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Global Output Gap and Domestic Inflation in China

Summary: This paper evaluates whether globalization has led to greater sensitivity of Chinese consumer price inflation to the global output gap. The empirical analysis uses quarterly data over the period 1995-2012. The global output gap is measured by weighted output gap of China's top eighteen trading partners. Estimating Phillips curve models and vector autoregressive models, we find that global capacity constraints have both explanatory and predictive power for domestic consumer price inflation in China. Therefore, the central bank of China should react to developments in global output gaps.

Key words: Globalization, Inflation, Output gap, China.

JEL: C22, E31, E37, E52, E58.

In recent years, a number of studies have addressed the question of whether greater global economic integration, or economic globalization, has had a significant impact on inflation. To date, most of the existing studies focus on industrial economies. The main motivation for concentrating on industrial economies, as explained in the literature review below, is that the increasing integration of China and other lower-cost producers into world production networks may have induced downward pressure on wages and import prices in industrial countries.

Different from the existing studies, this paper evaluates the global slack hypothesis for China. We attempt to examine the impact of global economic slack on inflation in China and link the results to broader debates in the academic literature as well as policy implications. To this end, we specify a dynamic model within a conventional backward-looking Phillips curve model. We modify the standard assumption of the elasticity of domestic demand *via* the inclusion of global economic slack, to provide a channel through which globalization may alter the dynamic response of inflation to domestic demand. To preview our results, we find that global economic slack exerts significant impact on China's inflation.

After this short introduction, the paper is organized as follows. Section 1 provides a brief literature review. Section 2 describes the data used in our empirical work and provides some stylized facts associated with the underlying data. Section 3 examines the relationship between globalization and domestic inflation in China in the Phillips curve models, followed by Section 4 which provides empirical analysis in a vector autoregressive system. Section 5 summarizes and concludes.

1. Literature Review

While there appears to be broad agreement on the importance of globalization as a real phenomenon, there is less agreement on whether global economic slack significantly drives inflation (i.e. the global slack hypothesis). Thomas Helbling, Florence Jaumotte, and Martin Sommer (2006), Nigel Pain, Isabell Koske, and Marte Sollie (2006), Claudio E. Borio and Andrew J. Filardo (2007), Gernot Pehnelt (2007), Benedicta Marzinotto (2009), Raphael Auer and Andreas M. Fischer (2010), Fabio Milani (2010), Niall Inerney (2013), and Chengsi Zhang (Forthcoming) appear to support the global slack hypothesis, while Laurence M. Ball (2006), Harald Badinger (2009), Alessandro Calza (2009), Frederic S. Mishkin (2009), and Jane Ihrig et al. (2010) provide contrasting evidence showing that globalization has little impact on inflation process in industrial countries.

Borio and Filardo (2007) and Ihrig et al. (2010) figure prominently among the most often cited papers in the relevant literature. These papers set the tone for the research agenda that followed, and articulated the complex puzzle that surrounds the empirical testing of the global slack hypothesis. In short, the findings of Borio and Filardo (2007) and Ihrig et al. (2010) are somewhat surprising because they suggest that while by most standards the world has become more integrated over the past 2 to 3 decades – through trade and finance, *via* information and migration flows etc. – there is little empirical evidence to conclusively validate the global slack hypothesis. Subsequent studies have reinforced this view by presenting mixed results. This appears to be due in part to the relative recentness, in some sense, of globalization, as well as in part to serious data limitations (Enrique Martínez-García and Mark A. Wynne 2010). But a more important factor keeping the debate over the global slack hypothesis alive is the absence of a wide range of compelling and consistent empirical evidence (Ihrig et al. 2010).

The different findings that exist for the industrial economies indicate that the integration of emerging countries into the global economy can impact the inflation process of advanced economies in opposite directions. On the one hand, higher demand may drive up prices for energy, raw materials, and general commodities, which eventually reflects in overall price inflation. On the other hand, an influx of lower-cost labor, products and services into the world market can drive prices downward. This two-way impact may blur the net influence of globalization on inflation and also explain, to some extent, why the global slack hypothesis remains controversial when data for industrial countries are considered.

Unlike industrial economies, China is less likely to experience the two-directional effects of globalization on its inflation process, being that it is the world's largest developing and emerging economy. For instance, economic globalization and the associated rise in trade integration have bolstered the dependence of the Chinese economy on global demand and supply *via* the international goods market. When the prices of the global goods market increase, for example, China's domestic prices also tend to rise. At the same time, there is no influx of lower-cost labor, products and services from industrial economies into China's market, so that there is no counter-effect to rising prices in China. From this aspect, the impact of globalization on inflation in China would be less ambiguous than industrial countries.

