REGULAR ARTICLES

The Effect of Globalization on Inflation in New Emerging Markets

Chengsi Zhang

School of Finance and China Financial Policy Research Center, Renmin University of China, Beijing, China

ABSTRACT: We investigate the effect of economic globalization on domestic inflation in twenty-one new emerging economies over the period 1990–2009. The empirical analysis using dynamic panel data models shows that the effect of domestic and global economic slacks on domestic inflation in the new emerging economies has changed significantly since the end of the 1990s. Before the end of the 1990s, the domestic economic slack played a predominant role in driving domestic inflation. After the year 2000, however, the global economic slack played a significant and more important role in affecting domestic inflation. This finding implies that the prescription that central banks should specifically react to developments in global output is justified for the new emerging economies over the most recent decade.

KEY WORDS: inflation, inflation dynamics, new emerging markets, trade openness

Introduction

The new emerging markets (NEMs) have now become one of the most dynamic and economically important groups in the world economy. As these economies become larger and more integrated into international trade and finance, they face an increasingly complex set of policy challenges (Law, Azman-Saini, and Tan 2014). Given their important role in the world economy in terms of population and sheer economic size, addressing these challenges effectively has important economic and political implications for both the NEMs and economies beyond their national borders.

One of the leading challenges for the NEMs is the changing nature of inflation dynamics in the process of rising globalization. In particular, the past decade (i.e., 2000–2010) saw a marked fall in inflation in the NEMs, also associated with a distinct increase in economic globalization in the NEMs more generally than that in the industrial countries. Economic globalization, defined broadly as the acceleration in the pace of growth of international trade relative to the rate of growth in domestic output, brings a new challenge for the NEMs’ monetary authorities: Central bankers could risk their nations lurching dangerously into secular deflation or unexpected high inflation if they fail to grasp profound global changes at play and their implications for domestic inflation developments.

Despite the conspicuous importance of the effects of globalization on inflation dynamics in the NEMs, many of the existing studies have focused on the relevant issue for industrial economies. The main motivation for concentrating on the industrial economies, as claimed in the literature, is that the increasing integration of China and other lower-cost producers in world production networks may have induced downward pressure on wages and import prices in industrial countries. Recent research by Bank for International Settlements (2005), Borio and Filardo (2007), Gamber and Hung (2001), International Monetary Fund (2006), and Pehnelt (2010) appears to support this argument.

Such a view, however, is not universally shared. Ball (2006), Ihrig et al. (2010), Kohn (2006), Romer (1993, 1998), and Tootell (1998) provide contrasting evidence showing that globalization has
little effect on the inflation process in major industrial countries.\(^1\) Other studies offer alternative explanations for the changing inflation performance in the industrial countries, including improved cyclical conditions (Buiter 2000), systematic improvements in monetary policy (Ball and Moffitt 2001; Kamin, Marazzi, and Schindler 2004; Mishkin 2007, 2009; Roberts 2006) or simply good luck (Stock and Watson 2007).

These different findings for the industrial economies may be unsurprising since the integration of emerging countries into the global economy can bring interconnecting and two-way effects on the inflation process of advanced economies. Higher demand from emerging economies may drive up prices for energy, raw materials, and general commodities, which will eventually reflect in consumer price inflation. An influx of lower cost labor, products, and services into the world market can drive prices downward. This two-way effect may also explain why the globalization-inflation relationship remains a “puzzle” (Temple 2002) when different pools of countries are considered (Gruben and Mcleod 2004; Romer 1993; Terra 1998).

Compared to the industrial economies, the NEMs are less likely to experience the two-direction effects of globalization on their inflation process. For instance, globalization and the associated rise in trade integration have bolstered the dependence of the NEMs’ economies on global demand and supply via the international goods market. When the prices of the global goods market increase, for example, the NEMs’ domestic prices also tend to rise. In the meantime, there is no influx of lower cost labor, products, and services from industrial economies into the NEMs’ market, so there is no counter effect to rising prices in the NEMs. From this aspect, the effect of globalization on inflation in emerging economies would be less ambiguous than in industrial countries.

In addition, most members of the NEMs have now opened their economies markedly and improved their connectedness to world trade networks more than industrial countries have improved (International Monetary Fund 2006). In conjunction with rising globalization, many emerging economies have 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 (i.e., 2000–2010) than before (Niedermayer 2009; Pires, Cunha, and De Alcantara 2009; Zhang and Clovis 2010).

Therefore, this article focuses on the effect of globalization on inflation in the NEM countries.\(^2\) While country-specific circumstances and initial conditions in the NEMs matter a great deal in formulating suitable frameworks for individual countries, are there clear general principles in inflation dynamics for the NEMs that can serve as a guide in the process of rising globalization? In the present article, we attempt to fill the existing void and provide a complementary explanation of changing inflation performance in the NEMs, linking it to broader debates in the academic literature as well as policy implications.

