Does Global Inflation Help Forecast Inflation in Industrialized Countries?*

Christian Gillitzer
The University of Sydney

Martin McCarthy
University of Oxford

January, 2019

Abstract

Ciccarelli and Mojon (Ciccarelli, M and B. Mojon 2010, *Review of Economics and Statistics* 92(3): 524-535) propose an inflation forecasting model incorporating a global inflation factor and show that it consistently beats several standard forecasting benchmarks. We show that CM's global inflation model does not improve upon the Atkeson and Ohanian (Atkeson, A. and L. E. Ohanian 2001, *Federal Reserve Bank of Minneapolis Quarterly Review*, 25(1): 2-11) naive benchmark. However, we find that augmenting the AO model with a global inflation factor improves forecast accuracy at longer horizons, supporting CM's claim about the usefulness of global inflation.

JEL Codes: E31, E37
Keywords: global inflation, forecast

*We are particularly grateful to Matteo Ciccarelli for his comments and suggestions. We would also like to thank Jonathan Kearns and James Morley for helpful comments. Contact information for authors: Christian Gillitzer, School of Economics, The University of Sydney, Social Sciences Building (A02), Science Road, Camperdown, NSW, Australia. Email address: christian.gillitzer@sydney.edu.au. Martin McCarthy, Department of Economics, University of Oxford, 10 Manor Rd, Oxford, United Kingdom. Email: martin.mccarthy@economics.ox.ac.uk. The authors have no conflicts of interest to report. The majority of work on this paper was done while the authors were in Economic Analysis Department at the Reserve Bank of Australia. Views expressed are those of the authors and should not be attributed to the Reserve Bank of Australia.

1 Introduction

In an influential paper Ciccarelli and Mojon (2010), hereafter CM, show that there has been a high degree of synchronization in inflation rates across industrialized economies. CM argue that "...there is a robust error correction mechanism that brings national inflation rates back to global inflation" and that "A simple model that accounts for this feature consistently beats standard benchmarks in forecasting inflation four to eight quarters ahead across samples and countries" (CM, p. 524). This is an important finding because inflation has become increasingly difficult to model (Stock and Watson, 2007; Mumtaz and Surico, 2012).

We reassess the evidence presented by CM that a parsimonious model including a global inflation factor improves upon traditionally difficult-to-beat forecasting benchmarks. We show that CM's global inflation model does not improve upon a naive benchmark that assumes inflation will be equal to its average over the past four quarters. This naive benchmark was first used by Atkeson and Ohanian (2001) and has been shown to be a difficult-to-beat benchmark for forecasting inflation for the United States. For example, Stock and Watson (2007) find that inflation is well described by a first-order integrated moving average process, and that for the post-1984 period in the United States the AO model is close to the optimal linear combination of past inflation rates. Although CM's global inflation model does not improve upon the AO model, we find that augmenting the AO model with a global inflation factor improves forecast accuracy, particularly at longer horizons. Our results support the central conclusion of CM on the usefulness of global inflation for forecasting country inflation but provide a model specification with improved forecast accuracy.[1]

CM also considered a naive forecasting benchmark. However, they used a random walk (RW) benchmark that assumes inflation will be equal to its latest quarterly rate, rather than its average over the past four quarters as in the AO model. The improved accuracy of the AO model relative to the RW model may arise because a forecast based on an average of the

[1] We are grateful to Matteo Ciccarelli for his suggestion to augment the AO model with a global inflation factor.

past four inflation outcomes removes some of the idiosyncratic noise in quarterly inflation. For the United States, the presence of noise is indicated by Stock and Watson (2007) finding moving average dynamics in the first difference of inflation. Our results indicate that the AO model is also a robust predictor of inflation for a range of other industrialized countries.

A few papers since CM have also looked at the usefulness of global inflation for forecasting national inflation rates. Medely, Pedersenz and Pincheira (2016) revisited CM but use data at a different frequency (monthly rather than quarterly) and for a different set of countries (31 rather than 22); they did not consider robustness of CM's results to the Atkeson and Ohanian (2001) benchmark. Hakkio (2009) expanded upon CM to consider different inflation measures and multiple common factors of global inflation. Both papers report mixed evidence on the usefulness of global inflation in forecasting national inflation rates. Ferroni and Mojon (2016) update CM to show that there remains substantial cross-country comovement in inflation in the post-2008 period. They also show that there is substantial cross-country correlation in inflation forecasts errors for a range of models, and that this correlation has increased in the post-2008 period. But they do not compare the accuracy of the global inflation model forecasts to benchmark models.[2]