Indeed, China has now opened its economy markedly and improved its connectedness to world trade networks more than that in the industrial countries. In conjunction with rising globalization, China has also witnessed a marked change in the nature of the inflation process. For example, both the level of inflation and inflation persistence are found to be significantly lower in the recent ten years than before (Zhang and Joel Clovis 2010).

Note that a recently published paper by Zhang, Ke Song, and Fang Wang (2015) also evaluate whether globalization has increased the role of global factors in driving inflation in China. Unlike the present study that employs both conventional Phillips curve models and multivariate dynamic models to examine driving effects of globalization on Chinese domestic inflation, Zhang, Song, and Wang (2015) use only multivariate dynamic models to examine the predicting power of globalization on inflation. Another important (and subtle) difference between the current study and Zhang, Song, and Wang (2015) is that this study follows the standard literature and use consumer price index (CPI) inflation to measure domestic inflation whereas Zhang, Song, and Wang (2015) define Chinese domestic inflation as the growth rate of the gross domestic product (GDP) deflator. Both studies, nonetheless, suggest that the central bank of China should take into account of developments in global output in its monetary policy making process.

2. The Data and Stylized Facts

Our empirical analysis involves series for domestic inflation, a measure of the domestic output gap, and a measure of the foreign output gap. Most of the data series were obtained from China Economic Information Center (CEIC) database[1], except for China's nominal and real gross domestic products (GDP) series, which were obtained from Thomson Reuters Datastream database[2]. The raw level data for all quarterly series were seasonally adjusted (with X-11 method) prior to any further application. The final series used in empirical estimations are stationary (confirmed by conventional unit root tests). The sample size in our empirical estimations spans the first quarter of 1995 to the last quarter of 2012 (i.e. 1995Q1-2012Q4).

China's domestic inflation is measured by quarterly year-on-year growth rate of CPI. Available monthly data on CPI is transformed using end-of-quarter observations as the corresponding quarterly values to avoid inducing serial correlation in the transformed data. The real domestic output gap was obtained from Hodrick-Prescott (HP) filter on the corresponding real GDP series (with the smoothing parameter 1600 for quarterly data). Note that many methodologies have been proposed to estimate

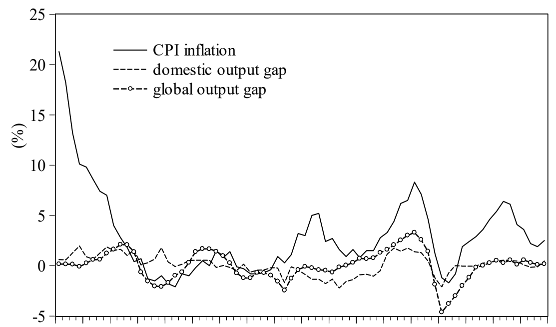
[1] **China Economic Information Center (CEIC).** 2014. China Premium Database. https://www.ceicdata.com/en/products/china-economic-database (accessed February 01, 2014).
[2] **Thomson Reuters.** 2014. Macroeconomic Analysis: Thomson Reuters Datastream. 2014. http://financial.thomsonreuters.com/en/products/tools-applications/trading-investment-tools/datastream-macroeconomic-analysis.html (accessed February 01, 2014).

output gap. HP filtering estimates (and so removes) long-term trends from macroeconomic time series. It specifies a filter bandwidth (*via* a fixed value of the smoothing parameter) which is more suitable in filtering terms for estimating long-term trends in quarterly macroeconomic time series. Univariate statistical methods, such as Kalman filter, deterministic trend extraction, and latent variable models, lack economic content and impose statistical relations that are difficult to justify on a theoretical basis.

In addition, the foreign output gap is computed by aggregating data on China's top 18 major trading partners using trade weights derived from bilateral trade statistics. China's top 18 major trading partners include Australia, Canada, France, Germany, Hong Kong, Indonesia, Italy, Japan, Korea, Malaysia, Netherlands, Russia, Singapore, Thailand, Tai Wan, the United Kingdom, the United States, and Latin America. Note that the trade data for Latin America aggregates the corresponding data of Argentina, Brazil, and Chile. The trade data and real GDP series for the 18 countries/regions were obtained from CEIC database.

