}_t^*$ respectively. The Home and Foreign monetary shock processes $\widehat{v}_t$ and $\widehat{v}_t^*$ enter through the specification of the Taylor monetary policy rule of each country.

The two countries are assumed to be symmetric in every respect, except on their consumption basket due to home-product bias in consumption. Even so, the share of local goods in the local consumption basket is the same in both countries and determined by the parameter ξ. Hence, we define the world aggregate and the difference variables $\widehat{g}_t^W$ and $\widehat{g}_t^R$ as,

$$\widehat{g}_t^W \equiv \frac{1}{2}\widehat{g}_t + \frac{1}{2}\widehat{g}_t^*, \tag{12}$$

$$\widehat{g}_t^R \equiv \widehat{g}_t - \widehat{g}_t^*. \tag{13}$$

We re-write the country variables $\widehat{g}_t$ and $\widehat{g}_t^*$ as,

$$\widehat{g}_t = \widehat{g}_t^W + \frac{1}{2}\widehat{g}_t^R, \tag{14}$$

$$\widehat{g}_t^* = \widehat{g}_t^W - \frac{1}{2}\widehat{g}_t^R. \tag{15}$$

If we characterize the dynamics for $\widehat{g}_t^W$ and $\widehat{g}_t^R$, the transformation above backs out the corresponding variables for each country $\widehat{g}_t$ and $\widehat{g}_t^*$. Then, under this transformation, we can orthogonalize the two-country model of Martínez-García and Wynne (2010) into one aggregate (or world) economic system and one difference system that can be studied independently.

C.1 Dynamics of World Inflation

The world economy New Keynesian model of Martínez-García and Wynne (2010) and Martínez-García (2014) is described with a world New Keynesian Phillips curve (NKPC), a log-linearized world Euler equation, and a world interest-rate-setting rule for monetary policy. The NKPC can be cast into the following augmented form,

$$\widehat{\pi}_t^W - \overline{\pi}_t^W = \beta \mathbb{E}_t \left(\widehat{\pi}_{t+1}^W - \overline{\pi}_{t+1}^W \right) + k^W \widehat{x}_t^W, \tag{16}$$

where $\mathbb{E}_t(.)$ refers to the expectations formed conditional on information up to time t, $\widehat{x}_t^W$ is the global output gap, $\widehat{\pi}_t^W$ is global inflation, and $\overline{\pi}_t^W$ is the global trend inflation. Moreover, $k^W \equiv \left(\frac{(1-\alpha)(1-\beta\alpha)}{\alpha} \right) (\varphi + \gamma) > 0$ is the slope of the global output gap that depends on the deep structural parameters of the model such as the frequency of price adjustment $0 < \alpha < 1$, and the intertemporal discount rate $0 < \beta < 1$. The NKPC describing the dynamics of aggregate world inflation arises in a two-country model with staggered price-setting à la Calvo (1983), augmented to include a time-varying inflation trend with price indexation in the decision of firms as in Yun (1996). In such an environment, firms that do not re-optimize their prices would automatically augment them at the trend inflation rate of the county where they reside.

The log-linearization of the Euler equation is given by,

$$\widehat{x}_t^W = \mathbb{E}_t\left[\widehat{x}_{t+1}^W\right] - \frac{1}{\gamma}\left(\widehat{i}_t^W - \mathbb{E}_t\left[\widehat{\pi}_{t+1}^W\right] - \widehat{\overline{r}}_t^W\right), \tag{17}$$

where $\widehat{i}_t^W$ is the aggregate short-term nominal interest rate, and $\widehat{\overline{r}}_t^W$ is the aggregate natural interest rate—the real interest rate absent all nominal rigidities, but with the same realization of shocks. Potential output and the natural (real) interest rate are both functions of exogenous real factors (technology).

We specify a general form of the monetary policy with a Taylor (1993) rule where the central bank of each country operates with their domestic short-term nominal interest rate with the same reaction function. The world Taylor rule can be cast in the following form,

$$\widehat{i}_t^W = \widetilde{\pi}_t^W + \psi_\pi\left(\widehat{\pi}_t^W - \widetilde{\pi}_t^W\right) + \psi_x \widehat{x}_t^W + \widehat{v}_t^W, \tag{18}$$

where $\widetilde{\pi}_t^W$ is the aggregate of both countries' central bank's inflation target and $\widehat{v}_t^W$ can be interpreted as the aggregate monetary policy shock. We assume that the inflation target for each country follows a random walk so that the aggregate itself, $\widetilde{\pi}_t^W$, also follows a random walk, i.e.,

$$\widetilde{\pi}_t^W = \widetilde{\pi}_{t-1}^W + \widetilde{\varepsilon}_t^W, \tag{19}$$

where $\widetilde{\varepsilon}_t^W$ is an i.i.d. shock with zero mean.

In this setting, the aggregate trend inflation $\overline{\pi}_t^W$ corresponds in equilibrium to the aggregate inflation target of both central banks $\widetilde{\pi}_t^W$. To see that, one can interpret the aggregate indexation rate $\overline{\pi}_t^W$ as the Beveridge-Nelson (stochastic) trend of the global inflation process,

$$\overline{\pi}_t^W = \lim_{h\to\infty} \mathbb{E}_t\left(\widehat{\pi}_{t+h}^W\right). \tag{20}$$

The world inflation rate $\widehat{\pi}_t^W$ fluctuates around a stochastic trend given by the aggregate central bank's inflation target $\widetilde{\pi}_t^W$. Hence, since we assume in (19) that the target is a random walk, it follows that $\mathbb{E}_t\left(\widetilde{\pi}_{t+h}^W\right) = \widetilde{\pi}_t^W$ at any period $h > 0$. In that case, the definition in (20) implies that $\overline{\pi}_t^W = \widetilde{\pi}_t^W$ at every point in time and this confirms that trend and target inflation must be equal in equilibrium.

Using the aggregate monetary policy rule in (18) to replace $\widehat{i}_t^W$ in $(16) - (17)$, the system of equations that determines world inflation and global slack can be written in the following form,

$$\widehat{z}_t^W = A^W \mathbb{E}_t\left(\widehat{z}_{t+1}^W\right) + a^W\left(\widehat{\overline{r}}_t^W - \widehat{v}_t^W\right), \tag{21}$$

where,

$$\widehat{z}_t^W \equiv \begin{bmatrix} \widehat{\pi}_t^W - \overline{\pi}_t^W \\ \widehat{x}_t^W \end{bmatrix}, \tag{22}$$

where A^W is a 2×2 matrix and a^W is a 2×1 matrix of structural coefficients. We assume that the process for the aggregate central bank's predicted real rate $\widehat{\overline{r}}_t^W$ is stochastic and exogenous. Under the assumption that the aggregate interest rate gap $\left(\widehat{\overline{r}}_t^W - \widehat{v}_t^W\right)$ is stationary, then the system in (21) has a unique nonexplosive solution in which both $\widehat{x}_t^W$ and $\widehat{\pi}_t^W - \overline{\pi}_t^W$ are stationary whenever both eigenvalues of the matrix A^W are inside the unit circle. A variant of the Taylor principle which requires that $\psi_\pi + \left(\frac{1-\beta}{k^W}\right)\psi_x > 1$ suffices to ensure the uniqueness and existence of the nonexplosive solution for the world aggregates.

Assuming that condition is satisfied, the solution can be characterized as follows,

$$\begin{pmatrix} \widehat{\pi}_t^W \\ \widehat{x}_t^W \end{pmatrix} = \begin{pmatrix} \overline{\pi}_t^W \\ 0 \end{pmatrix} + \sum\nolimits_{j=0}^{\infty} \left(A^W\right)^j a^j \mathbb{E}_t \left(\widehat{\bar{r}}_{t+j}^W - \widehat{v}_{t+j}^W\right). \tag{23}$$

Hence, world inflation is determined by the world inflation target and by current and expected future discrepancies between the aggregate natural rate of interest and the aggregate of the central bank's monetary policy shock. We assume that central banks adjust their policy to track changes in the natural rate of interest that are forecastable one period in advance implying that $\widehat{v}_t^W = \mathbb{E}_{t-1}\left(\widehat{\bar{r}}_t^W\right)$. Alternatively, we can simply assume—as most of the literature implicitly does—that $\widehat{v}_t^W = \widehat{\bar{r}}_t^W + \widehat{\varepsilon}_t^{vW}$, where $\widehat{\bar{r}}_t^W$ corresponds to the global natural interest rate and $\widehat{\varepsilon}_t^{vW}$ is an i.i.d. disturbance that captures non-persistent and unanticipated shocks to monetary policy. In either case, the world interest rate gap $\left(\widehat{\bar{r}}_t^W - \widehat{v}_t^W\right)$ is viewed as white noise and the solution to the global system in (21) becomes,

$$\widehat{\pi}_t^W = \overline{\pi}_t^W + \lambda^W \left(\widehat{\bar{r}}_t^W - \widehat{v}_t^W\right) = \overline{\pi}_t^W - \lambda^W \widehat{\varepsilon}_t^{vW}, \tag{24}$$

$$\widehat{x}_t^W = \mu^W \left(\widehat{\bar{r}}_t^W - \widehat{v}_t^W\right) = -\mu^W \widehat{\varepsilon}_t^{vW}, \tag{25}$$

where the composite coefficients λ^W and μ^W depend on the deep structural parameters of the model.

Proposition 1 *Given the solution of the world system in* $(24) - (25)$, *the following trade-off between world inflation and world slack arises in equilibrium*

$$\widehat{\pi}_t^W - \overline{\pi}_t^W = \frac{\lambda^W}{\mu^W}\widehat{x}_t^W, \tag{26}$$

which indicates that world inflation in deviations from trend and world slack are correlated.

If aggregate inflation evolves as predicted by this solution, then optimal forecasts of future global inflation at any horizon $h \geq 1$ must be given by,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}^W\right) = \overline{\pi}_t^W = \widehat{\pi}_t^W - \frac{\lambda^W}{\mu^W}\widehat{x}_t^W, \tag{27}$$

or, simply re-arranging, by,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}^W - \widehat{\pi}_t^W\right) = -\frac{\lambda^W}{\mu^W}\widehat{x}_t^W. \tag{28}$$

This implies that no other variable should improve our forecast of changes in global inflation when global slack and the current global inflation rate are included in our forecasting model. Forecasting future global inflation using the global output gap alone would not be accurate since global inflation potentially has a stochastic trend while global slack is stationary; one needs to include among the regressors some variable with a similar stochastic trend to that of inflation. Current global inflation itself has the same stochastic trend, so including it to forecast future inflation takes care of the trend component without the need to include any other regressors to track the stochastic trend. We use this identifying restriction in order to construct a reduced-form specification for forecasting inflation that is consistent with the NKPC.

C.2 Dynamics of Differential Inflation

The difference economy New Keynesian model of Martínez-García and Wynne (2010) and Martínez-García (2014) is described with a differential New Keynesian Phillips curve (NKPC), a log-linearized differential Euler equation, and a differential interest-rate-setting rule for monetary policy. The NKPC can be cast into the following augmented form,

$$\widehat{\pi}_t^R - \overline{\pi}_t^R = \beta \mathbb{E}_t \left(\widehat{\pi}_{t+1}^R - \overline{\pi}_{t+1}^R \right) + k^R \widehat{x}_t^R, \tag{29}$$

where $\mathbb{E}_t(.)$ refers to the expectations formed conditional on information up to time t, $\widehat{x}_t^R$ is the difference between the current output gap of the two countries, $\widehat{\pi}_t^R$ is the difference in inflation, and $\overline{\pi}_t^R$ is the difference in trend inflation. Moreover, $k^R \equiv \left(\frac{(1-\alpha)(1-\beta\alpha)}{\alpha}\right)\left((1-2\xi)\varphi + (2\Theta - 1)\gamma\right)$ is the slope of the difference output gap that depends on the deep structural parameters of the model such as the frequency of price adjustment $0 < \alpha < 1$, and the intertemporal discount rate $0 < \beta < 1$. The NKPC describing the dynamics of the inflation differential arises in a two-country model with staggered price-setting à la Calvo (1983), augmented to include a time-varying inflation trend with price indexation in the decision of firms as in Yun (1996). In such an environment, firms that do not re-optimize their prices would automatically increase them at the trend inflation rate of the county where they reside.