To this end, we specify a dynamic panel data model within a conventional backward-looking Phillips curve model, but modify the standard assumption of an elasticity of domestic demand via the inclusion of global demand, to provide a channel through which globalization may alter the dynamic response of inflation to domestic demand. To preview our results, we find that an increase in globalization has generated a significantly large increase in the response of inflation to the global demand since the end of 1999, which reduces the slope of the inflation–domestic demand relationship in the NEMs. The baseline finding is robust when the role of import prices is considered.

The rest of the article is organized as follows: First, we describe the data used in the empirical analysis and stylized facts of changing inflation and globalization in the NEMs. Second, we present the baseline model and estimation results for inflation dynamics with globalization over different sample periods. Third, we provide an extended analysis by considering the role of import prices in the inflation dynamics model. Finally, we provide further discussions on the declined sensitivity of inflation to the domestic economic slack over the new century, followed by an overall conclusion.
The Data and Stylized Facts

The data series considered in this article are chosen to provide relations that are of most interest for policy analysis and to facilitate comparisons with the relevant literature. In all, our empirical analysis involves series for inflation, a measure of domestic real output gap, and a measure of foreign real output gap. Inflation is measured by quarterly year-on-year growth rate of consumer price indexes (CPI). The raw data for CPI are obtained from the International Financial Statistics. The real output gap measures (domestic and foreign) are obtained from the estimates of the Hodrick-Prescott filter (with smoothing parameter 1600) based on the corresponding real gross domestic products (GDPs).

The foreign output gap for each member of the NEMs is represented by their corresponding trade-weighted real GDP gap. The trade weights are calculated based on the top ten largest trading partners of the underlying country. As the set of trading partners may change over time, the calculations of the trade weights are based on the most recent three years. The GDP data of the NEMs are obtained from the Economist Intelligent Unit (EIU) Country Data (China’s real GDP data are obtained from the China National Bureau of Statistics).

Since our empirical estimations demand stationary variables, we also carry out panel unit root tests for the underlying series of the NEMs (optimal lag orders are specified by the Akaike information criterion [AIC] with observation-based maximum lag length). Both the tests with common unit root assumption, as in Levin, Lin, and Chu (2002), and the tests with individual unit root assumption, as in Im, Pesaran, and Shin (2003) and Maddala and Wu (1999) produce very small p-values (smaller than 1 percent), which indicates that the null hypothesis of a unit root in the underlying series is rejected at the 1 percent level of significance.

Table 1 summarizes the level of globalization (measured by the sum of exports and imports as the percentage of nominal GDP) in conjunction with volatility (standard deviation) and mean of inflation series during 1992–2009. To illustrate the changing pattern of globalization and inflation, Table 1 reports the relevant statistics for each member of the twenty-one NEMs over two different sample periods, before and after the new century (demarcated by 1999).

The statistics summarized in Table 1 indicate that both the level and the volatility of inflation in the NEMs decrease substantively in the new century in comparison with those in the pre-1999 era. In the new century, most countries keep their inflation rate below 10 percent (on average) and virtually 50 percent of the NEM members maintain an average level of inflation rate below 5 percent. In addition, more than 75 percent of the NEM members witness drastic reductions in their inflation volatilities in the post-1999 period.

The marked changes in the inflation behavior are accompanied by a notable rise in the level of globalization in the post-1999 period. As evident in Table 1, the levels of globalization in virtually all members of the NEMs have increased remarkably since 1999. Among the twenty-one members of the NEMs, there are thirteen countries in which the levels of globalization have grown by more than 20 percent since the new century. The growth rates of the globalization levels in Argentina, Brazil, China, Hungary, India, Poland, and Thailand are striking and exceed 40 percent.

With the rising globalization, national markets are increasingly integrated with the global markets, and domestic prices may be increasingly influenced by supply-and-demand conditions in global markets rather than being set independently by domestic supply-and-demand conditions within a country. The following sections embark on empirical analyses of the effect of global economic slack on domestic inflation in the NEMs.

The Baseline Model and Results

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 in both 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 effect of foreign economic slack on domestic inflation expectations, which eventually affect actual inflation.

Effects of trade openness on domestic inflation in industrial countries may be different from those in emerging economies. For example, industrial countries could take advantage of the economic resource slack in emerging markets where costs of production may be lower, but the reverse may not be said of emerging countries. As the domestic resource slack is utilized in emerging countries due to increased high global demand, they may not have the option to shift production to industrial countries. However, trading partners of each member of the NEMs often also include other emerging countries, so individual emerging countries could still have the option to shift production to other emerging countries. Therefore, the rationale on effects of trade openness on domestic inflation in emerging economies may still maintain some similarities to industrial countries.