The weight for each trade partner in each year is determined by the percentage of the partner's trade (both exports and imports) to China over the total trade between China and the 18 partners for that year. Because the trade weights of different countries/regions to China change over time, the variations of the trade percentage are accommodated in the calculation of the foreign real GDP gap. More specifically, considering China as the domestic economy, foreign aggregate output gap is defined as the weighted sum of real GDP gap of the underlying 18 economies, i.e. $\hat{y}_t^f = \sum_{j=1}^{18} w_{j,t} \hat{y}_{j,t}$, where $w_{j,t}$ denotes the defined weight (i.e. trade percentage) at time t (quarterly observations within one year use the same weight of the year) and $\hat{y}_{j,t}$ is the output gap measure for country/region j.

To illustrate inflation developments and the evolution of globalization in China, Figure 1 plots the time series of quarterly data for inflation in conjunction with the domestic and global output gaps. It shows that Chinese inflation witnessed the most striking peak in 1995 and has been generally low and stable since 1997, reflecting success in stabilizing inflation after the late 1990s.



Source: CEIC (2014), Thomson Reuters (2014) and the authors' calculations.

Figure 1 China's Domestic Inflation and Output Gap Measures: 1995Q1-2012Q4

The period of low inflation over the new century has been accompanied by accelerated globalization. With the rising globalization over the recent decade, China's domestic markets are increasingly integrated with the global markets and domestic prices (and in turn inflation) may be increasingly influenced by supply-and-demand conditions in global markets rather than being set independently by domestic supply-and-demand conditions within the country. The following sections embark on empirical analyses of the impact of globalization on inflation in China.

3. The Phillips Curve Models

There are several ways of thinking about the effect of globalization on domestic inflation. First, globalization may make domestic inflation less responsive to rising domestic resource utilization because households and businesses can go outside the country to buy goods and services, so there will be less pressure for domestic prices to change. Another way of thinking about this point is to recognize that globalization may reduce the likelihood of having supply bottlenecks as domestic resource utilization rises (Mishkin 2009). Either way, the foreign economic slack exerts influences on domestic inflation. Second, in a globalized world, firms can sell their products both in the domestic and foreign markets, and the prices they charge in domestic markets are likely to be influenced by the foreign demand for their products. Third, the effect of globalization on inflation can operate through the impact of foreign economic performance on domestic inflation expectations, which eventually affect actual inflation. There are several additional hypotheses for globalization and inflation nexus highlighting alternative channels through which globalization affects inflation, including global factor and product markets (Ihrig et al. 2010), global competition (Natalie Chen, Jean M. Imbs, and Andrew Scott 2004; Argia M. Sbordone 2008), and the terms of trade (Kenneth Rogoff 2006).

The essence of these hypotheses, among other things, is that domestic inflation is increasingly influenced by global output gap rather than being affected exclusively by domestic output gap within a given country. We examine this issue for China by augmenting the conventional Phillips curve model. To facilitate notations, we will use variables with superscripts *d* and *f* referring to domestic and foreign variables, respectively. As such, the baseline inflation dynamic model can be written as an augmented form of the conventional Phillips curve, *viz.*:

$$\pi_t = c + \alpha(L)\pi_{t-1} + \delta_d \hat{y}_t^d + \delta_f \hat{y}_t^f + u_t \tag{1}$$

where $\pi_t = 100 \times (\ln P_t - \ln P_{t-4})$ denotes domestic inflation for China (with P_t denoting the quarterly CPI); $\alpha(L) = \alpha_1 + \alpha_2 L + \cdots + \alpha_n L^{n-1}$ is a polynomial in the lag operator; $\hat{y}^d$ and $\hat{y}^f$ refer to domestic and foreign output gaps; c denotes a constant term; n denotes the optimal lag order; u_t is the model specification error term.

In this model, overall domestic CPI depends on past inflation rates and contemporaneous domestic and global (that is, China's major trading partners) output gap. If the distributed lag on past inflation rates is viewed as a proxy for inflation expectations, Model (1) collapses to the stylized New Keynesian Phillips curve

(NKPC) in Jordi Gali and Mark Gertler (2000). Although the NKPC has the virtue of structural interpretation, the backward-looking Phillips curve framework is well suited for empirical analysis of the impact of globalization on inflation (Ihrig et al. 2010) and remains a workhorse model for inflation dynamics analysis (James H. Stock and Mark W. Watson 2008).