The log-linearization of the Euler equation is given by,

$$\widehat{x}_t^R = \mathbb{E}_t \left[\widehat{x}_{t+1}^R \right] - \frac{1}{\gamma} \left(\frac{(1-2\xi) + 2\Gamma}{1-2\xi} \right) \left(\widehat{i}_t^R - \mathbb{E}_t \left[\widehat{\pi}_{t+1}^R \right] - \widehat{\overline{r}}_t^R \right), \tag{30}$$

where $\widehat{i}_t^R$ is the difference in the short-term nominal interest rate, and $\widehat{\overline{r}}_t^R$ is the difference natural interest rate—the real interest rate differential that the economy would experience absent all nominal rigidities, but given the same realization of shocks. Potential output and the natural (real) interest rate are both functions of exogenous real factors (technology).

We specify a general form of the monetary policy with a Taylor (1993) rule where the central bank of each country operates with their domestic short-term nominal interest rate with the same reaction function. The difference Taylor rule can be cast in the following form,

$$\widehat{i}_t^R = \widetilde{\pi}_t^R + \psi_\pi \left(\widehat{\pi}_t^R - \widetilde{\pi}_t^R \right) + \psi_x \widehat{x}_t^R + \widehat{v}_t^R, \tag{31}$$

where $\widetilde{\pi}_t^R$ is the difference between both countries' central bank's inflation target and $\widehat{\overline{r}}_t^R$ can be interpreted as the difference between both country's central bank's monetary policy shock. We assume that the inflation target for each country follows a random walk so that the difference itself, $\widetilde{\pi}_t^R$, also follows a random walk, i.e.,

$$\widetilde{\pi}_t^R = \widetilde{\pi}_{t-1}^R + \widetilde{\varepsilon}_t^R, \tag{32}$$

where $\widetilde{\varepsilon}_t^R$ is an i.i.d. shock with zero mean.

In this setting, it also follows that the difference trend inflation $\overline{\pi}_t^R$ corresponds in equilibrium to the difference of the central bank's inflation target $\widetilde{\pi}_t^R$. To see that, one can interpret the rate $\overline{\pi}_t^R$ as the Beveridge-Nelson (stochastic) trend of the differential inflation process,

$$\overline{\pi}_t^R \;=\; \lim_{h\to\infty} \mathbb{E}_t\left(\widehat{\pi}_{t+h}^R\right). \tag{33}$$

The differential inflation rate $\widehat{\pi}_t^R$ in this model fluctuates around a stochastic trend given by the difference in central bank's inflation targets. Hence, since we assume in (32) that the target is a random walk, it follows that $\mathbb{E}_t\left(\widetilde{\pi}_{t+h}^R\right) = \widetilde{\pi}_t^R$ at any period $h > 0$. In that case, the definition in (33) implies that $\overline{\pi}_t^R = \widetilde{\pi}_t^R$ at every point in time and this confirms that trend and target inflation must be equal in equilibrium also for the differential economy.

Using the differential monetary policy rule in (31) to replace $\widehat{i}_t^R$ in (29) $-$ (30), the system of equations that determines the inflation differential and slack differential can be written in the following form,

$$\widehat{z}_t^R = A^R \mathbb{E}_t\left(\widehat{z}_{t+1}^R\right) + a^R\left(\widehat{\overline{r}}_t^R - \widehat{v}_t^R\right), \tag{34}$$

where,

$$\widehat{z}_t^R \equiv \begin{bmatrix} \widehat{\pi}_t^R - \overline{\pi}_t^R \\ \widehat{x}_t^R \end{bmatrix}, \tag{35}$$

where A^R is a 2×2 matrix and a^R is a 2×1 matrix of structural coefficients. We assume that the process for the difference in central bank's monetary shocks $\widehat{v}_t^R$ is stochastic and exogenous. Under the assumption that the interest rate gap differential $\left(\widehat{\overline{r}}_t^R - \widehat{v}_t^R\right)$ is stationary, then the system in (21) has a unique nonexplosive solution in which both $\widehat{x}_t^R$ and $\widehat{\pi}_t^R - \overline{\pi}_t^R$ are stationary whenever both eigenvalues of the matrix A^R are inside the unit circle. A variant of the Taylor principle which requires that $\psi_\pi + \left(\frac{1-\beta}{k^R}\right)\psi_x > 1$ suffices to ensure the uniqueness and existence of the nonexplosive solution for the differential variables.

Assuming that condition is satisfied, the solution can be characterized as follows,

$$\begin{pmatrix} \widehat{\pi}_t^R \\ \widehat{x}_t^R \end{pmatrix} = \begin{pmatrix} \overline{\pi}_t^R \\ 0 \end{pmatrix} + \sum_{j=0}^{\infty}\left(A^R\right)^j a^R \mathbb{E}_t\left(\widehat{\overline{r}}_{t+j}^R - \widehat{v}_{t+j}^R\right). \tag{36}$$

Hence, the inflation differential is determined by the inflation target differential across both countries and by current and expected future discrepancies between the differential natural rate of interest and the differential of the central bank's monetary policy shocks. We assume that central banks adjust their policy to track changes in the natural rate of interest that are forecastable one period in advance implying that $\widehat{v}_t^R = \mathbb{E}_{t-1}\left(\widehat{\overline{r}}_t^R\right)$. Alternatively, we can simply assume—as most of the literature implicitly does—that $\widehat{v}_t^R = \widehat{\overline{r}}_t^R + \widehat{\varepsilon}_t^{vR}$, where $\widehat{\overline{r}}_t^R$ corresponds to the natural interest rate differential and $\widehat{\varepsilon}_t^{vR}$ is an i.i.d. disturbance that captures non-persistent and unanticipated shocks to monetary policy. In either case, the interest rate gap differential $\left(\widehat{\overline{r}}_t^R - \widehat{v}_t^R\right)$ is viewed as white noise and the solution to the differential system in (34) becomes,

$$\widehat{\pi}_t^R \;=\; \overline{\pi}_t^R + \lambda^R\left(\widehat{\overline{r}}_t^R - \widehat{v}_t^R\right) = \overline{\pi}_t^R - \lambda^R \widehat{\varepsilon}_t^{vR}, \tag{37}$$

$$\widehat{x}_t^R \;=\; \mu^R\left(\widehat{\overline{r}}_t^R - \widehat{v}_t^R\right) = -\mu^R \widehat{\varepsilon}_t^{vR}, \tag{38}$$

where the composite coefficients λ^R and μ^R depend on the deep structural parameters of the model.

Proposition 2 *Given the solution of the difference system in* $(37) - (25)$*, the following trade-off between difference inflation and difference slack arises in equilibrium*

$$\widehat{\pi}^R_t - \overline{\pi}^R_t = \frac{\lambda^R}{\mu^R}\widehat{x}^R_t, \tag{39}$$

which indicates that differential inflation in deviations from trend and differential slack are correlated.

If inflation differential evolve as predicted by this solution, then optimal forecasts of future differential inflation at any horizon $h \geq 1$ must be given by,

$$\mathbb{E}_t\left(\widehat{\pi}^R_{t+h}\right) = \overline{\pi}^R_t = \widehat{\pi}^R_t - \frac{\lambda^R}{\mu^R}\widehat{x}^R_t, \tag{40}$$

or, simply re-arranging, by,

$$\mathbb{E}_t\left(\widehat{\pi}^R_{t+h} - \widehat{\pi}^R_t\right) = -\frac{\lambda^R}{\mu^R}\widehat{x}^R_t. \tag{41}$$

This implies that no other variable should improve our forecast of changes in the differential inflation whenever differential slack and the current inflation differential rate are included in our forecasting model. Forecasting future differential inflation using the differential output gap alone would not be accurate since differential inflation potentially has a stochastic trend while differential slack is stationary; one needs to include among the regressors some variable with a similar stochastic trend to that of inflation. Current differential inflation itself has the same stochastic trend, so including it to forecast future differential inflation takes care of the trend component without the need to include any other regressors to attempt to track the stochastic trend. We use this identifying restriction in order to construct a reduced-form specification for forecasting inflation that is consistent with the NKPC.

C.3 Dynamics of Home and Foreign Inflation

Undoing the transformation of variables indicated in $(14) - (15)$, we can use the equations that characterize the world system in $(14) - (15)$ and the equations that characterize the difference system in $(14) - (15)$ to recover the solution to Home and Foreign inflation, $\widehat{\pi}_t$ and $\widehat{\pi}^*_t$, as follows,

$$\begin{aligned}
\widehat{\pi}_t &= \widehat{\pi}^W_t + \frac{1}{2}\widehat{\pi}^R_t = \overline{\pi}^W_t - \lambda^W\widehat{\varepsilon}^{vW}_t + \frac{1}{2}\left(\overline{\pi}^R_t - \lambda^R\widehat{\varepsilon}^{vR}_t\right) = \overline{\pi}_t - \lambda^W\widehat{\varepsilon}^{vW}_t - \frac{1}{2}\lambda^R\widehat{\varepsilon}^{vR}_t, &(42)\\
\widehat{\pi}^*_t &= \widehat{\pi}^W_t - \frac{1}{2}\widehat{\pi}^R_t = \overline{\pi}^W_t - \lambda^W\widehat{\varepsilon}^{vW}_t - \frac{1}{2}\left(\overline{\pi}^R_t - \lambda^R\widehat{\varepsilon}^{vR}_t\right) = \overline{\pi}^*_t - \lambda^W\widehat{\varepsilon}^{vW}_t + \frac{1}{2}\lambda^R\widehat{\varepsilon}^{vR}_t. &(43)
\end{aligned}$$

Similarly, the solution to Home and Foreign slack, $\widehat{x}_t$ and $\widehat{x}^*_t$, can be expressed in the following terms,

$$\begin{aligned}
\widehat{x}_t &= \widehat{x}^W_t + \frac{1}{2}\widehat{x}^R_t = -\mu^W\widehat{\varepsilon}^{vW}_t - \frac{1}{2}\mu^R\widehat{\varepsilon}^{vR}_t, &(44)\\
\widehat{x}^*_t &= \widehat{x}^W_t - \frac{1}{2}\widehat{x}^R_t = -\mu^W\widehat{\varepsilon}^{vW}_t + \frac{1}{2}\mu^R\widehat{\varepsilon}^{vR}_t. &(45)
\end{aligned}$$

Accordingly, the solution of the full model can be expressed in matrix form as follows,

$$\begin{aligned}\begin{pmatrix} \widehat{\pi}_t - \overline{\pi}_t \\ \widehat{\pi}^*_t - \overline{\pi}^*_t \end{pmatrix} &= \begin{pmatrix} -\lambda^W & -\frac{1}{2}\lambda^R \\ -\lambda^W & \frac{1}{2}\lambda^R \end{pmatrix} \begin{pmatrix} \widehat{\varepsilon}^{vW}_t \\ \widehat{\varepsilon}^{vR}_t \end{pmatrix}, &(46)\\ \begin{pmatrix} \widehat{x}_t \\ \widehat{x}^*_t \end{pmatrix} &= \begin{pmatrix} -\mu^W & -\frac{1}{2}\mu^R \\ -\mu^W & \frac{1}{2}\mu^R \end{pmatrix} \begin{pmatrix} \widehat{\varepsilon}^{vW}_t \\ \widehat{\varepsilon}^{vR}_t \end{pmatrix}, &(47)\end{aligned}$$

from where we obtain the equilibrium reduced-form Phillips curve relationship as,

$$\begin{pmatrix} \widehat{\pi}_t - \overline{\pi}_t \\ \widehat{\pi}^*_t - \overline{\pi}^*_t \end{pmatrix} = \frac{1}{2} \begin{pmatrix} \frac{\lambda^W}{\mu^W} + \frac{\lambda^R}{\mu^R} & \frac{\lambda^W}{\mu^W} - \frac{\lambda^R}{\mu^R} \\ \frac{\lambda^W}{\mu^W} - \frac{\lambda^R}{\mu^R} & \frac{\lambda^W}{\mu^W} + \frac{\lambda^R}{\mu^R} \end{pmatrix} \begin{pmatrix} \widehat{x}_t \\ \widehat{x}^*_t \end{pmatrix}. \tag{48}$$

In other words, in equilibrium Home and Foreign inflation depend on their respective Home and Foreign targets as well as on a weighted average of Home and Foreign slack.

