BANK OF CANADA
BANQUE DU CANADA

Working Paper/Document de travail
2008-35

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by Denise Côté and Carlos de Resende

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Bank of Canada Working Paper 2008-35

October 2008

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Denise Côté and Carlos de Resende

International Department
Bank of Canada
Ottawa, Ontario, Canada K1A 0G9
dcote@bankofcanada.ca
cderesende@bankofcanada.ca

ISSN 1701-9397

Acknowledgements

We would like to thank Don Coletti, Michael Francis, Robert Lafrance, Louis Morel, Eric Santor, and Larry Schembri for helpful suggestions and discussions, and Yang Zhang for her contribution on this project. We would also like to thank Jonathan Hoddenbagh for his excellent research assistance with empirical estimations, and Sylvie Malette for helping us construct the database.

Abstract

In this paper, we develop a theoretical model which identifies four channels—import prices, competition with domestic suppliers and workers, and commodity prices—through which price- and wage-setting conditions in country *j* may affect inflation in country *i*. We estimate a dynamic inflation equation derived from the theoretical model using a quarterly dataset of eighteen OECD countries over the 1984-2006 period. Although our methodology can be applied to any pair of countries, we focus on the effect of China on the inflation rate of other countries. Our results suggest that while China's negative effect on global inflation has been quantitatively modest, it has increased in absolute terms since the early 2000s. We also find evidence that, for most countries examined, competition with domestic suppliers has been the most important channel.

JEL classification: E22, E32, E44
Bank classification: International topics

Résumé

Les auteurs élaborent un modèle théorique faisant intervenir quatre canaux (prix à l'importation, concurrence livrée aux fournisseurs et aux travailleurs nationaux et prix des produits de base) par lesquels les conditions d'établissement des prix et des salaires dans le pays *j* peuvent influer sur l'inflation dans le pays *i*. À l'aide de données trimestrielles se rapportant à 18 pays membres de l'Organisation de coopération et de développement économiques et couvrant la période 1984-2006, ils estiment une équation d'inflation dynamique inspirée du modèle théorique. Bien que leur méthodologie puisse être appliquée à n'importe quelle paire de pays, les auteurs examinent surtout l'effet de l'émergence de la Chine sur le taux d'inflation des autres pays. Leurs résultats indiquent que, si les retombées négatives de l'essor de l'économie chinoise sur l'inflation mondiale sont modestes en termes quantitatifs, elles ont toutefois augmenté en valeur absolue depuis le début des années 2000. Ils constatent également que, dans la plupart des pays examinés, la concurrence livrée aux fournisseurs nationaux constitue le plus important des canaux étudiés.

Classification JEL : E22, E32, E44
Classification de la Banque : Questions internationales

1 Introduction

The goal of this paper is two-fold. First, we aim to identify the channels of transmission − based on the direct effect of import prices, competition with domestic suppliers and workers, and commodity prices − through which price-and-wage-setting conditions in country j may affect the inflation rate of country i. Second, controlling for the monetary policy framework, we isolate and quantify the effect of China on global inflation according to these channels by estimating a dynamic inflation equation.

World inflation has fallen from nearly 30 per cent in 1990 to less than 4 per cent in 2005 (Table 1).[1] Inflation has fallen in developed and developing countries, from 5.4 to 2.3 per cent, and from 76.8 to 5.1 per cent, respectively. Sharp reductions have been observed in Asia and Africa, with even more dramatic declines in Latin America and emerging economies in Europe.

Table 1
Inflation (% per year)

Year	World	Developed	Developing	Asia	Africa	Latin America	Emerging Europe
1990	29.3	5.4	76.8	6.5	17.4	1293.8	162.0
1995	15.3	2.4	33.4	11.8	32.7	22.4	120.7
2000	4.4	2.4	6.8	1.5	11.5	12.6	25.3
2005	3.6	2.3	5.1	3.5	6.2	6.6	8.5

Source: International Financial Statistics (IMF)

The widely accepted view is that inflation is a monetary phenomenon (McCandless and Weber 1995), ultimately determined in the long run by monetary policy (Ball 2006). This suggests that institutional changes leading to better monetary policy frameworks may be the main explanation for the world-wide decline in inflation over the past decade. For instance, Carlstrom and Fuerst (2006) suggest that greater central bank independence accounts for about two-thirds of lower inflation outcomes among developed economies over the past two decades. Vega and Winkelried (2005) show that the adoption of inflation-targeting regimes has significantly reduced the mean inflation rate in a sample of developed and developing economies.