More generally, there has been considerable recent interest in the global dimension of inflation. Wang and Wen (2007) and Henriksen, Kydland and Sustek (2013) show that nominal variables are more highly correlated across countries than real variables; Neely and Rapach (2011) link the share of national inflation variability explained by international factors to country characteristics; Borio and Filardo (2007) and Auer, Borio and Filardo (2017) find evidence that the global output gap has become an important determinant of national inflation rates but Ihrig et al. (2010) and Mikolajun and Lodge (2016) do not. Among central bankers, Carney (2015), Draghi (2015) and Jordan (2015) have drawn attention to

[2]Duncan and Martínez-García (2015) develop a model to explain international inflation comovement, show that it can be represented as a Bayesian VAR, and use it to forecast inflation. Morales-Arias and Moura (2013) evaluate a conditionally heteroskedastic global inflation model for the G7 countries and Pincheira and Gatty (2016) consider the role of international factors in forecasting Chilean inflation. Kearns (2016) constructs forecasts of global inflation using survey forecasts of national inflation rates but finds the global inflation forecasts generally do not improve upon the accuracy of survey forecasts of national inflation rates.

international inflation comovement.

The next section describes the inflation forecasting models, Section 3 presents the results and Section 4 concludes.

2 Forecasting models

CM use the following global inflation model to construct forecasts of inflation for each of 22 OECD countries plus the euro area:

$$\pi^h_{i,t+h} = \alpha^h_{i,0} + \alpha^h_{i,1}(L)\,\pi_{i,t} + \alpha^h_{i,2}(L)\,f_t + u_{i,t+h}, \tag{1}$$

where h is the forecast horizon (in quarters), $\pi^h_{i,t+h} = (400/h)\,ln\,(P_{t+h}/P_t)$ is the inflation rate for country i over the period t to $t+h$ expressed at an annual rate, $\pi_{i,t} = \pi^1_{i,t}$ is the quarterly inflation rate for country i expressed at an annual rate and f_t is the global factor. The global factor is the common component of the national inflation rates,

$$\pi_{i,t} = \lambda_i f_t + \varepsilon_{i,t}, \tag{2}$$

and is estimated using the static principal components method, where λ_i is the country-specific factor loading and $\varepsilon_{i,t}$ is an idiosyncratic error term. CM fix the number of lags of the global factor equal to 4 and select the autoregressive lag length using the BIC criterion. Forecasts are constructed using estimates of Equation (1) for horizons of 1, 4 and 8 quarters ahead. The forecasting regression is re-estimated at each forecast date using only data known at the forecast date. An expanding in-sample estimation window is used containing data back to 1960. The forecast at time t for horizon h is given by

$$\hat{\pi}^h_{i,t+h} = \hat{\alpha}^h_{i,0} + \hat{\alpha}^h_{i,1}(L)\,\pi_{i,t} + \hat{\alpha}^h_{i,2}(L)\,\hat{f}_t. \tag{3}$$

CM compare the accuracy of the global inflation model forecasts to three benchmark models: an autoregressive model (AR), a Phillips curve model and a random walk model (RW). The AR model is a restricted version of the global inflation model, omitting the global factor:

$$\pi^h_{i,t+h} = \alpha^h_{i,0} + \alpha^h_{i,1}(L)\,\pi_{i,t} + u_{i,t+h}. \tag{4}$$

The Phillips curve model used by CM augments the AR model with lags of growth in industrial production (IP), growth in the M3 measure of money supply and growth in a commodity price index (CoP):

$$\pi^h_{i,t+h} = \alpha^h_{i,0} + \alpha^h_{i,1}(L)\,\pi_{i,t} + \alpha^h_{i,2}(L) \triangle IP_{i,t} + \alpha^h_{i,3}(L) \triangle M3_{i,t} + \alpha^h_{i,4}(L) \triangle CoP_{i,t} + u_{i,t+h}. \tag{5}$$

The lag length is selected using the BIC criterion. CM's RW forecast model is the latest (annualized) quarterly inflation rate:

$$\hat{\pi}^h_{i,t+h} = \pi_{i,t}. \tag{6}$$

We extend CM's results by comparing the accuracy of the global inflation model forecasts to the AO model forecasts. The model used by Atkeson and Ohanian (2001) for the forecast horizon $h = 4$ is

$$\hat{\pi}^4_{i,t+4} = \pi^4_{i,t} \tag{7}$$

$$= \frac{1}{4}\left(\pi_{i,t} + \pi_{i,t-1} + \pi_{i,t-2} + \pi_{i,t-3}\right). \tag{8}$$

Stock and Watson (2007) note that there is some ambiguity in the specification of the Atkeson and Ohanian (2001) model for other forecast horizons. However, they argue that "Because the AO forecast is essentially a random walk forecast, and a random walk forecast is the same at all horizons, we extend the AO forecast to other horizons without modification" (Stock and Watson, 2007, p. 8). We do the same.