C.4 Implications for Inflation Forecasting

A time t forecast of domestic inflation h-quarters-ahead, $\widehat{\pi}_{t+h}$, that is efficient—in the sense that it cannot be improved with additional information—can be achieved by combining two separate forecasts for global inflation, $\widehat{\pi}^W_{t+h}$, and for the inflation differential that arises between the Home and Foreign economies, $\widehat{\pi}^R_{t+h}$, as follows,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}\right) = \mathbb{E}_t\left(\widehat{\pi}^W_{t+h}\right) + \frac{1}{2}\mathbb{E}_t\left(\widehat{\pi}^R_{t+h}\right). \tag{49}$$

This decomposition implies that an efficient forecast for domestic inflation that is consistent with the workhorse open-economy New Keynesian model can be constructed by parts combining forecasts for global inflation and the inflation differential.

We found that no variable other than global slack, $\widehat{x}^W_t$, should help improve the forecast of changes in global inflation while no variable other than the difference between domestic and rest-of-the-world slack, $\widehat{x}^R_t$, should help improve the forecast of changes in the inflation differential. Hence, the theory laid out here (equations (28) and (41)) suggests that an efficient forecast of domestic inflation can be achieved based on the following model-consistent forecasting specification,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h} - \widehat{\pi}_t\right) = -\theta^W \widehat{x}^W_t - \frac{1}{2}\theta^R \widehat{x}^R_t, \tag{50}$$

where $\theta^W \equiv \frac{\lambda^W}{\mu^W}$ and $\theta^R \equiv \frac{\lambda^R}{\mu^R}$ are composite coefficients of the deep structural parameters of the model. Undoing the transformation of variables indicated in $(14) - (15)$, the forecasting equation in (50) can be expressed as follows,

$$\begin{aligned}\mathbb{E}_t\left(\widehat{\pi}_{t+h} - \widehat{\pi}_t\right) &= -\theta^W\left(\frac{1}{2}\widehat{x}_t + \frac{1}{2}\widehat{x}^*_t\right) - \frac{1}{2}\theta^R\left(\widehat{x}_t - \widehat{x}^*_t\right) \\ &= -\frac{1}{2}\left(\theta^W + \theta^R\right)\widehat{x}_t - \frac{1}{2}\left(\theta^W - \theta^R\right)\widehat{x}^*_t. \end{aligned} \tag{51}$$

This forecasting equation suggests that expected changes in domestic inflation over the next h-periods can be efficiently forecasted with a weighted measure of Home and Foreign slack.

Furthermore, we see that the measure of world slack $\widehat{x}_t^W = \frac{1}{2}\widehat{x}_t + \frac{1}{2}\widehat{x}_t^*$ that we have defined based on economic size (or population) weights is not appropriate for forecasting changes in inflation. In turn, the global slack measure needed for forecasting, $\widehat{x}_t^{W,adh}$, must be corrected to take into account the features of the open-economy New Keynesian model that capture the linkages across countries as follows,

$$\widehat{x}_t^{W,adh} = \frac{1}{2}\left(\frac{\theta^W + \theta^R}{\theta^W}\right)\widehat{x}_t + \frac{1}{2}\left(\frac{\theta^W - \theta^R}{\theta^W}\right)\widehat{x}_t^*, \tag{52}$$

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h} - \widehat{\pi}_t\right) = -\theta^W \widehat{x}_t^{W,adh}. \tag{53}$$

In this sense, we argue that computing global slack with appropriate weights suffices to predict domestic inflation changes. Given the complexity of constructing this measure of global slack due to data limitations and the difficulties associated with constructing the model-consistent weights, we consider alternative forecasting models based on the same theory that generate accurate forecasts and are easier to implement in practice. For that reason, we exploit the forecasting equation in (50) together with measures of global inflation in order to derive more practical and easily-measurable forecasting models based on the predictions of the open-economy New Keynesian model.

Forecasting Model with Global Inflation. The forecasting equation in (50) combined with the Phillips-curve-type relationship noted in (26) imply that,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h} - \widehat{\pi}_t\right) = -\left(\widehat{\pi}_t^W - \overline{\pi}_t^W\right) - \frac{1}{2}\theta^R \widehat{x}_t^R. \tag{54}$$

This forecasting equation suggests that global inflation in deviations should help forecast changes in domestic inflation, and contributes to partly account for the international linkages across countries suggested by theory. Given the transformation of variables indicated in (14) − (15), global inflation is constructed weighting each country equally. However, given that both countries are essentially symmetric, the equal weights in this case arise from the fact that the population shares and steady-state output shares of both economies are the same. Multiple countries with different economic sizes would have to be weighted accordingly and, hence, equal weights may not be the best theoretically-consistent weighting scheme to do so in every case.

Forecasting equation (54) indicates that global inflation alone does not suffice to generate an efficient forecast of domestic inflation. These forecasts might be improved upon if we augment the model with a good measure of the slack differential between the domestic and rest-of-the-world economies, $\widehat{x}_t^R$. For that reason, we propose two potential extensions of the forecasting model specification given in (54). First, we recognize that the inflation differential in the open-economy New Keynesian model may arise from movements in the terms of trade. Martínez-García and Wynne (2010) already noted that differential slack can be proxied by the terms of trade gap, $\widehat{tot}_t - \widehat{\overline{tot}}_t$, as follows,

$$\widehat{x}_t^R = \frac{1}{\kappa}\left(\widehat{tot}_t - \widehat{\overline{tot}}_t\right), \tag{55}$$

where κ is a composite coefficient of the deep structural parameters of the model. Hence, the forecasting equation in (54) can alternatively be expressed as,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}-\widehat{\pi}_t\right)=-\left(\widehat{\pi}_t^W-\overline{\pi}_t^W\right)-\frac{1}{2}\frac{\theta^R}{\kappa}\left(\widehat{tot}_t-\widehat{\overline{tot}}_t\right). \tag{56}$$

Oil prices are often viewed as driving terms of trade movements that are originated in global markets and reflect the balance of global demand and supply. In that sense, we use changes in oil prices to proxy for the unobserved terms of trade gap to exploit the model-consistent forecasting equation in (56) to generate more accurate forecasts of domestic inflation than those we could obtain with global inflation alone.

Second, the forecasting equation in (50) can also be re-expressed as follows,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}-\widehat{\pi}_t\right)=-\left(\theta^W-\theta^R\right)\widehat{x}_t^W-\theta^R\widehat{x}_t, \tag{57}$$

where $\widehat{x}_t$ stands for domestic slack. Combining this alternative specification of the forecasting equation with the theoretical relationship between global slack and global inflation in deviations indicated in (26), we obtain that,

$$\mathbb{E}_t\left(\widehat{\pi}_{t+h}-\widehat{\pi}_t\right)=-\left(\frac{\theta^W-\theta^R}{\theta^W}\right)\left(\widehat{\pi}_t^W-\overline{\pi}_t^W\right)-\theta^R\widehat{x}_t. \tag{58}$$

This alternative specification motivates our interest in using measures of filtered output (or slack) together with global inflation for forecasting domestic inflation.

C.5 Workhorse Open-Economy New Keynesian Model: Summary

Open-Economy New Keynesian Model: Core Equations	
	Home Economy
Phillips curve	$\widehat{\pi}_t - \overline{\pi}_t \approx \beta \mathbb{E}_t \left(\widehat{\pi}_{t+1} - \overline{\pi}_{t+1}\right) + \left(\frac{(1-\alpha)(1-\beta\alpha)}{\alpha}\right) \left[\left((1-\xi)\varphi + \Theta\gamma\right) \widehat{x}_t + \left(\xi\varphi + (1-\Theta)\gamma\right) \widehat{x}^*_t\right]$
Output gap	$\gamma (1-2\xi) \left(\mathbb{E}_t \left[\widehat{x}_{t+1}\right] - \widehat{x}_t\right) \approx \left((1-2\xi) + \Gamma\right) \left[\widehat{r}_t - \widehat{\overline{r}}_t\right] - \Gamma \left[\widehat{r}^*_t - \widehat{\overline{r}}^*_t\right]$
Monetary policy	$\widehat{i}_t \approx \widetilde{\pi}_t + \left[\Psi_\pi \left(\widehat{\pi}_t - \widetilde{\pi}_t\right) + \Psi_x \widehat{x}_t\right] + \widehat{v}_t,\ \widetilde{\pi}_t = \widetilde{\pi}_{t-1} + \widehat{\varepsilon}_t$
Fisher equation	$\widehat{r}_t \equiv \widehat{i}_t - \mathbb{E}_t \left[\widehat{\pi}_{t+1}\right]$
Natural interest rate	$\widehat{\overline{r}}_t \approx \gamma \left[\Theta \left(\mathbb{E}_t \left[\widehat{\overline{y}}_{t+1}\right] - \widehat{\overline{y}}_t\right) + (1-\Theta) \left(\mathbb{E}_t \left[\widehat{\overline{y}}^*_{t+1}\right] - \widehat{\overline{y}}^*_t\right)\right]$
	$\widehat{\overline{r}}_t \approx \gamma \left(\frac{1+\varphi}{\gamma+\varphi}\right) \left[\left(\Theta\Lambda + (1-\Theta)(1-\Lambda)\right) \mathbb{E}_t \left[\Delta\widehat{a}_{t+1}\right] + \left(\Theta(1-\Lambda) + (1-\Theta)\Lambda\right) \mathbb{E}_t \left[\Delta\widehat{a}^*_{t+1}\right]\right]$
Potential output	$\widehat{\overline{y}}_t \approx \left(\frac{1+\varphi}{\gamma+\varphi}\right) \left[\Lambda\widehat{a}_t + (1-\Lambda)\widehat{a}^*_t\right]$
	Foreign Economy
Phillips curve	$\widehat{\pi}^*_t - \overline{\pi}^*_t \approx \beta \mathbb{E}_t \left(\widehat{\pi}^*_{t+1} - \overline{\pi}^*_{t+1}\right) + \left(\frac{(1-\alpha)(1-\beta\alpha)}{\alpha}\right) \left[\left(\xi\varphi + (1-\Theta)\gamma\right) \widehat{x}_t + \left((1-\xi)\varphi + \Theta\gamma\right) \widehat{x}^*_t\right]$
Output gap	$\gamma (1-2\xi) \left(\mathbb{E}_t \left[\widehat{x}^*_{t+1}\right] - \widehat{x}^*_t\right) \approx -\Gamma \left[\widehat{r}_t - \widehat{\overline{r}}_t\right] + \left((1-2\xi) + \Gamma\right) \left[\widehat{r}^*_t - \widehat{\overline{r}}^*_t\right]$
Monetary policy	$\widehat{i}^*_t \approx \widetilde{\pi}^*_t + \left[\psi_\pi(\widehat{\pi}^*_t - \widetilde{\pi}^*_t) + \psi_x \widehat{x}^*_t\right] + \widehat{v}^*_t,\ \widetilde{\pi}^*_t = \widetilde{\pi}^*_{t-1} + \widehat{\varepsilon}^*_t,$
Fisher equation	$\widehat{r}^*_t \equiv \widehat{i}^*_t - \mathbb{E}_t \left[\widehat{\pi}^*_{t+1}\right]$
Natural interest rate	$\widehat{\overline{r}}^*_t \approx \gamma \left[(1-\Theta) \left(\mathbb{E}_t \left[\widehat{\overline{y}}_{t+1}\right] - \widehat{\overline{y}}_t\right) + \Theta \left(\mathbb{E}_t \left[\widehat{\overline{y}}^*_{t+1}\right] - \widehat{\overline{y}}^*_t\right)\right]$
	$\widehat{\overline{r}}^*_t \approx \gamma \left(\frac{1+\varphi}{\gamma+\varphi}\right) \left[\left((1-\Theta)\Lambda + \Theta(1-\Lambda)\right) \mathbb{E}_t \left[\Delta\widehat{a}_{t+1}\right] + \left((1-\Theta)(1-\Lambda) + \Theta\Lambda\right) \mathbb{E}_t \left[\Delta\widehat{a}^*_{t+1}\right]\right]$
Potential output	$\widehat{\overline{y}}^*_t \approx \left(\frac{1+\varphi}{\gamma+\varphi}\right) \left[(1-\Lambda)\widehat{a}_t + \Lambda\widehat{a}^*_t\right]$
	Exogenous, Country-Specific Shocks
Productivity shock	$\begin{pmatrix} \widehat{a}_t \\ \widehat{a}^*_t \end{pmatrix} \approx \begin{pmatrix} \delta_a & \delta_{a,a^*} \\ \delta_{a,a^*} & \delta_a \end{pmatrix} \begin{pmatrix} \widehat{a}_{t-1} \\ \widehat{a}^*_{t-1} \end{pmatrix} + \begin{pmatrix} \widehat{\varepsilon}^a_t \\ \widehat{\varepsilon}^{a*}_t \end{pmatrix}$ $\begin{pmatrix} \widehat{\varepsilon}^a_t \\ \widehat{\varepsilon}^{a*}_t \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_a & \rho_{a,a^*}\sigma^2_a \\ \rho_{a,a^*}\sigma^2_a & \sigma^2_a \end{pmatrix}\right)$
Monetary shock	$\begin{pmatrix} \widehat{v}_t \\ \widehat{v}^*_t \end{pmatrix} \approx \begin{pmatrix} \delta_v & 0 \\ 0 & \delta_v \end{pmatrix} \begin{pmatrix} \widehat{v}_{t_{-1}} \\ \widehat{v}^*_{t-1} \end{pmatrix} + \begin{pmatrix} \widehat{\varepsilon}^v_t \\ \widehat{\varepsilon}^{v*}_t \end{pmatrix}$ $\begin{pmatrix} \widehat{\varepsilon}^v_t \\ \widehat{\varepsilon}^{v*}_t \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_v & \rho_{v,v^*}\sigma^2_v \\ \rho_{v,v^*}\sigma^2_v & \sigma^2_v \end{pmatrix}\right)$
	Composite Parameters
	$\Theta \equiv (1-\xi) \left[\frac{\sigma\gamma - (\sigma\gamma-1)(1-2\xi)}{\sigma\gamma - (\sigma\gamma-1)(1-2\xi)^2}\right]$ $\Lambda \equiv 1 + (\sigma\gamma - 1) \left[\frac{\gamma\xi 2(1-\xi)}{\varphi\left(\sigma\gamma - (\sigma\gamma-1)(1-2\xi)^2\right) + \gamma}\right]$ $\Gamma \equiv \xi \left[\sigma\gamma + (\sigma\gamma - 1)(1-2\xi)\right]$