The essence of the rationale on the effects of globalization on inflation, among other things, is that domestic inflation is increasingly influenced by global economic slack rather than being affected

Table 1. Globalization and inflation in the NEMs: Statistical summary

<table>
<thead>
<tr>
<th>Country</th>
<th>Standard deviation of inflation (%)</th>
<th>Mean of inflation (%)</th>
<th>Globalization (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>8.9</td>
<td>2.5</td>
<td>8.8</td>
</tr>
<tr>
<td>India</td>
<td>3.4</td>
<td>2.3</td>
<td>9.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>21.0</td>
<td>4.0</td>
<td>16.4</td>
</tr>
<tr>
<td>Israel</td>
<td>3.4</td>
<td>2.4</td>
<td>9.4</td>
</tr>
<tr>
<td>Korea</td>
<td>2.0</td>
<td>0.9</td>
<td>4.9</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1.1</td>
<td>1.9</td>
<td>3.7</td>
</tr>
<tr>
<td>Philippines</td>
<td>1.8</td>
<td>2.6</td>
<td>7.9</td>
</tr>
<tr>
<td>Taiwan</td>
<td>1.9</td>
<td>1.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.5</td>
<td>2.3</td>
<td>4.8</td>
</tr>
<tr>
<td>Latin America</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>7.5</td>
<td>10.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Brazil</td>
<td>1174</td>
<td>3.2</td>
<td>710</td>
</tr>
<tr>
<td>Chile</td>
<td>4.0</td>
<td>2.3</td>
<td>8.6</td>
</tr>
<tr>
<td>Colombia</td>
<td>4.7</td>
<td>1.6</td>
<td>20.1</td>
</tr>
<tr>
<td>Mexico</td>
<td>11.6</td>
<td>1.7</td>
<td>19.4</td>
</tr>
<tr>
<td>Peru</td>
<td>24.4</td>
<td>1.8</td>
<td>23.0</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>5.1</td>
<td>1.9</td>
<td>9.9</td>
</tr>
<tr>
<td>Hungary</td>
<td>5.9</td>
<td>2.3</td>
<td>19.8</td>
</tr>
<tr>
<td>Poland</td>
<td>12.7</td>
<td>2.7</td>
<td>24.3</td>
</tr>
<tr>
<td>Russia</td>
<td>314</td>
<td>4.2</td>
<td>234</td>
</tr>
<tr>
<td>South Africa</td>
<td>2.4</td>
<td>3.6</td>
<td>8.9</td>
</tr>
<tr>
<td>Turkey</td>
<td>17.1</td>
<td>20.8</td>
<td>81.0</td>
</tr>
</tbody>
</table>

Notes: Sample spans 1992–2009. The statistics for CPI inflation are based on quarterly data; the levels of globalization are based on annual data over the underlying sample.
exclusively by domestic economic slack within a given country. We examine this issue for the NEMs by augmenting a conventional Phillips curve model as in Borio and Filardo (2007) and Tootell (1998).

To facilitate notations, we use variables with a $j$-index to refer to economy $j$, and variables with superscripts $d$ and $f$ refer to domestic and foreign variables, respectively. As such, the baseline dynamic panel data model can be written as

$$
\pi_{jt} = c_j + \beta \pi_{j,t-1} + \sum_{i=1}^{p-1} a_i \Delta \pi_{j,t-i} + \delta_d \delta^d_{j,t-1} + \delta_f \delta^f_{j,t-1} + u_{j,t},
$$

where $\pi_{jt}$ denotes domestic inflation for country $j$; $\delta^d_j$ and $\delta^f_j$ refer to domestic and foreign output gaps; $c_j$ captures cross-section specific effects; and $u_{jt}$ is the model specification error term. By construction, $\beta$ measures the degree of inflation inertia.

Several issues deserve discussion prior to empirical estimations. First, the inclusion of lags of the dependent variable in Model (1) provides characterization of the inflation dynamic adjustment process. The optimal lag order $p$ can be specified by the coefficient significance test, from general-to-specific, with a maximum eight lags. Second, the dynamic panel data model specification also brings an endogeneity issue. It may be argued that the output gap measures in Model (1) are exogenous, at least conditional on individual- and time-specific effects. However, this is often not the case in dynamic models, and the variables are most likely not strictly exogenous but simultaneously determined with the outcome variable of interest. Even if one is willing to believe that the regressors are not simultaneously determined, they may be influenced by past values of inflation.