We also consider an AO model augmented with global inflation. The AO-Global model takes the form

$$\pi^h_{i,t+h} = \pi^4_{i,t} + \beta\left(\pi^4_{global,t} - \pi^4_{i,t}\right) + u_{i,t+h}, \tag{9}$$

where $\pi^4_{i,t}$ is the AO model forecast for country i and $\pi^4_{global,t} = (1/N)\sum_{i=1}^{N} \pi^4_{i,t}$ is the equally-weighted cross-country average of inflation rates over the previous year. This specification captures CM's idea that national inflation rates error-correct to global inflation.[3] The parameter β controls the speed of convergence and is estimated over both expanding and rolling in-sample periods. We also conduct a grid search to find the value of β for each country that minimizes the root mean squared error (RMSE) of the AO-Global model over the forecast period; this variant demonstrates the predictive ability of global inflation in an ex-post evaluation.

The AO-Global model follows Cogley, Primiceri and Sargent (2010) and Stock and Watson (2010) in considering predictability of the inflation gap, defined to be the difference between actual and trend inflation. Those authors use an unobserved-components stochastic-volatility (UC-SV) model of trend inflation but for simplicity we use average inflation over the past year (the AO model forecast); Stock and Watson (2007) show that the AO model provides a good approximation to the UC-SV model for the United States.

3 Results

Table 1 compares forecast accuracy of CM's global inflation model against benchmark models for each country in the sample. Numbers in the table are the ratio of the forecast RMSE of CM's global inflation model to the forecast RMSE of the benchmark model. Numbers less than unity indicate that CM's global inflation model has lower forecast RMSE than the benchmark model. Numbers in bold denote ratios significantly less than one, based on a one-sided test at the 10 percent level of significance. CM focus on the post-1995 forecast evaluation period because this is the period over which it has become more difficult to improve upon simple forecasting models and outperformance of the global inflation model would be most notable. The choice of 4 and 8 quarter forecast horizons is based on their relevance to monetary policy decision making.

[3] Global inflation is measured by an equally-weighted average of national inflation rates rather than the first principal component of national inflation rates because this avoids the need to re-scale the principal component, which by construction has mean zero and standard deviation one. Figure 1 in Ciccarelli and Mojon (2010) shows that after re-scaling the first principal component of national inflation rates is very similar to an equally-weighted average of national inflation rates.

The first three columns at each forecast horizon replicate the results reported in Table 5 of CM.[4] CM's global inflation model outperforms the RW, AR and Phillips curve benchmark models for most countries at both the 4 and 8 quarter forecast horizons. For the median country, the global inflation model produces forecasts with RMSE 18 percent less than the RW model, 14 percent less than the AR model and 21 percent less than the Phillips curve model at the 4 quarter horizon. Results are similar at the 8 quarter forecast horizon (Table 1). This is the basis for CM's conclusion that a parsimonious model including a global inflation factor beats standard forecasting benchmarks.

We now compare the accuracy of CM's global inflation model forecasts to the AO benchmark model. For the median country, the forecast RMSE of CM's global inflation model is 12 percent larger than the AO benchmark at the 4 quarter horizon and 18 percent larger at the 8 quarter horizon (Table 1). Extending the sample to include data up to the end of 2016 does not materially change the results (see Table A1 in the online appendix).[5] Thus, the AO model forecasts are more accurate than CM's global inflation model and all other competitors considered by CM.

Although CM's global inflation model does not improve upon the AO model, it is nonetheless notable that CM's global inflation model outperforms the AR benchmark model (Table 1). However, this conclusion is sensitive to the in-sample period used to estimate the forecasting regressions. CM use an expanding estimation window that uses data from 1960 up to the date at which the forecasts are made. This long in-sample estimation period could hamper the performance of the AR model because there have been shifts in the trend inflation rate over the 1960-2008 period. Because these changes in trend inflation have been somewhat synchronized across countries, CM's global inflation model is potentially less affected than the AR model by the use of a long in-sample estimation window. Using a 15 year rolling-

[4] Our EViews code exactly replicates the point estimates produced from the RATS code provided by CM in their documentation files. However, there are some minor differences relative to the point estimates in Table 5 of CM. These differences are too minor to change any qualitative findings.