Open-Economy New Keynesian Model: Non-Core Equations	
	Home Economy
Output	$\widehat{y}_t = \widehat{\overline{y}}_t + \widehat{x}_t$
Consumption	$\widehat{c}_t \approx \Theta \widehat{y}_t + (1-\Theta)\,\widehat{y}_t^*$
Employment	$\widehat{l}_t \approx \widehat{y}_t - \widehat{a}_t$
Real wages	$(\widehat{w}_t - \widehat{p}_t) \approx \gamma \widehat{c}_t + \varphi \widehat{l}_t \approx (\varphi + \gamma\Theta)\,\widehat{y}_t + \gamma\,(1-\Theta)\,\widehat{y}_t^* - \varphi \widehat{a}_t$
Real Money Demand	$\widehat{m}_t^d - \widehat{p}_t \approx \widehat{c}_t - \eta \widehat{i}_t$
	Foreign Economy
Output	$\widehat{y}_t^* = \widehat{\overline{y}}_t^* + \widehat{x}_t^*$
Consumption	$\widehat{c}_t^* \approx (1-\Theta)\,\widehat{y}_t + \Theta \widehat{y}_t^*$
Employment	$\widehat{l}_t^* \approx \widehat{y}_t^* - \widehat{a}_t^*$
Real wages	$(\widehat{w}_t^* - \widehat{p}_t^*) \approx \gamma \widehat{c}_t^* + \varphi \widehat{l}_t^* \approx \gamma\,(1-\Theta)\,\widehat{y}_t + (\varphi + \gamma\Theta)\,\widehat{y}_t^* - \varphi \widehat{a}_t^*$
Real Money Demand	$\widehat{m}_t^{d*} - \widehat{p}_t^* \approx \widehat{c}_t^* - \eta \widehat{i}_t^*$
	International Relative Prices and Trade
Real exchange rate	$\widehat{rs}_t \approx (1-2\xi)\,\widehat{tot}_t$
Terms of trade	$\widehat{tot}_t \approx \left[\frac{\gamma}{\sigma\gamma-(\sigma\gamma-1)(1-2\xi)^2}\right](\widehat{y}_t - \widehat{y}_t^*)$
Home real exports	$\widehat{exp}_t \approx \Xi \widehat{y}_t + (1-\Xi)\,\widehat{y}_t^*$
Home real imports	$\widehat{imp}_t \approx -\,(1-\Xi)\,\widehat{y}_t - \Xi \widehat{y}_t^*$
Home real trade balance	$\widehat{tb}_t \equiv \widehat{y}_t - \widehat{c}_t = (1-\xi)\left(\widehat{exp}_t - \widehat{imp}_t\right) \approx (1-\Theta)\,(\widehat{y}_t - \widehat{y}_t^*)$
	Composite Parameters
	$\Theta \equiv (1-\xi)\left[\frac{\sigma\gamma-(\sigma\gamma-1)(1-2\xi)}{\sigma\gamma-(\sigma\gamma-1)(1-2\xi)^2}\right]$
	$\Xi \equiv \left[\frac{\sigma\gamma+(\sigma\gamma-1)(1-2\xi)\xi}{\sigma\gamma-(\sigma\gamma-1)(1-2\xi)^2}\right]$

D Empirical Findings: Tables and Figures

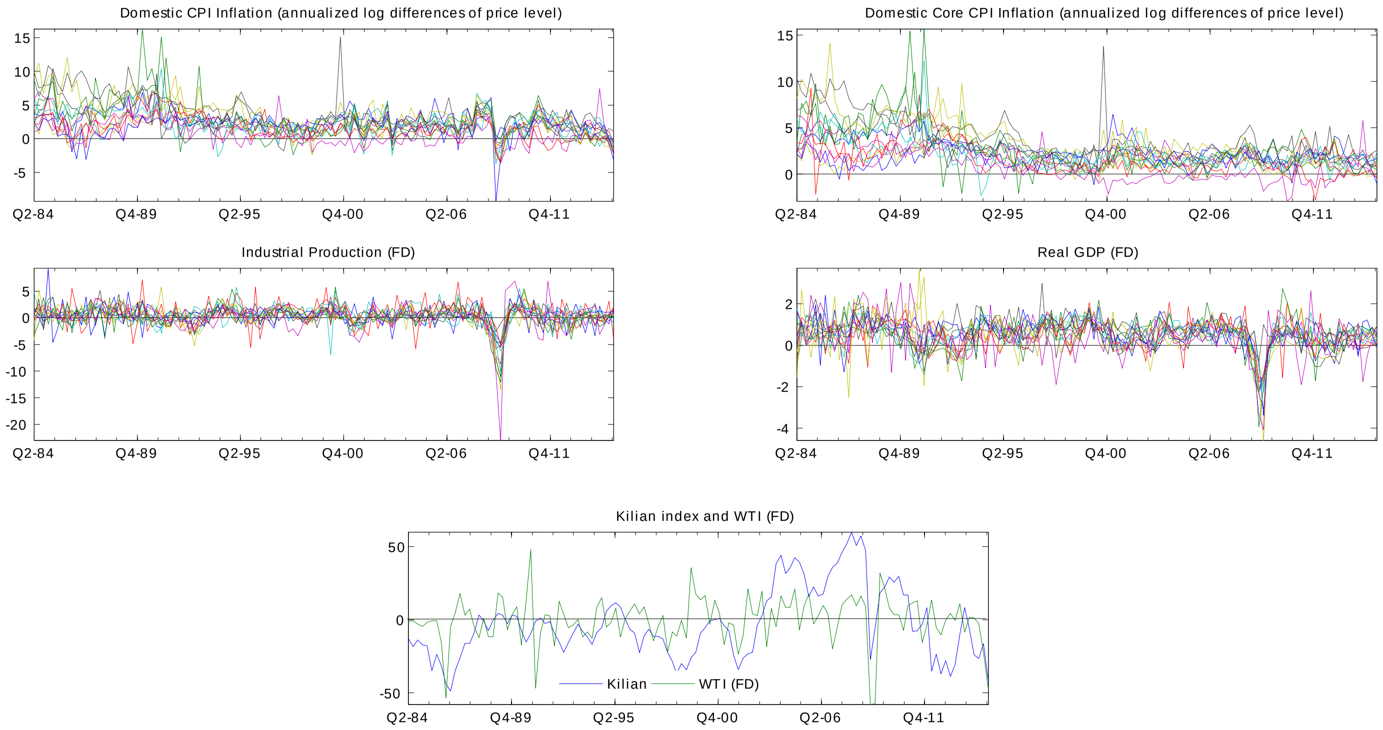

FIGURE A1

Note: Domestic inflation and domestic slack measures, WTI oil price and the Kilian index. We plot the series used inflation forecasts of the following countries: Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United States, United Kingdom.