Due to the various possibilities of the endogeneity problem, least-squares-based inference methods are likely to be biased and inconsistent. Hence, to estimate the dynamic panel data Model (1), we use instrumental variables (IV) methods or the (fixed effects) generalized method of moments (GMM), which produce consistent parameter estimates. The IV set includes lags of inflation in the regression model plus four lags of the domestic and foreign output gaps. The standard Hansen’s (1982) $J$-test is used as a diagnostic test for overidentifying restrictions.

In addition, to examine the changing effects of globalization (via global economic slack) on inflation, we need to employ a break point based on which we can compare different performances of inflation dynamics over different sample periods. The break time (i.e., 1999Q4) we have chosen in Table 1 is, of course, somewhat arbitrary. That choice is mainly motivated by the intuition of decade-by-decade analysis and the observation that the most remarkable reduction in the rates of inflation of the NEMs occurs at the end of the 1990s. Indeed, the plot of the median of inflation in the NEMs in conjunction with its two-year rolling average in Figure 1 shows that there is a distinct decline in the

Figure 1. The median of CPI inflation in the NEMs.
median series in late 1999, after which the median of inflation drops from above 6 percent to less than 3 percent.

In practice, we also carry out formal unknown structural break tests on the median of inflation series and the median of globalization series of the NEMs to find break points for subsample analysis. Specifically, we employ the supreme Wald test of Andrews (1993) to test for an unknown structural break in a constant model for the median of inflation series and globalization series. The break point in the tests concentrates in the end of the 1990s (the results are not reported).

Drawing on the above analysis, the end of the 1990s is obtained as a structural break point according to which we can investigate the nature of changes in the inflation dynamics model (1) and compare the effect of globalization on inflation dynamics over different sample periods, when the break in the underlying coefficients is recognized. To be specific, we will take the last quarter of 1999 as the benchmark time to split the sample. Slightly different break points do not render substantial changes in the baseline results.

Table 2 reports GMM estimates of Model (1) over the whole sample and pre- and post-1999 periods for coefficients on inflation inertia and the domestic and foreign output gap measures, in conjunction with relevant diagnostic statistics and optimal lag orders. The results in Table 2 reveal significant changes in the effect of the domestic and foreign output gaps on domestic inflation in the NEMs over different sample periods. Specifically, the first column shows that if the structural break is neglected, the domestic output gap drives inflation significantly with the coefficient estimate of 0.084. The coefficient estimate on the foreign output gap is comparatively small (0.048) and statistically insignificant.

When the structural change is accounted for, however, the results change distinctively. The last two columns in Table 2 provide evidence that the effect of the domestic and foreign output gaps on inflation changes significantly after 1999. The coefficient estimate of the domestic output gap falls substantially from a large and significant value of 0.085 pre-1999 to a small and insignificant value 0.037 post-1999. Conversely, the coefficient estimate of the foreign output gap has risen from an insignificant and small negative value (−0.03) to a significant and large positive value (0.199).

Overall, the results in Table 2 suggest that there is a significant decline in the sensitivity of inflation to the domestic output gap in 1999. In addition, the effect of globalization, as captured by the foreign

<table>
<thead>
<tr>
<th></th>
<th>Whole sample</th>
<th>Pre-1999</th>
<th>Post-1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>β</td>
<td>0.897***</td>
<td>0.865***</td>
<td>0.803***</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.013)</td>
<td>(0.048)</td>
</tr>
<tr>
<td>δd</td>
<td>0.084***</td>
<td>0.085***</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.029)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>δf</td>
<td>0.048</td>
<td>−0.003</td>
<td>0.199***</td>
</tr>
<tr>
<td></td>
<td>(0.054)</td>
<td>(0.113)</td>
<td>(0.054)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.96</td>
<td>0.93</td>
<td>0.96</td>
</tr>
<tr>
<td>J-test (p-value)</td>
<td>0.99</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Optimal lag</td>
<td>8</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Notes: GMM estimation results of cross-section fixed effects are reported. The IV set includes lags of inflation in the regression model, plus four lags of the domestic and foreign output gaps. The optimal lag order in Model (1) is specified by significance test (from general to specific) with maximum eight lags. J-test refers to the overidentifying restrictions test (under the null hypothesis that the overidentifying restrictions are valid).

*Statistical significance at the 10 percent level; **statistical significance at the 5 percent level; ***statistical significance at the 1 percent level.
output gap, on domestic inflation has increased dramatically since 1999. 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 the NEMs since 1999.