While inflation may be a monetary phenomenon in the long run, demand and supply shocks can affect inflation in the short run for at least three reasons. First, it takes time for central banks to identify and respond to shocks. Second, they may follow a strategy known as "opportunistic disinflation" (Bomfim and Rudebusch 2000, and Orphanides and Wilcox 2002) and decide not to completely offset certain types of favourable supply shocks (e.g., reductions in the relative price of imports). Third, even when central banks do react, the presence of nominal and real rigidities in

[1] The data are from the International Monetary Fund (IMF), and the Organization for Economic Cooperation and Development (OECD). See Appendix A for a detailed description of the data used in this paper.

the economy may delay the full materialization of these effects.[2] Additional factors may also help explain changes in the short-run inflation dynamics in recent years. Rogoff (2003) suggests, for instance, higher productivity growth, increased competition resulting from deregulation, reduced government size, and more importantly, globalization.

Globalization, defined as the economic integration of national markets in goods, services, labour, and capital, has intensified since the early 2000s (Frankel 2006). Indeed, average trade flows (the sum of exports and imports) as a share of gross domestic product (GDP) have increased from 13 per cent in 1980 to 29 per cent in 2000, accelerated thereafter, and reached 42 per cent in 2006 (Figure 1).[3] As a result, policy makers have been increasingly interested in the potential connection between globalization and inflation (Ihrig et al. 2007).

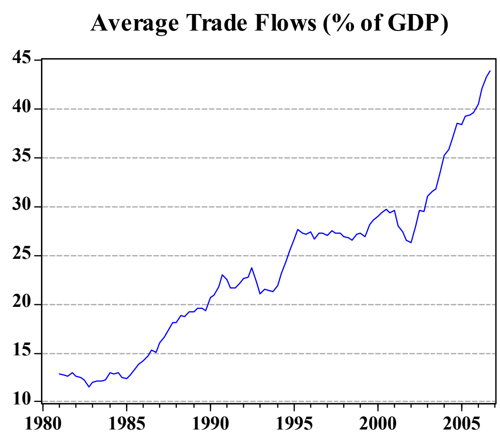

Figure 1

To the extent that globalization brings about a continuous entry of lower-cost producers from emerging-market countries into the global trading system, this implies reduced market power for domestic producers (Bernanke 2007) and acts as a tailwind for central banks' efforts to lower inflation. If that is the case, monetary policy risks being too restrictive (expansive) if the duration and magnitude of the tailwind are under(over)estimated (Fischer 2006).[4]

Recently, a number of papers have examined the relationship between globalization and inflation in developed countries, using a reduced-form Phillips curve framework. For instance, panel and single-

[2]Monetary policy stance also has a role in the short-run dynamics of inflation. To the extent that agents perceive the central bank as being more aggressive in reacting to inflationary shocks, inflation expectations become better anchored over time, and actual inflation can be brought back to its long-run objective more quickly.

[3]Based on data from the International Financial Statistics (IFS) compiled by the IMF for a sample of 25 countries that account for 70 per cent of world GDP.

[4]Rogoff (2003) also proposes that globalization implies more flexible prices and a steeper Phillips curve. With less incentives to stimulate the real economy through higher unexpected inflation, central banks become more credible in keeping inflation low, which in turn reduces the cost of actually doing it, and leads to lower long-term inflation rates. This channel does not seem to be supported by most empirical studies.

equation estimations by the International Monetary Fund (IMF 2006) suggest that globalization reduced average inflation by about 0.1 of a percentage point per year over the 1960-2004 period. Borio and Filardo (2007) find that foreign output gaps add significant explanatory power to "globe-centric" versions of a Phillips curve over the 1985Q1-2005Q4 period. Using the same basic approach as Borio and Filardo, but with different equation specifications and alternative definitions of the foreign output gap, both Ball (2006) and Ihrig et al. (2007) reach the opposite conclusion.