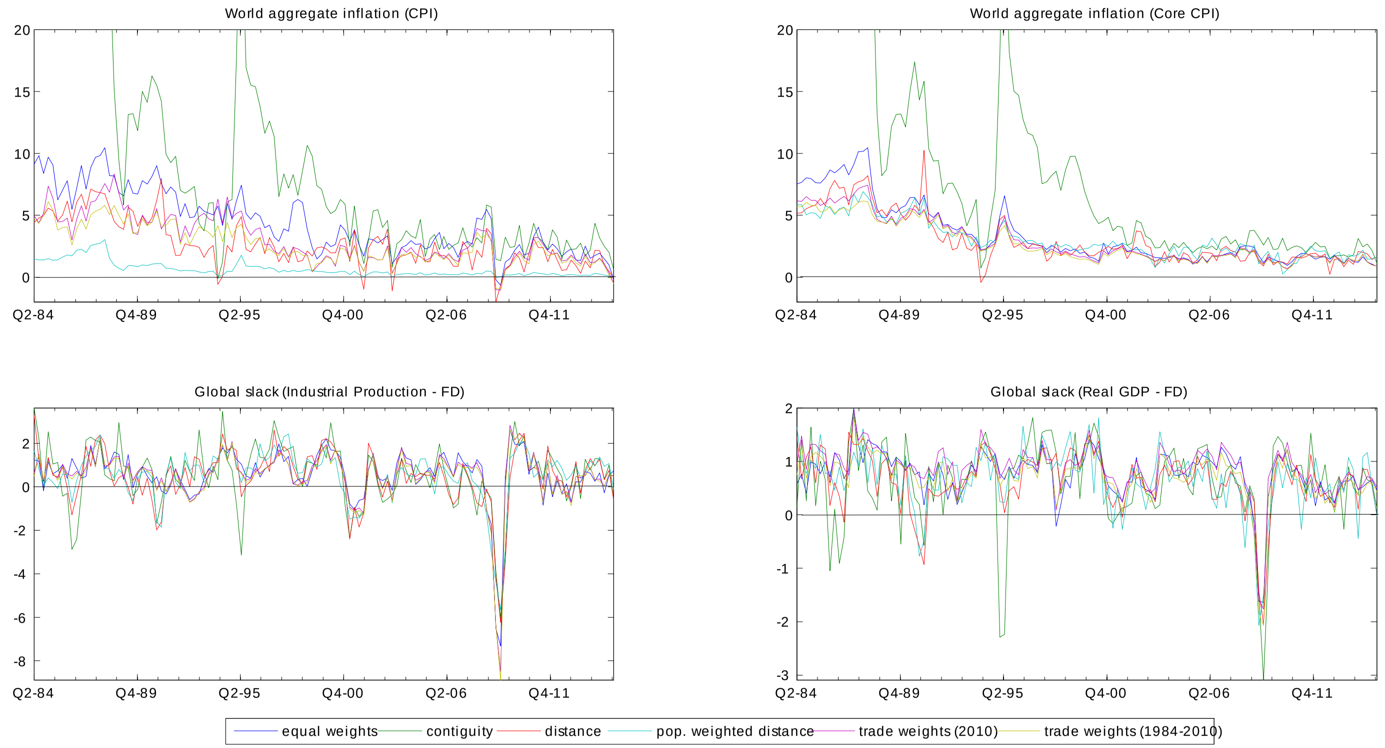

FIGURE A2

Note: Global inflation and global slack measures, based on six weighting schemes, using data of the following countries: Australia, Austria, Belgium, Canada, Chile, France, Germany, Greece, Hungary, India, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, United States, United Kingdom. Note that the contiguity, distance and pop. weighted distance measures are constructed focusing on the U.S. only.

Table A1. Forecasts of U.S. inflation - Relative MSFEs (1997Q1:2015Q1)

Horizon	**1**	**4**	**6**	**8**	**10**	**12**	**1**	**4**	**6**	**8**	**10**	**12**
	Headline CPI						**Core CPI (CPI ex. Food & Energy)**					
Model 1	(a)						(b)					
Autoregressive	5.445	2.035	1.354	1.119	0.991	0.905	0.313	0.296	0.292	0.304	0.316	0.305
Model 2												
WTI oil price	(c)						(d)					
HP-filtered	1.047	1.162	1.089	1.048	1.035	1.087	1.121	1.118	1.131	1.085	1.047	1.045
first-differenced	1.010	1.022	1.004	1.014	0.972*	0.921***	1.024	1.016	0.994	0.996	1.010	1.011
Domestic slack	(e)						(f)					
IP - HP	1.029	1.080	1.148	1.173	1.173	1.194	0.991	0.824**	0.833	0.892	1.071	1.443
GDP - HP	1.012	1.014	1.075	1.105	1.117	1.160	0.988	0.833**	0.809	0.974	1.205	1.408
IP - FD	1.055	1.046	1.054	1.072	1.059	1.065	1.049	0.958*	0.871**	0.852**	0.882**	0.918*
GDP - FD	0.992	0.983	0.692	0.973	0.972	0.969	1.004	0.929**	0.834***	0.832***	0.869**	0.914**

Note: This table reports the forecasting performances with an estimation sample covering 1984Q1:1996Q4 and a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. In Model 1, we report MSFEs of forecasts with the simple univariate AR process of inflation (restricted model) and are therefore in absolute terms. The entries in this table are the MSFEs of the forecasts under model 2 relative to the MSFEs of the restricted model. Asterisks denote that the relative MSFEs are statistically different and (more accurate) than the MSFEs of the benchmark (restricted) model at 1 (***), 5 (**), and 10 (*) percent significance levels.

Table A2. Forecasts of U.S. inflation - Relative MSFEs (1997Q1:2015Q1)

Horizon	1	4	6	8	10	12	1	4	6	8	10	12
	Headline CPI						Core CPI (CPI ex. Food & Energy)					
Model 2	(a)						(b)					
Global slack (Kilian)	1.031	1.098	1.112	1.102	1.114	1.081	1.029	1.059	1.096	1.233	1.411	1.542
Global slack (IP - HP)	(c)						(d)					
equal weights	1.040	0.974	1.035	1.094	1.115	1.193	1.051	0.868**	0.871**	0.992	1.184	1.572
contiguity	1.020	1.088	1.187	1.207	1.175	1.177	0.985*	0.858**	0.883**	0.924*	0.957	1.049
distance	1.013	1.034	1.081	1.082	1.081	1.087	0.965**	0.789***	0.773***	0.827**	0.930**	1.055
pop. weighted distance	1.028	1.077	1.144	1.167	1.167	1.188	0.991	0.835**	0.822**	0.884*	1.065	1.424
trade weights (2010)	1.050	0.992	1.057	1.128	1.160	1.244	1.049	0.853**	0.857**	0.985	1.199	1.699
trade weights (1984-2014)	1.049	0.993	1.056	1.128	1.162	1.243	1.048	0.850**	0.854**	0.982	1.193	1.683
Global slack (GDP - HP)	(e)						(f)					
equal weights	1.015	1.000	1.088	1.198	1.239	1.293	1.035	0.957*	1.057	1.267	1.513	2.018
contiguity	1.022	1.069	1.165	1.180	1.142	1.185	1.021	0.969	1.047	1.084	1.082	1.156
distance	1.010	1.016	1.060	1.054	1.059	1.090	0.999	0.886**	0.925*	1.044	1.190	1.342
pop. weighted distance	1.012	1.015	1.077	1.104	1.113	1.157	0.994	0.848**	0.833**	1.004	1.237	1.450
trade weights (2010)	1.032	1.024	1.114	1.219	1.243	1.305	1.041	0.940*	1.039	1.243	1.514	2.059
trade weights (1984-2014)	1.038	1.025	1.112	1.219	1.262	1.333	1.041	0.930*	1.012	1.208	1.478	2.002
Global slack (IP - FD)	(g)						(h)					
equal weights	1.034	1.039	1.007	1.047	1.105	1.129	1.056	1.102	1.003	0.996	1.124	1.240
contiguity	1.009	1.037	1.055	1.053	1.052	1.032	1.022	0.951*	0.916**	0.934*	0.935*	0.938*
distance	1.009	1.030	1.031	1.032	1.025	1.031	1.068	0.913**	0.822***	0.827***	0.871**	0.920**
pop. weighted distance	1.050	1.049	1.057	1.074	1.061	1.066	1.051	0.953*	0.862**	0.846**	0.879**	0.919*
trade weights (2010)	1.083	1.085	1.016	1.063	1.132	1.157	1.087	1.156	1.049	1.040	1.186	1.343
trade weights (1984-2014)	1.096	1.092	1.019	1.070	1.139	1.168	1.098	1.175	1.066	1.060	1.213	1.389
Global slack (GDP - FD)	(i)						(j)					
equal weights	0.960**	0.929**	0.905**	1.026	1.096	1.106	1.141	1.088	1.007	1.066	1.269	1.543
contiguity	1.007	1.017	1.028	1.020	1.008	1.001	1.018	0.955*	0.927**	0.944*	0.951*	0.963*
distance	1.002	1.009	1.003	1.005	1.019	1.043	1.085	0.978	0.888**	0.914**	0.985	1.078
pop. weighted distance	0.991	0.987	0.967*	0.978	0.979	0.978	1.008	0.931**	0.831***	0.833***	0.876**	0.929**
trade weights (2010)	0.970**	0.938**	0.875**	0.944*	1.003	1.013	1.136	1.088	0.959*	1.016	1.231	1.477
trade weights (1984-2014)	0.986*	0.955*	0.891**	0.983	1.059	1.074	1.136	1.100	0.966	1.026	1.257	1.509

Note: This table reports the forecasting performances with an estimation sample covering 1984Q1:1996Q4 and a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. In Model 1, we report MSFEs of forecasts with the simple univariate AR process of inflation (restricted model) and are therefore in absolute terms. The entries in this table are the MSFEs of the forecasts under model 2 relative to the MSFEs of the restricted model. Asterisks denote that the relative MSFEs are statistically different and (more accurate) than the MSFEs of the benchmark (restricted) model at 1 (***), 5 (**), and 10 (*) percent significance levels.

Table A3. Forecasts of U.S. inflation - Relative MSFEs (1997Q1:2015Q1)

Horizon	**1**	**4**	**6**	**8**	**10**	**12**	**1**	**4**	**6**	**8**	**10**	**12**
	Headline CPI						**Core CPI (CPI ex. Food & Energy)**					
Model 3												
Global inflation	(a)						(b)					
equal weights	0.598***	0.788***	0.825**	0.800**	0.743**	0.679**	0.911***	0.777**	0.755**	0.736**	0.685**	0.608**
contiguity	0.982*	0.915*	0.838**	0.776**	0.696**	0.577***	0.977*	0.907*	0.869**	0.832**	0.783**	0.708**
distance	0.762***	0.786***	0.728***	0.679***	0.636***	0.567***	0.964**	0.917**	0.881**	0.847**	0.813**	0.811**
pop. weighted distance	0.961**	0.888**	0.809**	0.774**	0.662**	0.542***	0.972*	0.897**	0.856**	0.818**	0.766**	0.691**
trade weights (2010)	0.563***	0.797***	0.824**	0.779**	0.717**	0.642**	0.900***	0.791**	0.785**	0.772**	0.718**	0.637**
trade weights (1984-2014)	0.507***	0.773***	0.812**	0.771**	0.707**	0.626**	0.895***	0.785**	0.786**	0.776**	0.726**	0.656**

Note: This table reports the forecasting performances with an estimation sample covering 1984Q1:1996Q4 and a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. In Model 1, we report MSFEs of forecasts with the simple univariate AR process of inflation (restricted model) and are therefore in absolute terms. The entries in this table are the MSFEs of the forecasts under model 3 relative to the MSFEs of the restricted model. Asterisks denote that the relative MSFEs are statistically different and (more accurate) than the MSFEs of the benchmark (restricted) model at 1 (***), 5 (**), and 10 (*) percent significance levels.