[5] Results for the Phillips curve model are not included because we have been unable to access the same original data sources to extend the sample period.

sample estimation window (rather than an expanding window including data from 1960) improves the accuracy of the AR model forecasts in absolute terms and relative to the global inflation model (Table 2). For the median country, CM's global inflation model has similar accuracy to the AR model. The use of a rolling estimation window improves the accuracy of CM's global inflation model forecasts relative to the RW and AO model forecasts, which are unchanged. This can be seen by comparing the results for the RW and AO models in Tables 1 and 2. There is now a negligible difference in forecast accuracy for the median country between CM's global inflation model, the AR model and the AO model.

Table 3 reports results on forecast accuracy of the AO-Global model. Entries are the ratio of the forecast RMSE of the AO-Global model relative to the AO model. We use the AO model as the reference model in Table 3 because we have seen that it produces forecasts at least as accurate as all other competitors considered by CM. There is evidence that the AO-Global model outperforms the AO model for a majority of countries when estimated with the full sample, and for many countries when estimated with the rolling sample. Outperformance is greatest at the 8 quarter horizon, at which the AO-Global model has about 5 percent lower forecast RMSE than the AO model on average and for the median country. An ex-post evaluation in which the weight on global inflation for each country is chosen by a grid search to minimize forecast RMSE indicates larger potential gains in forecast accuracy on average and for the median country (Table 3). These results demonstrate the usefulness of global inflation for forecasting country inflation.

Figure 1 presents results graphically, showing for each model a 10-year rolling forecast RMSE averaged across each country in the sample. These results replicate Figure 4 in CM, with the exception that we have added the AO and AO-Global model results and extended the sample to 2016.[6] The AO model has lower forecast RMSE than CM's global inflation model over each rolling 10-year window between 1995 and 2016 at the 4 and 8 quarter forecast

[6] The results differ from those in Figure 4 of CM. CM appear to have calculated the forecast RMSE for each model as $\pi^1_{i,t} - \hat{\pi}^h_{i,t}$ rather than $\pi^h_{i,t} - \hat{\pi}^h_{i,t}$. Making this correction does not affect the ranking of the models. We have been able to replicate all other figures and tables in CM. Note also that, following CM, the Phillips curve model in Figure 1 contains only commodity prices as a covariate.

horizons. The AO-Global model further improves forecast accuracy at the 4 and 8 quarter forecast horizons. However, CM's global inflation model is more accurate than the AO and AO-Global models at the 1 quarter forecast horizon for rolling 10-year windows ending after 2008. This is consistent with Stock and Watson (2007) for the United States, who found that the AO model outperforms other univariate models at 4 and 8 quarter forecast horizons but not at the 1 quarter horizon.

4 Conclusion

CM (p. 534) argue that "...simple and parsimonious extensions of a standard AR model, where we consider the attraction role of the global inflation model, outperform robust predictors of inflation" and go on to say that this result "...surely deserves further investigation." We have shown that CM's global inflation model does not outperform the Atkeson and Ohanian (2001) naive benchmark. However, we find that augmenting the AO model with a global inflation factor improves forecast accuracy. Our results support CM's central conclusion that global inflation helps forecast country inflation.

References

Atkeson, A. , and L. E. Ohanian. 2001. "Are Phillips Curves Useful for Forecasting Inflation?" *Federal Reserve Bank of Minneapolis Quarterly Review*, 25(1): 2–11.

Auer, R. , C. Borio, and A. Filardo. 2017. "The Globalisation of Inflation: The Growing Importance of Global Value Chains." BIS Working Paper No. 602, January.

Borio, C. , and A. Filardo. 2007. "Globalization and Inflation: New Cross-Country Evidence on the Global Determinants of Domestic Inflation." BIS Working Paper No. 227, May.

Carney, M. . 2015. "Inflation in a Globalised World." Speech at the Economic Policy Symposium hosted by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August.

Ciccarelli, M. , and B. Mojon. 2010. "Global Inflation." *Review of Economics and Statistics*, 92(3): 524–535.

Cogley, T. , G. Primiceri, and T. J. Sargent. 2010. "Inflation-Gap Persistence in the U.S." *American Economic Journal: Macroeconomics*, 2: 43–69.

Draghi, M. . 2015. "Global and Domestic Inflation." Speech to the Economic Club of New York, 4 December.

Duncan, R. , and E. Martínez-García. 2015. "Forecasting Local Inflation with Global Inflation: When Economic Theory Meets the Facts." Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute Working Paper No. 235.