**An Extended Model With Import Prices**

An inflation model that incorporates the foreign output gap will already capture information about the effect of globalization on inflation, but there may be scope for an additional factor of globalization capturing relative import prices on inflation. Import prices provide information about the cost of goods and services that are imported, which may eventually pass through to the domestic inflation. Many observers suggest that international trade has produced negative shocks to domestic inflation. These shocks are caused by declines in import prices and/or increased imports of inexpensive goods. Many economists presume that such an effect exists. To include the effect of relative import prices on inflation, we extend the baseline model (1) by explicitly taking into account import prices, which is similar to the model used in Ihrig et al. (2010). The extended model can be written as

$$
\pi_{jt} = c + \beta \pi_{j,t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \pi_{j,t-i} + \delta_d \tilde{y}^{d}_{jt-1} + \delta_f \tilde{y}^{f}_{jt-1} + \eta (P_{j,mt} - \pi_{j,t-1}) + \nu_{jt},
$$

(2)

where $P_{j,mt}$ denotes the year-on-year growth rate of import prices of country $j$, and the other notations follow those associated with Model (1). By construction, the coefficient $\eta$ measures the sensitivity of domestic inflation to the growth rate of import prices (relative to inflation).

Table 3 reports the GMM estimation results of Model (2). The results provide a scenario similar to the baseline finding in Table 2: The domestic output gap is significant for the pre-1999 period but insignificant (and small) for the post-1999 era, while the converse applies to the foreign output gap. In

<table>
<thead>
<tr>
<th></th>
<th>Whole sample</th>
<th>Pre-1999</th>
<th>Post-1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>0.902***</td>
<td>0.892***</td>
<td>0.812***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.017)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>$\delta_d$</td>
<td>0.086***</td>
<td>0.090***</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.028)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>$\delta_f$</td>
<td>0.039</td>
<td>-0.003</td>
<td>0.181***</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td>(0.110)</td>
<td>(0.056)</td>
</tr>
<tr>
<td>$\eta$</td>
<td>0.004</td>
<td>0.027**</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.011)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.96</td>
<td>0.96</td>
<td>0.89</td>
</tr>
<tr>
<td>$J$-test (p-value)</td>
<td>0.96</td>
<td>1.00</td>
<td>0.78</td>
</tr>
<tr>
<td>Optimal lag</td>
<td>8</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Notes: GMM estimation results of cross-section fixed effects are reported. The IV set includes lags of inflation in the regression model, plus four lags of the domestic and foreign output gaps. The optimal lag order in Model (2) is specified by significance test (from general to specific) with maximum eight lags. $J$-test refers to the overidentifying restrictions test (under the null hypothesis that the overidentifying restrictions are valid).

*Statistical significance at the 10 percent level; **statistical significance at the 5 percent level; ***statistical significance at the 1 percent level.
addition, the coefficient estimate for import prices is significant in the pre-1999 sample but insignif-
icant (and much smaller) in the post-1999 sample.

These results suggest that over the most recent decade, the effect of globalization on inflation in the NEMs works mainly through global economic slack rather than import prices. This finding is consistent with Borio and Filardo (2007), who point out that import prices are not a sufficient statistic for the influence of foreign markets on domestic prices.

This finding may also indicate that the foreign economic slack has already provided some signal about the evolution of import prices going forward. Because many domestic firms sell their products in both the domestic and foreign markets, the prices they charge in domestic markets are likely to be influenced by the foreign demand for their product and the prices they can charge in foreign markets, and these factors may be more highly correlated with foreign economic slack than with import prices (Ihrig et al. 2010).

Further Discussion

Although we have found that domestic inflation in the NEMs is less sensitive to the domestic output gap but more responsive to the foreign output gap over the new century, this is not equivalent to saying that globalization (trade openness) has directly led to a decline in the sensitivity of inflation to the domestic output gap. The effect of globalization on inflation, as we have discussed previously, is likely to materialize through various indirect channels.

To evaluate whether globalization has caused a reduction in the sensitivity of inflation to the domestic output gap, a common practice in the literature (e.g., Ihrig et al. 2010) is to formulate a model with an interaction term between trade openness and domestic output gap and to test for significance of the coefficient on the interaction term. Following this practice, we modify the baseline model (1) and estimate the following regression model:

$$
\pi_{jt} = c_j + \beta \pi_{jt-1} + \sum_{i=1}^{p-1} a_i \Delta \pi_{jt-i} + \delta_{d} \hat{y}_{jt-1}^d + \delta_{o} \text{openness} \hat{y}_{jt-1}^d + u_{jt},
$$

where openness is trade openness (i.e., the measure of globalization level), and other notations follow those associated with Model (1). By construction, if globalization (directly) reduces the sensitivity of inflation to the domestic output gap, then $\delta_{o}$ should be negative and not negligible. An alternative modification to Model (3) is