Table A4. Forecasts of U.S. inflation - Relative MSFEs (1997Q1:2015Q1)

Horizon	1	4	6	8	10	12	1	4	6	8	10	12
			Headline CPI						**Core CPI (CPI ex. Food & Energy)**			
Model 4												
WTI (HP)												
& Global inflation	(a)						(b)					
equal weights	0.730***	1.007	1.022	0.986	0.902*	0.818**	1.043	0.894**	0.825**	0.858*	0.834*	0.717**
contiguity	1.027	1.064	0.932*	0.861*	0.754**	0.649**	1.088	0.963	0.886*	0.908*	0.892	0.794*
distance	0.802***	0.918**	0.814***	0.751***	0.675***	0.608***	1.023	0.940*	0.848**	0.859**	0.849**	0.803**
pop. weighted distance	1.003	1.003	0.905*	0.835**	0.722**	0.607***	1.081	0.953*	0.872*	0.891*	0.871*	0.775**
trade weights (2010)	0.886***	0.962*	0.979	0.975	0.865*	0.722**	1.043	0.900*	0.848**	0.898*	0.874*	0.752**
trade weights (1984-2014)	0.630***	0.953*	1.022	1.035	0.975	0.876**	1.035	0.894**	0.848**	0.904*	0.881*	0.768**
WTI (FD)												
& Global inflation	(c)						(d)					
equal weights	0.864***	0.892**	0.911*	0.853**	0.755**	0.669**	0.997	0.895*	0.831**	0.808**	0.766**	0.666**
contiguity	0.993**	0.960*	0.895*	0.858*	0.768**	0.640**	1.045	0.975	0.899*	0.866*	0.832*	0.746**
distance	0.769***	0.824***	0.776**	0.743***	0.681***	0.586***	1.018	0.965*	0.898**	0.865**	0.842**	0.830**
pop. weighted distance	0.972**	0.933*	0.868**	0.825**	0.733**	0.602***	1.039	0.964	0.886*	0.851*	0.813*	0.727**
trade weights (2010)	0.819***	0.827**	0.869**	0.844*	0.789**	0.680**	0.991	0.889*	0.835**	0.821*	0.776*	0.674**
trade weights (1984-2014)	0.749***	0.812***	0.866**	0.842**	0.787***	0.704***	0.978*	0.872**	0.826**	0.818**	0.775**	0.681**
Kilian												
& Global inflation	(e)						(f)					
equal weights	0.856***	1.001	1.079	1.045	1.009	0.950	0.966*	0.892**	0.891*	0.943	0.978	0.935
contiguity	1.003	1.037	1.021	0.969	0.897	0.755**	1.010	0.961	0.945	1.010	1.082	1.079
distance	0.749***	0.889**	0.886**	0.850**	0.794**	0.692***	0.996*	0.948*	0.903*	0.925*	0.987	1.009
pop. weighted distance	0.973**	1.004	0.988	0.934	0.857*	0.713**	1.006	0.952	0.934	0.994	1.062	1.058
trade weights (2010)	0.835***	0.906**	0.999	1.042	1.093	1.040	0.956**	0.878**	0.888*	0.948	0.981	0.926
trade weights (1984-2014)	0.771***	0.918*	1.024	1.058	1.089	1.048	0.947**	0.866**	0.883*	0.938	0.963	0.907

Note: This table reports the forecasting performances with an estimation sample covering 1984Q1:1996Q4 and a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. In Model 1, we report MSFEs of forecasts with the simple univariate AR process of inflation (restricted model) and are therefore in absolute terms. The entries in this table are the MSFEs of the forecasts under model 4 relative to the MSFEs of the restricted model. Asterisks denote that the relative MSFEs are statistically different and (more accurate) than the MSFEs of the benchmark (restricted) model at 1 (***), 5 (**), and 10 (*) percent significance levels.

Table A5. Forecasts of U.S. inflation - Relative MSFEs (1997Q1:2015Q1)

Horizon	1	4	6	8	10	12	1	4	6	8	10	12
	Headline CPI						Core CPI (CPI ex. Food & Energy)					
Model 4												
Domestic slack (IP-HP)												
& Global inflation	(a)						(b)					
equal weights	0.571***	0.789**	0.851**	0.840*	0.892*	1.067	0.911***	0.692***	0.685***	0.683**	0.684**	0.764*
contiguity	1.005	0.969	0.936*	0.881*	0.781**	0.642**	0.972*	0.800**	0.785**	0.769**	0.738**	0.754**
distance	0.775***	0.799***	0.761***	0.733**	0.711**	0.659***	0.947**	0.764***	0.732***	0.735**	0.729**	0.819**
pop. weighted distance	0.984*	0.936*	0.894*	0.834**	0.737**	0.599***	0.967*	0.790**	0.773**	0.756**	0.719**	0.731**
trade weights (2010)	0.822***	0.835**	0.854**	0.820**	0.783**	0.787**	0.990***	0.710***	0.727**	0.737**	0.747**	0.849*
trade weights (1984-2014)	0.777***	0.809**	0.840**	0.822**	0.814**	0.858*	0.894***	0.703***	0.725**	0.747**	0.786**	0.943
Domestic slack (GDP-HP)												
& Global inflation	(c)						(d)					
equal weights	0.889***	0.854**	0.853**	0.801**	0.753**	0.710**	0.913**	0.641***	0.558***	0.667**	0.815*	0.903
contiguity	0.990	0.909**	0.860**	0.813**	0.738**	0.632**	0.970*	0.746***	0.672***	0.791**	0.967	1.088
distance	0.768***	0.752***	0.699***	0.670***	0.636***	0.587***	0.935**	0.718***	0.614***	0.750**	0.974	1.121
pop. weighted distance	0.970**	0.877**	0.819**	0.766**	0.689**	0.580***	0.964*	0.734***	0.654***	0.767**	0.933	1.044
trade weights (2010)	0.848***	0.797***	0.837**	0.814**	0.782**	0.681**	0.910***	0.658***	0.582***	0.716**	0.895	1.024
trade weights (1984-2014)	0.793***	0.783***	0.801**	0.796**	0.779**	0.716**	0.893***	0.622***	0.556***	0.689**	0.864*	0.995
Domestic slack (IP-FD)												
& Global inflation	(e)						(f)					
equal weights	0.596***	0.787***	0.825**	0.789**	0.731**	0.714**	0.953**	0.776**	0.713**	0.683**	0.634**	0.557**
contiguity	1.037	0.963*	0.902*	0.853**	0.742**	0.606***	1.022	0.896**	0.818**	0.782**	0.742**	0.668**
distance	0.796***	0.797***	0.729***	0.697***	0.652***	0.595***	0.997*	0.856**	0.723***	0.651***	0.625***	0.611***
pop. weighted distance	1.014	0.932*	0.865**	0.811**	0.702**	0.565***	1.016	0.885**	0.803**	0.763**	0.721**	0.648**
trade weights (2010)	0.842***	0.838**	0.840**	0.796**	0.709**	0.637***	0.939**	0.786**	0.739**	0.719**	0.667**	0.584**
trade weights (1984-2014)	0.791***	0.806***	0.816**	0.781**	0.706***	0.646***	0.933**	0.773***	0.726***	0.707**	0.660**	0.591**
Domestic slack (GDP-FD)												
& Global inflation	(g)						(h)					
equal weights	0.884***	0.871**	0.849**	0.782**	0.699**	0.629**	0.941**	0.782***	0.680**	0.644**	0.609**	0.554**
contiguity	0.980*	0.913**	0.827**	0.772**	0.692**	0.573***	0.987	0.864**	0.753**	0.720**	0.707**	0.682**
distance	0.762***	0.766***	0.682***	0.637***	0.588***	0.530***	0.969**	0.836***	0.692***	0.621***	0.594***	0.588***
pop. weighted distance	0.961**	0.885**	0.794**	0.733**	0.649***	0.529***	0.983*	0.853**	0.742**	0.706**	0.688**	0.662**
trade weights (2010)	0.845***	0.804***	0.808**	0.772**	0.716**	0.602***	0.935**	0.775***	0.680**	0.651**	0.611**	0.550***
trade weights (1984-2014)	0.790***	0.800***	0.807**	0.775**	0.728**	0.653***	0.922***	0.755***	0.663***	0.634***	0.590***	0.530***

Note: This table reports the forecasting performances with an estimation sample covering 1984Q1:1996Q4 and a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. In Model 1, we report MSFEs of forecasts with the simple univariate AR process of inflation (restricted model) and are therefore in absolute terms. The entries in this table are the MSFEs of the forecasts under model 4 relative to the MSFEs of the restricted model. Asterisks denote that the relative MSFEs are statistically different and (more accurate) than the MSFEs of the benchmark (restricted) model at 1 (***), 5 (**), and 10 (*) percent significance levels.

Table A6. Forecasts of U.S. inflation - Relative MSFEs (1997Q1:2015Q1)

Horizon	1	4	6	8	10	12	1	4	6	8	10	12
	Headline CPI						Core CPI (CPI ex. Food & Energy)					
Model 4												
Global slack (IP-HP)												
& Global inflation	(a)						(b)					
equal weights	0.570***	0.763***	0.845**	0.856**	0.817**	0.827*	0.893***	0.598***	0.634***	0.740**	0.831*	1.057
contiguity	0.997	0.965	0.940*	0.886*	0.792**	0.707**	0.929**	0.772***	0.796**	0.810**	0.828*	0.892
distance	0.766***	0.781***	0.749**	0.713**	0.687***	0.629***	0.886***	0.746***	0.753***	0.742**	0.718**	0.727**
pop. weighted distance	0.983*	0.933*	0.889*	0.829**	0.733**	0.597**	0.940**	0.797**	0.821**	0.807**	0.779**	0.767**
trade weights (2010)	0.847***	0.818**	0.855**	0.871*	0.823**	0.814**	0.874***	0.602***	0.661***	0.789**	0.919	1.272
trade weights (1984-2014)	0.517***	0.777***	0.861**	0.893**	0.869*	0.890*	0.863***	0.588***	0.656***	0.797**	0.938	1.297
Global slack (GDP-HP)												
& Global inflation	(c)						(d)					
equal weights	0.898***	0.878**	0.941*	0.996	0.935	0.874*	0.933**	0.698***	0.729**	0.857*	0.969*	1.160
contiguity	1.002	0.953*	0.938*	0.900*	0.816*	0.769**	0.999	0.853**	0.870*	0.888*	0.884*	0.943
distance	0.775***	0.773***	0.735***	0.686***	0.651***	0.598***	0.940**	0.730***	0.662***	0.709**	0.797**	0.858**
pop. weighted distance	0.971**	0.878**	0.821**	0.768**	0.691**	0.583***	0.969*	0.744***	0.672***	0.791**	0.961	1.083
trade weights (2010)	0.869***	0.831**	0.919*	0.963	0.892*	0.810**	0.941**	0.696***	0.715**	0.879*	1.045	1.296
trade weights (1984-2014)	0.822***	0.845**	0.923*	0.985	0.948	0.905*	0.926**	0.675***	0.679***	0.848*	1.030	1.283
Global slack (IP-FD)												
& Global inflation	(e)						(f)					
equal weights	1.034	1.039	1.007	1.047	1.105	1.129	0.953**	0.814**	0.706**	0.677**	0.703**	0.671**
contiguity	1.009	1.037	1.055	1.053	1.052	1.032	0.999	0.864**	0.789**	0.767**	0.721**	0.658**
distance	1.009	1.030	1.031	1.032	1.246	1.031	1.013	0.818***	0.683***	0.627***	0.619***	0.618***
pop. weighted distance	1.050	1.049	1.057	1.074	1.061	1.066	1.017	0.877**	0.789**	0.751**	0.713**	0.646**
trade weights (2010)	1.083	1.085	1.016	1.063	1.132	1.157	0.961**	0.871**	0.772**	0.750**	0.791**	0.780*
trade weights (1984-2014)	1.096	1.092	1.019	1.070	1.139	1.168	0.962**	0.880**	0.786**	0.772**	0.823*	0.839*
Global slack (GDP-FD)												
& Global inflation	(g)						(h)					
equal weights	0.842***	0.812**	0.788**	0.834**	0.810**	0.745**	0.978*	0.843**	0.702***	0.679**	0.707**	0.721**
contiguity	0.987**	0.928**	0.855**	0.792***	0.703***	0.581***	0.996	0.858**	0.784**	0.762**	0.724**	0.669**
distance	0.773***	0.791***	0.725***	0.667***	0.625***	0.568***	1.057	0.894**	0.767***	0.744***	0.757***	0.820**
pop. weighted distance	0.960**	0.887**	0.796**	0.735**	0.651**	0.532***	0.985	0.853**	0.736**	0.703**	0.691**	0.671**
trade weights (2010)	0.825***	0.793***	0.774**	0.765**	0.735**	0.646**	1.033	0.849**	0.694**	0.716**	0.810*	0.858*
trade weights (1984-2014)	0.778***	0.800**	0.786**	0.803**	0.791**	0.736**	1.015	0.831**	0.675***	0.703**	0.808**	0.866*

Note: This table reports the forecasting performances with an estimation sample covering 1984Q1:1996Q4 and a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. In Model 1, we report MSFEs of forecasts with the simple univariate AR process of inflation (restricted model) and are therefore in absolute terms. The entries in this table are the MSFEs of the forecasts under model 4 relative to the MSFEs of the restricted model. Asterisks denote that the relative MSFEs are statistically different and (more accurate) than the MSFEs of the benchmark (restricted) model at 1 (***), 5 (**), and 10 (*) percent significance levels.