Ferroni, F. , and B. Mojon. 2016. "Domestic and Global Inflation." mimeo, March.

Hakkio, C. . 2009. "Global Inflation Dynamics." Federal Reserve Bank of Kansas City Research Working Paper 09-01.

Henriksen, E. , F. E. Kydland, and R. Sustek. 2013. "Globally Correlated Nominal Fluctuations." *Journal of Monetary Economics*, 60(6): 613–631.

Ihrig, J. , S. B. Kamin, D. Lindner, and J. Marquez. 2010. "Some Simple Tests of the Globalization and Inflation Hypothesis." *International Finance*, 13(3): 343–375.

Jordan, T. . 2015. "The Impact of International Spillovers on Inflation Dynamics and Independent Monetary Policy: the Swiss Experience." background paper for presentation at the Economic Policy Symposium hosted by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August.

Kearns, J. . 2016. "Global Inflation Forecasts." BIS Working Paper No. 582.

Medely, C. A. , M. Pedersenz, and P. M. Pincheira. 2016. "The Elusive Predictive Ability of Global Inflation." *International Finance*, 19(2): 120–146.

Mikolajun, I. , and D. Lodge. 2016. "Advanced Economy Inflation: The Role of Global Factors." ECB Working Paper No. 1948, August.

Morales-Arias, L. , and G. V. Moura. 2013. "A Conditionally Heteroskedastic Global Inflation Model." *Journal of Economic Studies*, 40(4): 572–596.

Mumtaz, H. , and P. Surico. 2012. "Evolving International Inflation Dynamics: World and Country-Specific Specifications." *Journal of the European Economic Association*, 10(4): 716–734.

Neely, C. J. , and D. E. Rapach. 2011. "International Comovements in Inflation Rates and Country Characteristics." *Journal of International Money and Finance*, 30(7): 1471–1490.

Pincheira, P. , and A. Gatty. 2016. "Forecasting Chilean Inflation with International Factors." *Empirical Economics*, 51(3): 981–1010.

Stock, J. H. , and M. W. Watson. 2007. "Why Has U.S. Inflation Become Harder to Forecast?" *Journal of Money, Credit and Banking*, 39(S1): 3–33.

Stock, J. H. , and M. W. Watson. 2010. "Modeling Inflation After the Crisis." *Proceedings - Economic Policy Symposium - Jackson Hole*, 173–220.

Wang, P. , and Y. Wen. 2007. "Inflation Fynamics: A Cross-Country Investigation." *Journal of Monetary Economics*, 54(7): 2004–2031.

Table 1: RMSE of Global Inflation Models Relative to Standard Benchmarks: 1995-2008

	4-step ahead				8-step ahead			
	RW	AR	PHIL	AO	RW	AR	PHIL	AO
Euro area total	**0.82**	**0.90**	**0.71**	1.04	0.89	**0.85**	**0.71**	1.18
G7								
United States	**0.82**	1.03	0.90	1.10	**0.78**	**0.83**	**0.83**	0.99
Canada	**0.63**	**0.84**	**0.87**	1.01	**0.56**	**0.76**	**0.76**	0.99
United Kingdom	1.09	**0.72**	**0.57**	1.88	1.35	**0.66**	**0.58**	2.08
Japan	1.10	1.05	1.44	1.64	1.37	1.03	2.30	2.03
Germany	**0.70**	**0.89**	**0.89**	1.00	**0.77**	**0.91**	0.92	1.21
France	**0.81**	0.90	**0.74**	1.19	**0.80**	**0.81**	0.77	1.26
Italy	1.10	**0.69**	**0.60**	0.94	1.15	**0.53**	**0.49**	0.91
Other Euro/EU								
Austria	**0.79**	**0.74**	**0.73**	0.96	**0.76**	**0.71**	**0.75**	0.97
Belgium	**0.69**	0.90	**0.76**	1.00	**0.53**	**0.67**	**0.58**	**0.85**
Denmark	1.36	**0.70**	**0.84**	1.75	1.35	**0.63**	0.94	1.95
Finland	1.07	0.92	**0.73**	1.21	1.10	**0.80**	**0.69**	1.25
Greece	0.95	**0.76**	**0.69**	1.32	1.08	**0.67**	**0.66**	1.43
Ireland	1.23	1.33	0.90	1.33	1.03	1.20	**0.74**	1.16
Luxembourg	**0.84**	1.11	0.87	1.12	**0.78**	0.96	**0.78**	1.08
Portugal	1.09	**0.49**	**0.56**	1.34	1.13	**0.44**	**0.51**	1.54
Spain	**0.80**	**0.71**	**0.79**	1.14	0.82	**0.58**	**0.79**	1.23
Sweden	1.07	**0.90**	**0.89**	1.38	1.23	**0.87**	**0.82**	1.60
The Netherlands	**0.79**	**0.77**	**0.85**	0.95	0.90	**0.88**	**0.90**	1.06
Others								
Australia	**0.65**	0.86	**0.79**	**0.87**	**0.57**	0.78	**0.71**	**0.76**
New Zealand	**0.75**	**0.67**	**0.56**	0.93	**0.74**	**0.57**	**0.47**	0.97
Norway	**0.52**	**0.71**	**0.66**	**0.92**	**0.51**	**0.65**	**0.64**	1.10
Switzerland	1.18	1.06	0.93	1.49	1.80	1.07	1.18	2.43
Overall median	0.82	0.86	0.79	1.12	0.89	0.78	0.75	1.18
Overall mean	0.91	0.85	0.79	1.20	0.96	0.78	0.81	1.31