$$
\pi_{jt} = c_j + \beta \pi_{jt-1} + \sum_{i=1}^{p-1} a_i \Delta \pi_{jt-i} + \delta_{d} \hat{y}_{jt-1}^d + \delta_{f} \hat{y}_{jt-1}^f + \delta_{o} \text{openness} \hat{y}_{jt-1}^d + u_{jt},
$$

where the foreign output gap is considered in the regression model. We can also modify Model (2) by adding the interaction term between the domestic output gap and trade openness:

$$
\pi_{jt} = c_j + \beta \pi_{jt-1} + \sum_{i=1}^{p-1} a_i \Delta \pi_{jt-i} + \delta_{d} \hat{y}_{jt-1}^d + \delta_{f} \hat{y}_{jt-1}^f + \delta_{o} \text{openness} \hat{y}_{jt-1}^d + \eta(P_{jt} - \pi_{jt-1}) + v_{jt}
$$

Table 4 presents estimates of the coefficients of our interest for Models (3)–(5). The estimated coefficients on the interaction term between the domestic output gap and the extent of trade openness are generally small and insignificant. This finding is consistent with the results in Ihrig et al. (2010), and at first glance, it seems to support the conclusion in Mishkin (2009) that globalization has not led to a decline in the sensitivity of inflation to the domestic output gap.
However, it may be the case that the influence of globalization on the coefficients on the domestic output gap is too subtle to identify from the interaction term in the underlying equations. As mentioned in our previous discussion, the influence of globalization on inflation may be transmitted via foreign economic slack, and hence the effect of globalization on the coefficients on the domestic output gap is indirect and cannot be solely captured by the interaction term between the domestic output gap and trade openness.

An alternative way to check whether globalization has led to a decline in the sensitivity of inflation to domestic economic slack is to compare the relevant estimates for a Phillips curve model with domestic output gap without foreign output gap and vice versa. The results of such exercises, however, may not be interpreted straightforwardly due to the possible effect of multicollinearity between the domestic and foreign output gaps. In fact, there is a possibility that the drastic fall of the coefficient estimate of the domestic slack when we include foreign slack may reflect that the domestic and foreign slacks in the post-1999 period are highly correlated as we can imagine from the global credit cycle upturn and subsequent economic stagnation.

To overcome the possible effect of multicollinearity, we conduct a nonnested hypothesis testing over the two competing models that contain the domestic output gap without the foreign output gap and contain the foreign output gap without the domestic output gap, respectively, over the pre- and post-1999 periods. Specifically, we utilize Davidson and MacKinnon’s (1993) J-test of nonnested models. The test was developed within the framework of Gauss-Newton regression, but it is straightforward to extend the test to the present setting of our model.

Suppose the two different implementations of what is basically the same theoretical model, both of which purport to explain the same dependent variable, yield the two regression models:

\[ H_1 : y = x(\beta) + u_1 \]  

(6)

Table 4. GMM estimation results for Equations (3)–(5)

<table>
<thead>
<tr>
<th>Equation (3)</th>
<th>Equation (4)</th>
<th>Equation (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>0.898***</td>
<td>0.897***</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>$\delta_d$</td>
<td>0.087***</td>
<td>0.080***</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>$\delta_f$</td>
<td>0.061</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td>(0.057)</td>
<td>(0.058)</td>
</tr>
<tr>
<td>$\eta$</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td></td>
</tr>
<tr>
<td>$\delta_o$</td>
<td>0.048</td>
<td>0.020</td>
</tr>
<tr>
<td></td>
<td>(0.098)</td>
<td>(0.101)</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.96</td>
<td>0.96</td>
</tr>
<tr>
<td>J-test (p-value)</td>
<td>0.99</td>
<td>1.00</td>
</tr>
<tr>
<td>Optimal lag</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Notes: The whole sample of 1992–2009 is used. GMM estimation results of cross-section fixed effects are reported. The IV set includes lags of inflation in the regression model, plus four lags of the domestic and foreign output gaps. The optimal lag order in Models (3)–(5) is specified by significance test (from general to specific) with maximum eight lags. J-test refers to the overidentifying restrictions test (under the null hypothesis that the overidentifying restrictions are valid). *Statistical significance at the 10 percent level; **statistical significance at the 5 percent level; ***statistical significance at the 1 percent level.
where \( \beta \) and \( \gamma \) denote parameter vectors of lengths \( k_1 \) and \( k_2 \), respectively. These models are nonnested if it is in general impossible to find restrictions on \( \beta \) such that, for arbitrary \( \gamma \), \( x(\beta) \) equals \( z(\gamma) \), and impossible to find restrictions on \( \gamma \) such that, for arbitrary \( \beta \), \( z(\gamma) \) equals \( x(\beta) \). In the case of linear regression models like ours, what is required is that each of the two regression functions contains at least one regressor that is not in the other.