In essence, Model (1) is in line with the Phillips curve model specified in Ihrig et al. (2010), but differ from the specifications in Borio and Filardo (2007) and Calza (2009) in a small but presumably important way. Specifically, we use contemporaneous output gap variables in Model (1), but Borio and Filardo (2007) and Calza (2009) use lagged output gaps in their models, *viz*.:

$$\pi_t = c + \alpha(L)\pi_{t-1} + \delta_d \hat{y}_{t-1}^d + \delta_f \hat{y}_{t-1}^f + u_t \,. \tag{2}$$

However, for models with quarterly data, it is highly plausible to observe contemporaneous effect of real variables of inflation. Therefore, the use of lagged real variables may omit such contemporaneous effect. More importantly, recent development in structural inflation dynamics with micro foundations highlights the use of contemporaneous real variables; see the seminal work of Gali and Gertler (2000).

In addition, the specification of lag order for lags of inflation in the equations in most existing studies is *ad hoc*, in nature. An inappropriate lag order specification, however, may invalidate estimation results because insufficient lag order in the Phillips curve models can lead to autocorrelation of the residuals. This autocorrelation not only distorts standard error estimates, as correctly pointed out by Ihrig et al. (2010), but also invalidates coefficient estimates permanently, no matter which estimation methods are used, given the model is specified with lagged dependent variable on the right side of the equations. In our specification, therefore, the optimal lag order n is specified by Akaike Information Criteria (AIC), from general-to-specific, with a maximum 8 lags to allow the dynamics to take effect within two years' time.

Several econometric issues deserve discussion prior to empirical estimations. First, the real variables at current period in Model (1) are likely to be correlated with the contemporaneous noise, since demand shocks may influence both variables. Therefore, we use IV, or more generally the generalized method of moments (GMM) estimator to estimate Model (1) and mitigate the endogeneity problem. The baseline IV set includes lags of inflation in the regression model, plus four lags of each of the domestic and foreign output gaps and the growth rate of monetary aggregate (M2).

Second, since the dynamic model in (1) is specified with sufficient dynamics and is generally free of significant serial correlation in empirical estimations, lagged inflation values on the right-hand-side of (1) are used as valid instruments for themselves. In addition, the baseline estimations are verified through Leslie George Godfrey's (1994) IV serial correlation test and the Stock and Motohiro Yogo (2002) generalized F-test for weak IV.

Note that the Godfrey IV serial correlation test is implemented by adding appropriate lagged residuals from the initial estimation to the regressors from the initial model and checking their joint significance by the Lagrange multiplier (LM) principle. This test is used to check the possibility of disturbance serial correlation in the IV estimations with null hypothesis of no serial correlation. Therefore, a large p-

value indicates no significant serial correlation in the regression and *vice versa*. The Stock-Yogo weak instrument test provides diagnostic information on to what extent the underlying instruments are weak in the estimation. The statistics reported in the empirical results are the Cragg-Donald statistics, with larger values indicating stronger IV sets.

Based on the preceding discussion, Table 1 reports GMM estimates of Model (1) for coefficients on the domestic and foreign output gap measures, in conjunction with the diagnostic statistics. The results in Table 1 show that the foreign output gap drives domestic consumer price inflation significantly with the coefficient estimate of 0.109, while the coefficient estimate on the domestic output gap is very small (0.000) and insignificant. The comparison between the coefficient estimates on the domestic and foreign output gaps clearly shows that the foreign output gap has played a more prominent role than its domestic counterpart has in the domestic inflation process of China over the underlying period. In practice, we have also estimated the underlying model with an alternative sample start point in 1997 to avoid possible outlier problem. The results are otherwise similar, but the statistical significance of the foreign output gap falls. The other regressions in the following sections using 1997 as a start point provided consistent results with those reported in the paper.

Note that the lack of statistical significance for the domestic output gap is not an artifact of high correlation between domestic and foreign output gaps (the correlation coefficient between them is 0.52); as shown in Figure 1, the two series frequently diverge from each other and there are many occasions when the signs of the output gap are different for the domestic and foreign measures. In addition, the empirical model appears to be properly specified: the diagnostic test statistics in Table 1 indicate that the specification of Model (1) is free from significant serial correlation and the IV choice is valid and significantly strong.