Notes: Entries are the ratios of the forecast RMSE of CM's global inflation model to the forecast RMSE of the benchmark model: RW is the random walk forecast, AR is the autoregressive model, PHIL is the Phillips curve model and AO is the Atkeson and Ohanian (2001) model forecast. Numbers less than unity indicate that CM's global inflation model forecasts are more accurate than the benchmark model. Bold entries denote ratios less than unity at the 10 percent level of significance. The entries in the columns RW, AR and PHIL are from CM. We have augmented the results with the AO columns, comparing the accuracy of the global inflation model forecasts to the AO benchmark model.

Table 2: RMSE of Global Inflation Models Relative to Standard Benchmarks: 1995-2008
15-year Rolling-Sample Estimation Period

	4-step ahead				8-step ahead			
	RW	AR	PHIL	AO	RW	AR	PHIL	AO
Euro area total	**0.71**	**0.87**	**0.75**	0.90	**0.60**	**0.75**	**0.61**	0.79
G7								
United States	**0.71**	1.02	**0.85**	0.95	**0.74**	1.10	0.89	0.94
Canada	**0.55**	0.98	0.97	**0.89**	**0.47**	0.97	0.85	**0.84**
United Kingdom	1.12	0.99	**0.81**	1.92	1.54	1.05	0.98	2.36
Japan	**0.72**	0.99	1.04	1.08	0.71	**0.87**	1.03	1.06
Germany	**0.70**	1.02	**0.88**	1.00	**0.60**	0.88	0.89	0.94
France	**0.64**	0.93	**0.80**	0.95	**0.59**	1.06	0.92	0.92
Italy	0.96	0.92	0.88	0.83	1.15	1.04	0.98	0.91
Other Euro/EU								
Austria	**0.72**	**0.87**	**0.78**	0.88	**0.54**	0.76	**0.73**	**0.69**
Belgium	**0.64**	1.07	0.94	0.94	**0.56**	1.03	0.98	0.89
Denmark	**0.78**	1.15	0.81	1.01	**0.73**	1.20	0.98	1.05
Finland	0.89	1.04	**0.86**	1.00	**0.83**	1.05	0.95	0.94
Greece	1.80	1.31	0.97	2.49	2.23	1.10	1.00	2.94
Ireland	1.08	1.29	1.16	1.17	1.03	1.51	1.32	1.16
Luxembourg	**0.72**	1.14	1.03	0.96	**0.81**	1.34	1.25	1.13
Portugal	1.04	1.02	0.96	1.27	1.23	1.04	0.87	1.68
Spain	**0.71**	0.99	0.96	1.01	**0.65**	1.05	**0.79**	0.98
Sweden	0.98	1.02	**0.82**	1.27	1.11	0.96	**0.81**	1.43
The Netherlands	**0.79**	0.95	0.98	0.95	**0.81**	1.03	1.03	0.96
Others								
Australia	0.83	1.15	1.00	1.09	**0.66**	0.91	0.91	**0.88**
New Zealand	1.18	1.15	0.98	1.47	0.91	0.76	0.71	1.18
Norway	**0.53**	1.01	0.90	0.94	**0.41**	**0.88**	**0.69**	**0.88**
Switzerland	0.92	0.93	**0.84**	1.16	1.05	**0.85**	**0.88**	1.42
Overall median	0.78	1.02	0.90	1.00	0.74	1.03	0.91	0.96
Overall mean	0.86	1.03	0.91	1.14	0.87	1.01	0.92	1.17

Notes: This table presents results analogous to those in Table 1, with the exception that the in-sample period used to estimate each of the forecasting models at each forecast horizon is now the most recent 15 years of data, rather than than an expanding data window including data back to 1960, as in CM.