This setting is very much relevant to the exercise of regressions that we are trying to conduct. The two regression models over different samples (i.e., pre-1999 and post-1999) we are comparing are

\[
\pi_{j,t} = c_j + \beta \pi_{j,t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \pi_{j,t-i} + \delta_d \hat{y}_{j,t-1}^d + u_{1j,t}
\]  

and

\[
\pi_{j,t} = c_j + \beta \pi_{j,t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \pi_{j,t-i} + \delta_f \hat{y}_{j,t-1}^f + u_{2j,t}.
\]

Davidson and MacKinnon (1993) propose that the easiest nonnested tests to perform are those based on artificial nesting. The idea is to embed both of the two competing regression functions in a more general one and then to test one or both of the original models against it. However, the artificial model will not be estimable unless all parameters are separately identifiable.

One solution to the problem is to construct a regression model in which the unknown parameters of the model that is not being tested are replaced by estimates of those parameters that would be consistent if the data-generating process actually belonged to the model for which they are defined. There are many ways to do so, but the simplest and asymptotically attractive solution is to replace \( \beta \) by the estimate of \( \hat{\beta} \), and replace \( \gamma \) by the estimate of \( \hat{\gamma} \) in the regression models (6) and (7). In turn, the nonnested hypothesis testing can be implemented in compound regressions with fitted values of (6) and (7), respectively.

Following this vein, the Davidson-MacKinnon \( J \)-test in the case of our models can be implemented by running the following two regressions over the pre- and post-1999 periods:

\[
\pi_{j,t} = c_j + \beta \pi_{j,t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \pi_{j,t-i} + \delta_d \hat{y}_{j,t-1}^d + \delta_d Z_{j,t}^d + v_{1j,t}
\]  

and

\[
\pi_{j,t} = c_j + \beta \pi_{j,t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \pi_{j,t-i} + \delta_f \hat{y}_{j,t-1}^f + \delta_f Z_{j,t}^f + v_{2j,t},
\]

where \( Z^d \) and \( Z^f \) refer to the fitted values of \( \hat{\pi}_{j,t} \) pertaining to the regression models (8) and (9), respectively. To conduct the \( J \)-test is then to evaluate statistical significance of the tests for \( \delta_d = 0 \) in (10) and \( \delta_f = 0 \) in (11), respectively. By construction, if the null hypothesis \( \delta_d = 0 \) is rejected and the null \( \delta_f = 0 \) is not, then it is reasonable to pick (11) as the preferred model. Alternatively, if the null hypothesis \( \delta_f = 0 \) is rejected and the null \( \delta_d = 0 \) is not, then it is reasonable to pick (10) as the preferred model. Of course, the \( J \)-test may generate another two possible outcomes (both models, or neither model, may be rejected), since each pair of the null hypothesis may or may not be rejected. We will have to evaluate the specific estimation results.

The results of the \( J \)-tests pertaining to (10) and (11) are reported in Table 5. The results show that before 1999 the null hypothesis \( \delta_d = 0 \) is rejected and the null \( \delta_f = 0 \) is not; by contrast, after 1999 the
null hypothesis $\delta_{zd} = 0$ is rejected and $\delta_{zf} = 0$ is not. These results suggest that from a model competition perspective, the regression with the domestic output gap is the preferred model before 1999, while the regression model with the foreign output gap becomes preferable after 1999. Therefore, the results of the Davidson and MacKinnon $J$-test reinforce the baseline finding that the domestic output gap plays a predominant role pre-1999 and the foreign output gap is predominant post-1999 in driving domestic inflation.

Conclusions

The past two decades (i.e., 1990–2010) saw increasing globalization in the NEMs. Interaction between supply and demand for goods, services, and factors of production has been polarized on a global scale. While the increasing globalization can exert downward pressure on domestic inflation in the NEMs by, for example, stable global economic slack, as recent experience of rising commodity prices suggests, globalization may sometimes be associated with rising import prices. Even when import prices were falling, the consequences for inflation depended on how foreign real incomes changed. Therefore, studies that neglect the role of foreign demand are likely to underestimate the effect of globalization on domestic inflation dynamics.

In this article, we study inflation dynamics in the NEMs in an extended framework by augmenting the traditional Phillips curve model with global economic slack and import prices. We estimate the underlying models before and after the end of the 1990s and find that the effect of domestic and global economic slack on domestic inflation in the NEMs changes over time. The domestic economic slack played a dominant role in driving domestic inflation before 1999. In the new century, however, the global economic slack plays a significant and more important role in affecting inflation. In addition, our results show that globalization affects the sensitivity of inflation to the domestic output gap, although the effect may be realized through various channels. The finding implies that the prescription that central banks should specifically react to developments in global output is justified for the new emerging economies over the most recent decade.