Table 1 IV Estimation Results for Model (1)

δ_d	δ_f	*p-auto*	*Weak IV*	*Adj* R^2	*Opt-lag*
0.000 (0.046)	0.109*** (0.032)	0.167	6.57**	0.85	7

Notes: Sample spans 1995Q1-2012Q4 prior to lag adjustment; the Bartlett kernel with Newey-West (fixed bandwidth) HAC-robust standard errors are reported in parentheses. The baseline IV set includes four lags of each of the domestic and foreign output gap and M2 growth rate, plus the lags of inflation included in the model (and a constant). *Opt-lag* refers to optimal lag order in the model specified by AIC and serial correlation test. *p-auto* and *Weak IV* refer to *p*-values of Godfrey's (1994) IV serial correlation test (for first order) and Stock and Yogo's (2002) weak instrumental variables test. (Critical values for the weak IV test are provided in Stock and Yogo (2002), Table 1, with ****, ***, **, and * denoting statistically significantly strong IV (5% significance level) when the desired maximal bias of the IV estimator relative to ordinary least squares (OLS) is specified to be 5, 10, 20 and 30 percent respectively; the null hypothesis is that the underlying IV set is weak). ***, **, and * denote statistical significance at 1, 5, and 10 percent levels, respectively.

Source: Authors' calculations.

Thus, our baseline results support the significant role of foreign output gap in determining domestic inflation, which is in line with the conclusion in Borio and Filardo (2007) but in contrast to Ihrig et al. (2010). As we have noted before, our specification of real variables in the baseline model is contemporaneous (rather than lagged) which is the same as the specification of Ihrig et al. (2010). But our finding for the role of foreign output gap in affecting China's domestic consumer price inflation is apparently different from the scenario for the industrial countries examined by Calza (2009) and Ihrig et al. (2010). This different finding may reflect the importance of studying globalization with individual countries.

Interestingly however, empirical results in the existing literature for pooled countries witnessed striking disparity. Calza (2009) attributes the disparity to the particular formation of inflation equations and he believes that standard specifications of inflation equations indicate little effect of foreign output gap for industrial countries, or at least for the European countries they examined. However, this assertion is challenged by the evidence that different findings arise for different countries even if the model is specified by similar standard inflation equations.

Note that Model (1) does not incorporate possible pass-through effect of exchange rate on domestic inflation. There is a theoretical reason to consider this specification. For instance, Martínez-García and Wynne (2010) shows that the open-economy Phillips curve can be expressed in terms of a domestic gap and a gap on terms of trade (or the real exchange rate). In addition, Model (1) also neglects possible impact of supply shocks, notably import price inflation, on domestic inflation, which is explicitly considered in Borio and Filardo (2007) and Ihrig et al. (2010).

Therefore, there is a concern that the pass-through effect and supply shocks might be squeezed into the foreign output gap when these variables are omitted. To assess whether the baseline finding is robust when these factors are considered, we do two augmentation exercises. First, we augment the baseline Model (1) by taking into account the possible impact of exchange rate on inflation, *viz.*:

$$\pi_t = c + \alpha(L)\pi_{t-1} + \delta_d y_t^d + \delta_f y_t^f + \delta_s \Delta eer_t + \eta_t \qquad (3)$$

where Δeer_t denotes growth rate of effective exchange rate and all other notations follow those in (1). The effective exchange rate is defined as a trade-weighted effective exchange rate index. By definition, an increase of the effective exchange rate denotes an appreciation. Also note that Model (3) does not contain lags of exchange rate because the dynamic Model (3) with lags of inflation rate as regressors have implicitly captured possible impact of lagged exchange rate on inflation, which can be shown by using standard properties of lag polynominal.

Second, we further augment Model (3) by considering the impact of import price inflation on domestic inflation, *viz.*:

$$\pi_t = c + \alpha(L)\pi_{t-1} + \delta_d y_t^d + \delta_f y_t^f + \delta_s \Delta eer_t + \delta_m \Delta imp_t + \eta_t \qquad (4)$$

where Δimp_t refers to growth rate of import price of China (expressed as deviations from overall CPI inflation).