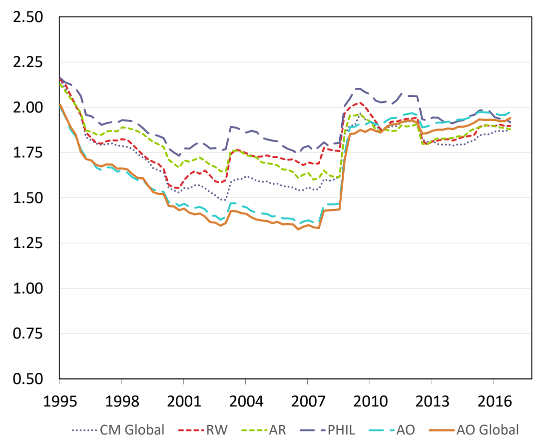
Table 3: RMSE of AO Model Augmented with Global Inflation Relative to AO Benchmark: 1995-2016

	4-step ahead			8-step ahead		
	Full sample	Rolling sample	Grid search	Full sample	Rolling sample	Grid search
Euro area total	1.00	1.05	0.99	1.00	1.03	0.96
G7						
United States	**0.99**	**0.93**	0.88	**0.95**	**0.92**	0.84
Canada	0.97	0.97	0.96	**0.95**	0.97	0.93
United Kingdom	1.02	1.09	0.97	1.02	1.08	0.94
Japan	0.96	1.00	0.96	0.94	0.98	0.94
Germany	1.00	1.04	0.99	1.00	1.05	0.99
France	1.00	1.02	1.00	1.01	1.01	1.00
Italy	**0.90**	**0.89**	0.84	**0.88**	**0.86**	0.83
Other Euro/EU						
Austria	**0.99**	0.99	0.96	**1.00**	0.97	0.89
Belgium	**0.95**	0.93	0.84	**0.93**	**0.87**	0.76
Denmark	1.03	1.03	1.00	1.03	1.04	1.00
Finland	**0.90**	**0.94**	0.89	**0.83**	**0.92**	0.82
Greece	**0.93**	0.96	0.92	**0.87**	**0.91**	0.85
Ireland	**0.91**	**0.92**	0.89	**0.83**	0.87	0.78
Luxembourg	**0.98**	0.98	0.97	**0.96**	0.96	0.93
Portugal	**0.95**	0.96	0.94	**0.93**	**0.89**	0.89
Spain	**0.95**	**0.95**	0.94	**0.93**	0.93	0.91
Sweden	0.97	0.96	0.94	0.93	0.94	0.90
The Netherlands	**0.97**	0.94	0.89	**0.99**	0.94	0.89
Others						
Australia	**0.91**	0.95	0.91	**0.86**	0.88	0.85
New Zealand	**0.88**	0.91	0.85	**0.86**	0.85	0.85
Norway	0.94	1.03	0.92	**0.83**	0.91	0.82
Switzerland	1.00	1.02	1.00	1.00	1.04	1.00
Overall median	0.97	0.96	0.94	0.94	0.94	0.89
Overall mean	0.96	0.98	0.93	0.94	0.95	0.89

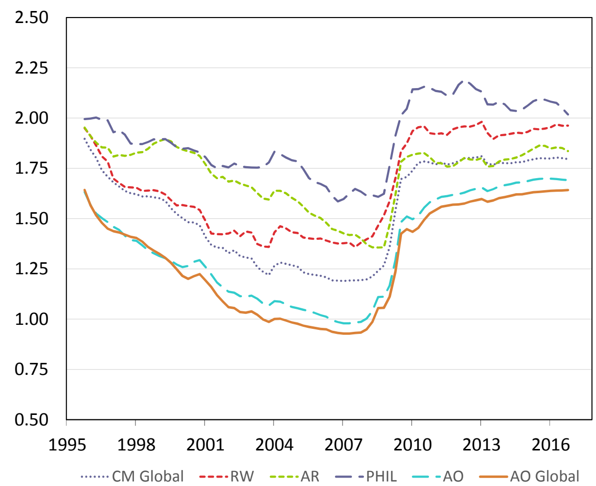
Notes: Entries are the ratios of the forecast RMSE of an AO model augmented with global inflation relative to the forecast RMSE of an AO model. Numbers less than unity indicate that augmenting the AO model with global inflation improves forecast accuracy. The full-sample estimates use an in-sample estimation period beginning in 1960 and the rolling-sample estimates use a fixed 15-year in-sample estimation period. The grid-search estimates select the weight on global inflation for each country that minimizes the forecast RMSE of the AO model in an ex-post evaluation. Bold entries denote ratios less than unity at the 10 percent level of significance; statistical significance tests were not conducted for the grid-search results.