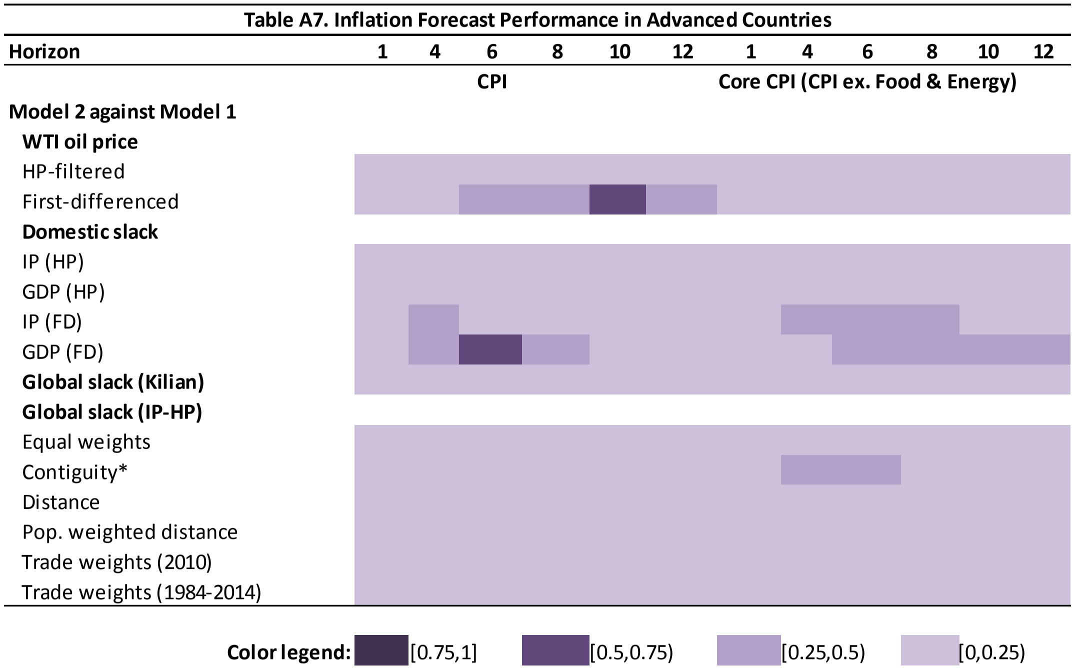

Table A7. Inflation Forecast Performance in Advanced Countries

Horizon	1	4	6	8	10	12	1	4	6	8	10	12
	CPI						Core CPI (CPI ex. Food & Energy)					
Model 2 against Model 1												
WTI oil price												
HP-filtered	░	░	░	░	░	░	░	░	░	░	░	░
First-differenced	░	░	▒	▒	▓	▒	░	░	░	░	░	░
Domestic slack												
IP (HP)	░	░	░	░	░	░	░	░	░	░	░	░
GDP (HP)	░	░	░	░	░	░	░	░	░	░	░	░
IP (FD)	░	▒	░	░	░	░	░	▒	▒	▒	░	░
GDP (FD)	░	▒	▓	▒	░	░	░	░	▒	▒	▒	▒
Global slack (Kilian)	░	░	░	░	░	░	░	░	░	░	░	░
Global slack (IP-HP)												
Equal weights	░	░	░	░	░	░	░	░	░	░	░	░
Contiguity*	░	░	░	░	░	░	░	▒	▒	░	░	░
Distance	░	░	░	░	░	░	░	░	░	░	░	░
Pop. weighted distance	░	░	░	░	░	░	░	░	░	░	░	░
Trade weights (2010)	░	░	░	░	░	░	░	░	░	░	░	░
Trade weights (1984-2014)	░	░	░	░	░	░	░	░	░	░	░	░

Color legend: █ [0.75,1] ▓ [0.5,0.75) ▒ [0.25,0.5) ░ [0,0.25)

Note: This table summarizes the forecasting performances for a sample of 14 countries which includes: Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom and United States. The estimation sample covers the period 1984Q1:1996Q4 with a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. The entries in this table are the fraction of countries out of the 14 for which we have data where we find that the MSFEs of each forecasting model are statistically different (and more accurate) than the MSFEs of the country's benchmark (restricted) model (Model 1) at least at the 10 percent significance level. *The results for the contiguity measure are reported for 10 countries (Australia, Japan, Sweden and UK were omitted). Specific country results are available from the authors upon request.

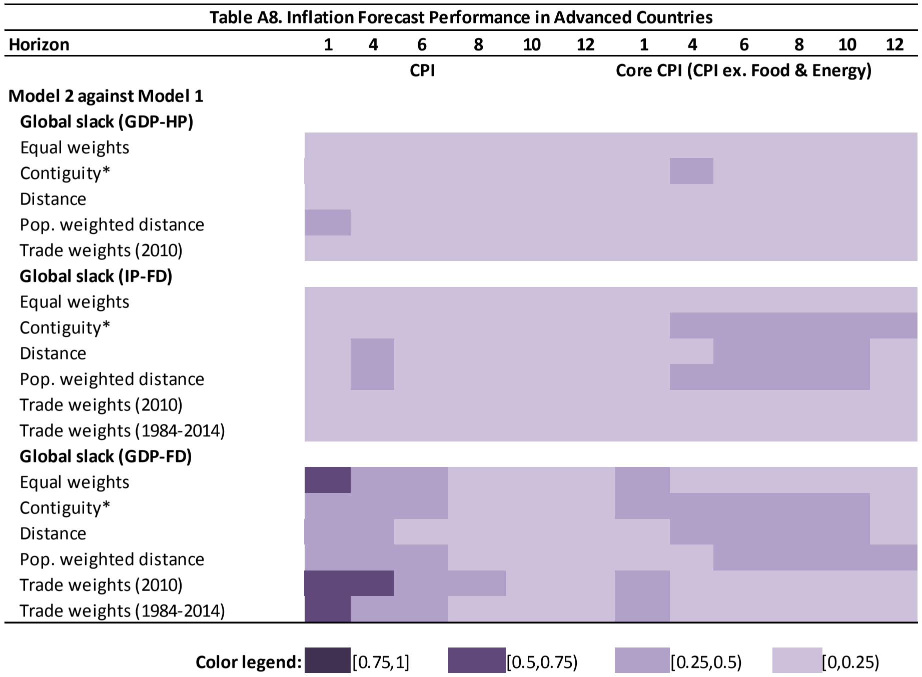

Table A8. Inflation Forecast Performance in Advanced Countries

Horizon	1	4	6	8	10	12	1	4	6	8	10	12
			CPI					Core CPI (CPI ex. Food & Energy)				
Model 2 against Model 1												
Global slack (GDP-HP)												
Equal weights	░	░	░	░	░	░	░	░	░	░	░	░
Contiguity*	░	░	░	░	░	░	░	▒	░	░	░	░
Distance	░	░	░	░	░	░	░	░	░	░	░	░
Pop. weighted distance	▒	░	░	░	░	░	░	░	░	░	░	░
Trade weights (2010)	░	░	░	░	░	░	░	░	░	░	░	░
Global slack (IP-FD)												
Equal weights	░	░	░	░	░	░	░	░	░	░	░	░
Contiguity*	░	░	░	░	░	░	░	▒	▒	▒	▒	▒
Distance	░	▒	░	░	░	░	░	░	▒	▒	▒	░
Pop. weighted distance	░	▒	░	░	░	░	░	▒	▒	▒	▒	░
Trade weights (2010)	░	░	░	░	░	░	░	░	░	░	░	░
Trade weights (1984-2014)	░	░	░	░	░	░	░	░	░	░	░	░
Global slack (GDP-FD)												
Equal weights	▓	▒	▒	░	░	░	▒	░	░	░	░	░
Contiguity*	▒	▒	▒	░	░	░	▒	▒	▒	▒	▒	░
Distance	▒	▒	░	░	░	░	░	▒	▒	▒	▒	░
Pop. weighted distance	▒	▒	▒	░	░	░	░	░	▒	▒	▒	▒
Trade weights (2010)	▓	▓	▒	▒	░	░	▒	░	░	░	░	░
Trade weights (1984-2014)	▓	▒	▒	░	░	░	▒	░	░	░	░	░

Color legend: █ [0.75,1] ▓ [0.5,0.75) ▒ [0.25,0.5) ░ [0,0.25)

Note: This table summarizes the forecasting performances for a sample of 14 countries which includes: Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom and United States. The estimation sample covers the period 1984Q1:1996Q4 with a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. The entries in this table are the fraction of countries out of the 14 for which we have data where we find that the MSFEs of each forecasting model are statistically different (and more accurate) than the MSFEs of the country's benchmark (restricted) model (Model 1) at least at the 10 percent significance level. *The results for the contiguity measure are reported for 10 countries (Australia, Japan, Sweden and UK were omitted). Specific country results are available from the authors upon request.

Table A9. Inflation Forecast Performance in Advanced Countries

Horizon	1	4	6	8	10	12	1	4	6	8	10	12
	CPI						Core CPI (CPI ex. Food & Energy)					
Model 3 against Model 1												
Global inflation												
Equal weights	█	▓	▓	▒	▒	▓	█	█	█	█	█	█
Contiguity*	█	▓	▓	▒	▒	▒	▓	▓	▓	▓	▓	▒
Distance	█	█	▒	▒	▒	▒	█	▓	▓	▓	▓	▓
Pop. weighted distance	█	█	▓	▓	▓	▓	█	▓	▓	▓	▓	▒
Trade weights (2010)	█	█	▓	▒	▒	▓	█	█	▓	▓	▓	▓
Trade weights (1984-2014)	█	█	▓	▒	▒	▓	█	█	▓	▓	▓	▓
Model 4 against Model 1												
Global inflation & WTI (HP-filt.)												
Equal weights	▓	▒	░	░	░	▒	▒	▒	▒	▒	▒	▒
Contiguity*	▓	▒	▒	▒	▒	▒	░	░	▒	░	░	░
Distance	█	▓	▒	▒	░	░	▒	▒	▒	▒	░	░
Pop. weighted distance	▓	▒	▒	▒	░	░	▒	▒	▒	░	░	░
Trade weights (2010)	▓	▓	░	░	░	▒	▒	░	░	░	░	▒
Trade weights (1984-2014)	█	▓	▒	░	▒	▒	▒	░	░	░	▒	▒
Global inflation & WTI (First diff.)												
Equal weights	█	▓	▒	▒	▒	▓	▒	█	█	█	█	▓
Contiguity*	▓	▓	▒	▒	▒	▒	▒	▓	▓	▓	▓	▓
Distance	█	▓	▓	▒	▒	▒	▓	▓	▓	▓	▓	▓
Pop. weighted distance	█	▓	▓	▓	▓	▓	▓	▓	▓	▓	▒	▒
Trade weights (2010)	█	█	▓	▓	▓	▓	▓	█	█	▓	▓	▓
Trade weights (1984-2014)	█	█	▓	▓	▓	▓	▓	█	▓	▓	▓	▓
Global inflation & Kilian												
Equal weights	█	▒	▒	▒	▒	▒	▓	▓	▒	▒	▓	▓
Contiguity*	▓	▒	░	░	░	░	▒	░	░	░	░	░
Distance	█	▓	▒	░	░	▒	▓	▓	▓	▒	▒	▒
Pop. weighted distance	█	▓	▒	░	░	░	▓	▒	▒	░	░	░
Trade weights (2010)	█	▓	▒	▒	▒	▒	▓	▒	▒	▒	▓	▒
Trade weights (1984-2014)	█	▓	░	░	░	▒	▓	▓	▓	▒	▒	▒

Color legend: █ [0.75,1] ▓ [0.5,0.75) ▒ [0.25,0.5) ░ [0,0.25)

Note: This table summarizes the forecasting performances for a sample of 14 countries which includes: Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom and United States. The estimation sample covers the period 1984Q1:1996Q4 with a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. The entries in this table are the fraction of countries out of the 14 for which we have data where we find that the MSFEs of each forecasting model are statistically different (and more accurate) than the MSFEs of the country's benchmark (restricted) model (Model 1) at least at the 10 percent significance level. *The results for the contiguity measure are reported for 10 countries (Australia, Japan, Sweden and UK were omitted). Specific country results are available from the authors upon request.