Table 2 summarizes the results for these exercises. The corresponding results show that the baseline finding generally has no substantial change when exchange rate (both real and nominal effective exchange rates) and import price inflation are explicitly addressed in the model. In all regressions of the robustness analysis, the coefficient estimates on the foreign output gap outweigh the domestic counterparts, with the coefficient estimates on the foreign output gap ranging from 0.14 to 0.22 *vs.*

-0.04 to 0.08 relevant to the domestic output variables. Another interesting finding is that the pass-through effect of exchange rate on inflation is statistically significant but the supply shock does not exert significant impact on domestic inflation. That said, although exchange rate movements do pass-through significant impact on domestic inflation of China, the effect of supply shocks on domestic inflation is negligible. Taken as a whole, these results reinforce the conclusion that the foreign economic activity plays a quantitatively important and statistically significant role in affecting China's inflation over the period from 1995 to 2012.

Table 2 Robustness Estimation Results of the Inflation Dynamics Model for China

	δ_d	δ_f	δ_s	δ_{imp}	*p-auto*	*Weak IV*	*Adj R^2*
Model (3) with real	0.050	0.141	-0.051*		0.219	2.53	0.85
exchange rate	(0.107)	(0.088)	(0.026)				
Model (3) with nominal	0.084	0.172**	-0.084***		0.170	2.56	0.87
exchange rate	(0.110)	(0.086)	(0.017)				
Model (4) with real	-0.041	0.192*	-0.076**	-0.040	0.570	2.19	0.85
exchange rate	(0.111)	(0.106)	(0.035)	(0.040)			
Model (4) with nominal	-0.017	0.222***	-0.101***	-0.043	0.405	2.51	0.87
exchange rate	(0.125)	(0.080)	(0.024)	(0.028)			

Notes: Sample spans 1995Q1 to 2012Q4 prior to lag adjustment; other notations follow Table 1.

Source: Authors' calculations.

4. The VAR Analysis

In the foregoing analysis, globalization effect of inflation is captured by the Phillips curve framework, which documents unilateral impact of global output gap on domestic inflation. However, the possible dynamic interaction between inflation and output gaps is still beyond consideration. In this section, therefore, we utilize a vector autoregressive (VAR) empirical analytical framework, based on which the comparison of the predictive power on the inflation between the domestic output gap and its foreign counterpart can be more carefully explored by Granger causality test. The empirical model for our analysis employs an unrestricted VAR system that is simple but can capture the dynamic interactions properly among the underlying variables. To be specific, the VAR system can be written as:

$$X_t = \Phi(L)X_{t-1} + \varepsilon_t \tag{5}$$

where X_t is a vector time series incorporating the endogenous variables; $\Phi(L)$ denotes the vector polynomial of the lag operator with the optimal lag order determined by AIC, from general-to-specific, with a maximum 8 lags; and ε_t is a vector shock.

Similar to the vein of Section 3, for the baseline analysis, the VAR model simply contains domestic output gap, foreign output gap, and CPI inflation rate. In addition to this baseline specification, we also consider an augmented system which incorporates monetary growth (i.e. growth rate of M2, denoted $\Delta M2$) and effective exchange rate (in the form of growth rate) as additional endogenous variables. The specification of the augmented VAR model is based on the New Keynesian policy analysis framework with an IS equation, a Phillips curve equation, and a policy reaction function, as in Richard Clarida, Gali, and Gertler (1999), Stock and Watson (2003), and Michael Woodford (2003), among many other important works. It may be noted that monetary aggregates, rather than interest rates, are used as monetary policy indicator variable in China. This is explicitly stated in the People's Bank of China (PBOC) quarterly Monetary Policy Report, albeit the PBOC has recently promoted the development of market-based interest rates as policy instruments.

To examine the dynamic interactions between inflation and output gaps, we estimate the VAR models specified above. VAR modeling involves estimating a system of equations in which each variable is expressed as a linear combination of lagged values of itself and of all other variables in the system. In our analysis, VARs are estimated equation by equation using the principle of least squares using quarterly data from the first quarter of 1995 to the last quarter of 2012. To determine the appropriate lag length of the VAR model, the AIC is implemented and the criterion suggests that optimal lags are 7 and 2 for the baseline and augmented VAR models, respectively. The VAR models are then used to conduct Granger causality tests. By definition, a variable x_{1t} is said to be Granger-caused by x_{2t} if x_{2t} helps in the prediction of x_{1t}, or equivalently if the coefficients of the lagged x_{2t}'s are significantly different from zero.

Table 3 tabulates the results of the Granger causality tests for the three equations of the baseline VAR system, which are VAR model tests of the joint statistical significance of the lagged values of each regressor in causing (predicting) the dependent variables. The results presented in Table 3 show that the p-value pertaining to the null hypothesis that foreign output gap does not Granger-cause inflation is 0.019, which indicates that inflation in China can be predicted by foreign output gap occurring at earlier stages.