Figure 1: Rolling 10-Year RMSE: By Forecast Horizon

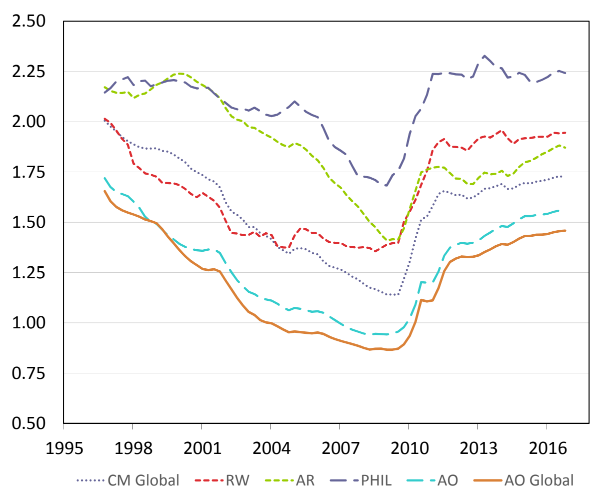
(a) 1-quarter ahead



(b) 4-quarter ahead



(c) 8-quarter ahead



Notes: Figures show rolling 10-year forecast RMSEs for each model. CM Global is CM's global inflation model, RW is the random walk forecast, AR is the autoregressive model, PHIL is the Phillips curve model, AO is the Atkeson and Ohanian (2001) model forecast, and AO Global is forecasts from an AO model augmented with global inflation. The value at each date shows the forecast RMSE computed over the previous 10 years to that date.

Online Appendix

Table A1: RMSE of Global Inflation Models Relative to Standard Benchmarks: 1995-2016

	4-step ahead			8-step ahead		
	RW	AR	AO	RW	AR	AO
Euro area total	**0.92**	0.97	1.00	0.95	0.96	1.08
G7						
United States	**0.77**	**0.97**	1.08	**0.68**	**0.82**	0.99
Canada	**0.69**	**0.90**	1.07	**0.66**	**0.87**	1.10
United Kingdom	1.14	1.03	1.56	1.21	0.90	1.60
Japan	0.94	1.02	1.22	1.00	0.99	1.41
Germany	**0.77**	**0.92**	0.96	**0.84**	0.95	1.09
France	**0.92**	0.98	1.11	**0.93**	0.95	1.20
Italy	1.17	0.91	1.10	1.19	0.83	1.16
Other Euro/EU						
Austria	**0.77**	**0.78**	0.90	**0.74**	**0.78**	0.89
Belgium	**0.75**	0.87	**0.82**	**0.64**	**0.79**	**0.79**
Denmark	1.25	**0.81**	1.53	1.20	**0.73**	1.58
Finland	0.94	**0.90**	0.96	0.99	**0.87**	1.09
Greece	1.07	**0.90**	1.27	1.10	**0.79**	1.39
Ireland	1.02	1.02	0.95	0.89	0.95	0.91
Luxembourg	**0.79**	0.94	0.97	**0.76**	0.93	1.00
Portugal	1.37	**0.81**	1.52	1.26	**0.73**	1.47
Spain	0.96	**0.89**	1.15	0.97	**0.81**	1.21
Sweden	1.01	**0.92**	1.13	1.05	**0.89**	1.26
The Netherlands	**0.72**	**0.79**	0.96	**0.87**	**0.91**	1.07
Others						
Australia	**0.71**	**0.89**	0.93	**0.63**	**0.81**	**0.86**
New Zealand	**0.75**	**0.77**	0.98	**0.72**	**0.69**	1.05
Norway	**0.59**	**0.81**	1.00	**0.54**	**0.72**	1.06
Switzerland	1.07	1.06	1.33	1.32	1.07	1.87
Overall median	0.92	0.90	1.07	0.93	0.87	1.09
Overall mean	0.92	0.91	1.11	0.92	0.86	1.18

Notes: This table presents results analogous to those in Table 1, extending the forecast evaluation period to 2016. The PHIL model forecasts are omitted because we have been unable to exactly match data sources for the M3 and industrial production data required to extend the dataset from 2008 to 2016.