Table A10. Inflation Forecast Performance in Advanced Countries

Horizon	1	4	6	8	10	12	1	4	6	8	10	12
			CPI						Core CPI (CPI ex. Food & Energy)			
Model 4 against Model 1												
Global inflation & Domestic Slack (IP-HP)												
Equal weights	▓	▓	▒	▒	▒	░	▓	▓	▓	▒	▒	▒
Contiguity*	▓	▒	░	░	▒	░	▒	▓	▒	▒	▒	▒
Distance	■	▓	░	░	░	░	▓	▓	▒	░	░	░
Pop. weighted distance	▓	▓	▒	▒	░	░	▓	▓	░	░	░	░
Trade weights (2010)	■	▓	▒	▒	▒	▒	▓	▒	▒	▒	▒	▒
Trade weights (1984-2014)	■	▓	▒	▒	▒	▒	▓	▒	▒	▒	▒	▒
Global inflation & Domestic Slack (GDP-HP)												
Equal weights	■	▒	▒	░	░	░	▓	▓	▒	▒	▒	░
Contiguity*	▓	▓	▒	▒	░	░	▒	░	░	░	░	░
Distance	■	▓	░	░	░	░	▓	▒	▒	░	░	░
Pop. weighted distance	■	▓	░	░	░	░	▓	▒	▒	▒	░	░
Trade weights (2010)	▓	▒	▒	▒	▒	░	▒	▒	▒	░	░	░
Trade weights (1984-2014)	▓	▒	▒	░	░	░	▒	░	░	░	░	░
Global inflation & Domestic Slack (IP-FD)												
Equal weights	■	▓	▒	▒	▒	▒	▓	■	■	■	■	▓
Contiguity*	■	▓	░	▒	▒	▒	▒	▓	▓	▒	▒	▒
Distance	■	■	▒	▒	▒	░	▓	▓	▓	▓	▓	▒
Pop. weighted distance	■	▓	▓	▒	▒	▒	▓	▓	▓	▓	▓	▒
Trade weights (2010)	■	■	▓	▒	▒	▒	▓	■	■	▓	▓	▓
Trade weights (1984-2014)	■	■	▓	▒	▒	▒	▓	▓	▓	▓	▓	▓
Global inflation & Domestic Slack (GDP-FD)												
Equal weights	■	▒	▒	▒	▒	▒	▓	■	▓	▓	■	▓
Contiguity*	■	▓	▓	▓	▒	▒	▒	▓	▒	▒	▒	░
Distance	■	■	▒	▓	▒	▒	▓	▓	▓	▒	▒	▒
Pop. weighted distance	■	■	▒	▒	▒	▒	▓	▓	▓	▓	▓	▒
Trade weights (2010)	■	■	▒	▒	▒	▒	▓	■	■	▓	▓	▓
Trade weights (1984-2014)	■	■	▒	▒	▒	▒	▓	■	▓	▓	▓	▓

Color legend: ■ [0.75,1] ▓ [0.5,0.75) ▒ [0.25,0.5) ░ [0,0.25)

Note: This table summarizes the forecasting performances for a sample of 14 countries which includes: Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom and United States. The estimation sample covers the period 1984Q1:1996Q4 with a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. The entries in this table are the fraction of countries out of the 14 for which we have data where we find that the MSFEs of each forecasting model are statistically different (and more accurate) than the MSFEs of the country's benchmark (restricted) model (Model 1) at least at the 10 percent significance level. *The results for the contiguity measure are reported for 10 countries (Australia, Japan, Sweden and UK were omitted). Specific country results are available from the authors upon request.

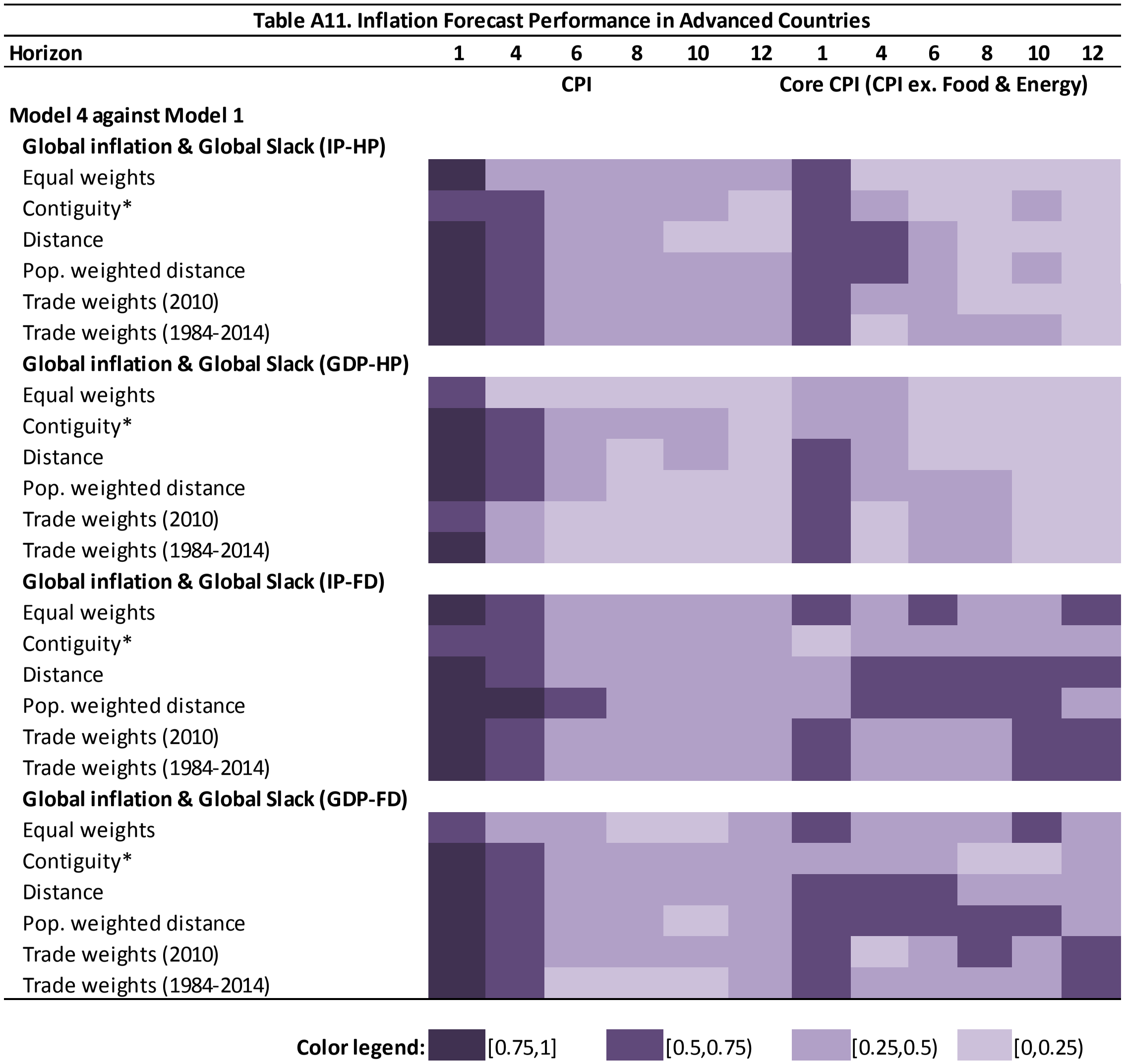

Table A11. Inflation Forecast Performance in Advanced Countries												
Horizon	1	4	6	8	10	12	1	4	6	8	10	12
			CPI				Core CPI (CPI ex. Food & Energy)					
Model 4 against Model 1												
Global inflation & Global Slack (IP-HP)												
Equal weights	■	▨	▨	▨	▨	▨	▩	□	□	□	□	□
Contiguity*	▩	▩	▨	▨	▨	□	▩	▨	□	□	▨	□
Distance	■	▩	▨	▨	□	□	▩	▩	▨	□	□	□
Pop. weighted distance	■	▩	▨	▨	▨	▨	▩	▩	▨	□	▨	□
Trade weights (2010)	■	▩	▨	▨	▨	▨	▩	▨	▨	□	□	□
Trade weights (1984-2014)	■	▩	▨	▨	▨	▨	▩	□	▨	▨	▨	□
Global inflation & Global Slack (GDP-HP)												
Equal weights	▩	□	□	□	□	□	▨	▨	□	□	□	□
Contiguity*	■	▩	▨	▨	▨	□	▨	▨	□	□	□	□
Distance	■	▩	▨	□	▨	□	▩	▨	□	□	□	□
Pop. weighted distance	■	▩	▨	□	□	□	▩	▨	▨	▨	□	□
Trade weights (2010)	▩	▨	□	□	□	□	▩	□	▨	▨	□	□
Trade weights (1984-2014)	■	▨	□	□	□	□	▩	□	▨	▨	□	□
Global inflation & Global Slack (IP-FD)												
Equal weights	■	▩	▨	▨	▨	▨	▩	▨	▩	▨	▨	▩
Contiguity*	▩	▩	▨	▨	▨	▨	□	▨	▨	▨	▨	▨
Distance	■	▩	▨	▨	▨	▨	▨	▩	▩	▩	▩	▩
Pop. weighted distance	■	■	▩	▨	▨	▨	▨	▩	▩	▩	▩	▨
Trade weights (2010)	■	▩	▨	▨	▨	▨	▩	▨	▨	▨	▩	▩
Trade weights (1984-2014)	■	▩	▨	▨	▨	▨	▩	▨	▨	▨	▩	▩
Global inflation & Global Slack (GDP-FD)												
Equal weights	▩	▨	▨	□	□	▨	▩	▨	▨	▨	▩	▨
Contiguity*	■	▩	▨	▨	▨	▨	▨	▨	▨	□	□	▨
Distance	■	▩	▨	▨	▨	▨	▩	▩	▩	▨	▨	▨
Pop. weighted distance	■	▩	▨	▨	□	▨	▩	▩	▩	▩	▩	▨
Trade weights (2010)	■	▩	▨	▨	▨	▨	▩	□	▨	▩	▨	▩
Trade weights (1984-2014)	■	▩	□	□	□	▨	▩	▨	▨	▨	▨	▩

Color legend: ■ [0.75,1] ▩ [0.5,0.75) ▨ [0.25,0.5) □ [0,0.25)

Note: This table summarizes the forecasting performances for a sample of 14 countries which includes: Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom and United States. The estimation sample covers the period 1984Q1:1996Q4 with a pseudo out-of-sample forecasting sample over 1997Q1:2015Q1. The entries in this table are the fraction of countries out of the 14 for which we have data where we find that the MSFEs of each forecasting model are statistically different (and more accurate) than the MSFEs of the country's benchmark (restricted) model (Model 1) at least at the 10 percent significance level. *The results for the contiguity measure are reported for 10 countries (Australia, Japan, Sweden and UK were omitted). Specific country results are available from the authors upon request.

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