Table 3 Results (p-values) of Granger Causality Tests for the Baseline VAR Model

	Inflation	y^d	y^f
lag(inflation)		0.161	0.597
lag(y^d)	0.001		0.310
lag(y^f)	**0.019**	0.264	

Notes: The p-values associated with the Wald statistics in Granger causality tests are reported; sample spans 1995Q1-2012Q4 prior to lag adjustment; the optimal lag length is chosen by AIC (with a maximum of 8 lags); *lag(inflation)* denotes all lagged items of inflation rate on right-hand-side of each regression, and *lag*(y^d) and *lag*(y^f) are defined analogously (with y^d and y^f denoting domestic and foreign output gaps).

Source: Authors' calculations.

Highlighting this result is the finding that, in the regression equation for CPI inflation, the coefficients of the lagged foreign output gaps are jointly significant at the 5 percent significance level. Interestingly, the p-value pertaining to the null hypothesis that domestic output gap does not Granger-cause inflation is also significant (0.001), indicating that domestic output gap also has significant predictive power on domestic inflation in the baseline VAR model.

However, looking at the results in Table 4 for the augmented VAR model with monetary policy variable and exchange rate, the results suggest that foreign output gap, rather than domestic output gap, has significant predictive power on domestic inflation. Specifically, the *p*-value (0.043) pertaining to the null hypothesis that foreign output gap does not Granger-cause inflation is statistically significant, whereas the *p*-value (0.172) pertaining to the null hypothesis that domestic output gap does not Granger-cause inflation is insignificant.

Table 4 Results (*p*-values) of Granger Causality Tests for the Augmented VAR Model

	inflation	y^d	y^f	*ΔM2*	*ΔREER*
lag(inflation)		0.948	0.580	0.058	0.137
lag(y^d)	0.172		0.965	0.706	0.800
lag(y^f)	**0.043**	0.114		0.009	0.000
lag(ΔM2)	0.031	0.632	0.190		0.179
lag(ΔREER)	0.280	0.068	0.884	0.789	

Notes: *ΔM2* and *ΔREER* refer to growth rate of monetary aggregate (i.e. M2) and real effective exchange rate, respectively; other notes follow Table 1.

Source: Authors' calculations.

Therefore, the Granger causality tests associated with the VAR models indicate that foreign output gap has significant predictive power on domestic inflation, and this conclusion is robust to both the baseline and the augmented VAR systems. Although domestic output gap also has significant predictive power on domestic inflation in the baseline three variables VAR model, this significance is not robust to the augmented setting for the VAR model. Taken as whole, the results in this section reinforce the significant role of global output gap in affecting domestic consumer price inflation.

5. Conclusions

There is increasing interest in understanding the global dimensions of domestic inflation in recent decades. Globalization may have altered short-run inflation dynamics through various channels. One of the main channels thorough which globalization has affected domestic inflation dynamics is by increasing the sensitivity of domestic inflation developments to foreign output gaps. Verifying the effect of globalization on inflation, however, has proven challenging. In particular, the existing literature finds limited evidence that the global output gap has explanatory power for domestic consumer price inflation in industrial countries.

This paper has aimed to provide new empirical evidence on this globalization effect of domestic inflation for China, whose emergence as a major player in the global economy over the past decades has been viewed as an essential part and a catalyst of this new wave of globalization. Towards that end, we have estimated both Phillips curves and VAR models with global output gap. Overall, we find robust evidence that global output plays a significant role in driving and predicting domestic consumer price inflation in China over the recent two decades.

This finding indicates that global developments have played an important role in determining domestic inflation of China as the Chinese economy is increasingly integrated into the world economy through trade and other economic linkages. Our finding also provides an important policy implication that the Chinese central bank should specifically react to developments in global output gap. For instance, policy interest rates may be increased when the global output gap rises and *vice versa*.

Further implications should also be underscored. On the one hand, globalization may have already changed monetary policymakers' objective function and may thus have contributed to lower inflation through various channels. On the other hand, however, monetary policy may have become less effective in influencing inflation through the traditional demand channel, and it becomes harder to bring inflation back to target once it deviates. The transmission of monetary policy to domestic inflation may be further loosened by increasing interlinkages among world long-term interest rates (Borio and Filardo 2007). Stabilizing inflation expectations, therefore, seems to be more important in this globalized economic environment.

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