To mitigate the negative effect of globalization on domestic inflation and other key economic variables, appropriate policy reforms in the NEMs are warranted. These may include reducing remaining tariff barriers, implementing trade-related regulatory reforms, and opening up service sectors. Such reforms would likely strengthen the NEMs’ economies to the extent that they could emerge from a negative world economic status with improved trade positions and a more robust performance than would otherwise have been possible.

The finding in this article, however, does not necessarily imply that the rising globalization of the NEMs will eliminate the capacity of the central banks to stabilize domestic inflation, neither do we regard rising globalization as a fatal threat to the national economy. The bottom line, however, is that the central banks in the NEMs can gear up their capacity to control inflation by appropriate coordination with other central banks. Even without material coordinated actions, the monetary authorities of the NEMs may still be able to increase the precision of their relevant forecasts and thereby improve the effect of their policies.

### Table 5. The results of the Davidson-MacKinnon $J$-test ($p$-values)

<table>
<thead>
<tr>
<th></th>
<th>$\delta_{zd}$</th>
<th>$\delta_{zf}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-1999</td>
<td>0.000***</td>
<td>0.311</td>
</tr>
<tr>
<td>Post-1999</td>
<td>0.138</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

*Notes:* The results for the $J$-tests are based on GMM estimation results of cross-section fixed effects. The IV sets include lags of inflation in the regression model, plus four lags of the domestic and foreign output gaps. ***Statistical significance at the 1 percent level.
on the domestic economy by adding the global development into their forecasting information set or augmenting their policy analysis framework with the globalization factor.

The baseline finding in the present article does call attention to rising globalization, which may engender material forces that oblige central bankers to confront more practical issues than the traditional issues in a closed economy. As Woodford (2009) notes, the changing degree of globalization also makes the issue of change over time in the correct quantitative specification of the models used in a central bank a more pressing one to consider.

Admittedly, the augmented Phillips curve with foreign output gaps may not have a theoretical justification (Ball 2006), although it seems to have an influence on the domestic inflation of the emerging countries. Without the strong theoretical foundation of including foreign output gaps in the Phillips curve, perhaps we could also consider other control variables that could affect domestic inflation of emerging markets as in Calderon and Schmidt-Hebbel (2010). Clearly, further research adopting a more structural framework incorporating, when tractability allows, all the relevant factors pertaining to domestic inflation in the NEMs is warranted. In addition, another potentially important channel of global shock transmission to domestic inflation is through financial sector. For instance, global business cycles and global liquidity conditions can be easily transmitted to open emerging market economies through capital flows. It would be worthwhile for future research to try a globalization proxy measured by capital market openness and examine its effect on domestic inflation in that regard accordingly.

Notes

1. In particular, Ball (2006) criticizes the idea that a country’s inflation depends on output in its trading partners, not its own output. Ball believes that the augmented Phillips curve with foreign output gaps may not have a theoretical justification.

2. There are twenty-one NEM countries in our analysis: nine in Asia (China, India, Indonesia, Israel, Korea, Malaysia, Philippines, Taiwan, and Thailand), six in Latin America (Argentina, Brazil, Chile, Colombia, Mexico, and Peru), and six in Europe and Africa (Czech Republic, Hungary, Poland, Russia, Turkey, and South Africa). Although the term NEM may be loosely defined, countries that fall into this category, varying from very big to very small, are usually considered to be newly emerging because of their developments and reforms. Countries belong to this category because they have embarked on economic development and reform programs and have begun to open up their markets and recently “emerge” onto the global economy.

3. The data for inflation series in most countries are available from 1991Q4 to 2009Q3 (Q denotes quarter; data for China and Czech Republic start from 1992 and for Russia from 1993), while the data for real output gap spans 1993Q1–2009Q3, dictated by availability.

4. 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 (Chen, Imbs, and Scott 2004; Sbordone 2009), and the terms of trade (Rogoff 2006).

5. We thank the referee for reminding us about this point.

6. There may be unobserved time-specific effects over the period considered in the article arising from, among many other possibilities, the change to inflation targeting and flexible exchange rate regimes implemented by many countries in the sample from the 1990s to early 2000. In practice, however, adding time-specific dummies (at quarterly frequency) consumes a substantial number of degrees of freedom, which consequently causes very unreliable estimates.

7. Note that the regression sample pertaining to the results in Table 4 is the whole sample of 1993–2009, so it is unsurprising to observe that the domestic output gap is significant while the foreign output gap is insignificant. When we split the sample by 1999, the estimation results provide a scenario similar to that in Table 2.

Funding

The research is supported by the National Natural Science Foundation of China (No. 71173224).

References