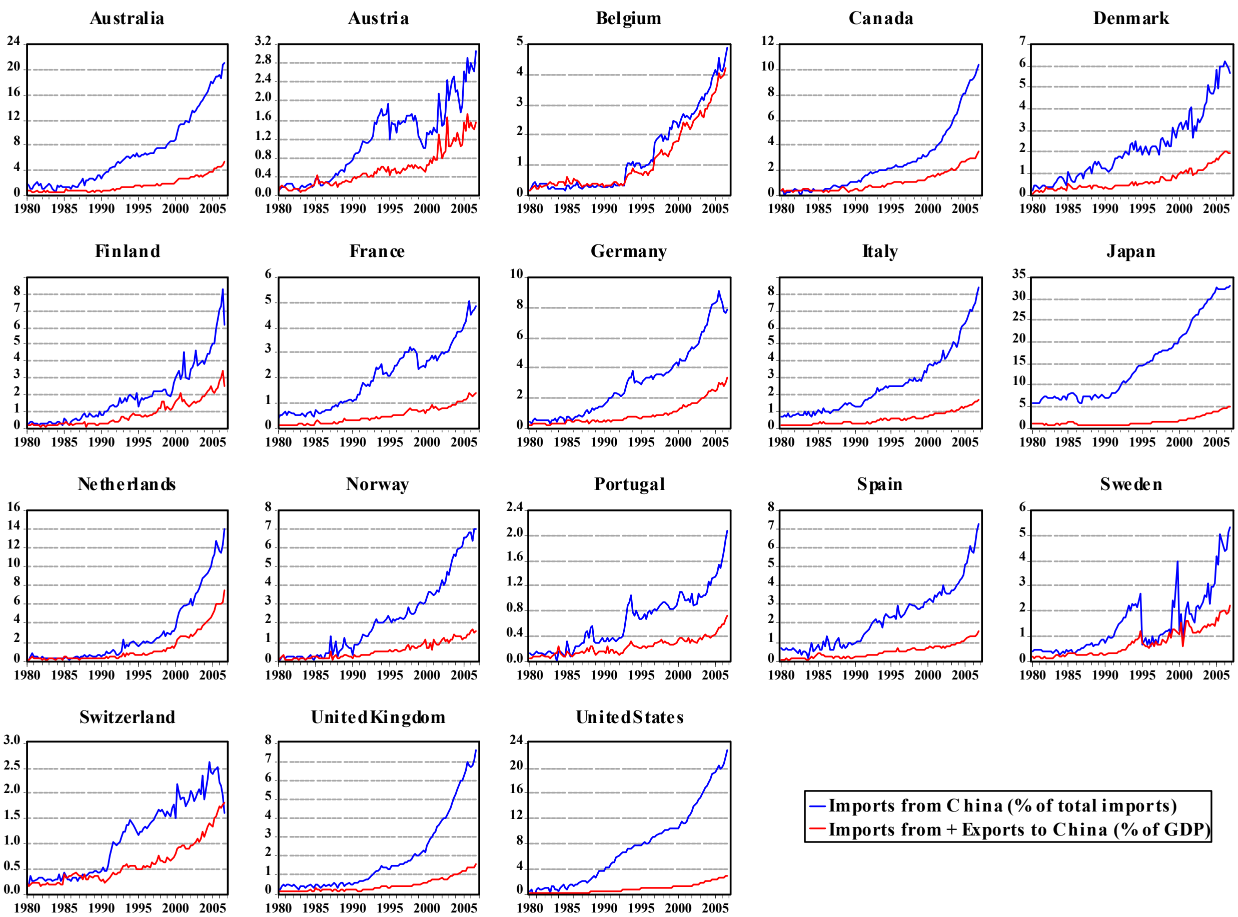

Figure 2

In this paper, we follow a similar approach – the estimation of dynamic equations for the inflation process – to investigate the globalization and inflation hypothesis, but we focus on the role played by one particular low-cost emerging-market economy: China. The emphasis on China is motivated by its strong export (Figure 2) and GDP growth over the past two decades, leading to a sharp increase in China's share of the world economy (Figure 3).[5]

[5]World GDP in Figure 3 is based on IFS/IMF data for the same twenty-five countries used to generate Figure 1 (see Footnote 3). They also include the eighteen countries – all members of the Organization for Economic Cooperation and Development (OECD) – displayed in Figure 2.

Over the past few years, a number of studies have investigated whether increased integration of China into the global economy has contributed to lower inflation rates in other countries. Taken as a whole, these studies suggest that the effect of China, while non-negligible, is quantitatively modest. For instance, Morel (2007) finds that cheaper goods imports from China have reduced Canadian CPI inflation by about 0.1 of a percentage point, on average, over the 2001−2006 period. Using a Vector Auto Regression (VAR) analysis, Kumar et. al (2003) find that price fluctuations in China have a moderate impact on inflation in a few Asian countries, but a small impact on inflation in the United States, the United Kingdom, and Japan, over the 1993−2002 period. Their study also suggests that the effect of China appears to have risen over time. Feyzioglu and Willard (2006), using cointegration techniques and impulse-response functions over the 1984Q1−2005Q2 period, find limited evidence that inflation in China had an effect on the inflation rate of the United States and Japan. They find, however, stronger sector-specific linkages for food and household-manufactured goods prices.

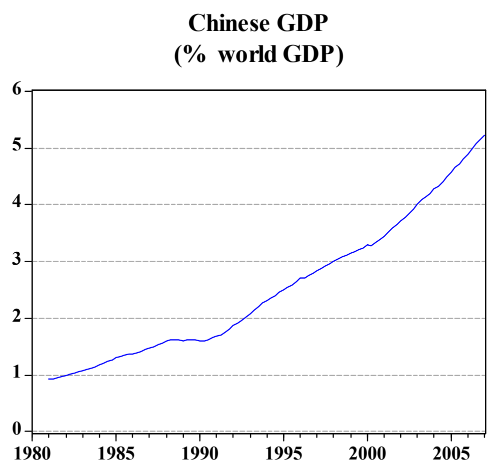

Figure 3

Kamin, Marazzi, and Schindler (2006) estimate that imports from China may have lowered U.S. import price inflation by about 0.8 of a percentage point annually, over the past decade. This would imply a reduction of about 0.1 of a percentage point or less on CPI inflation, given the share of merchandise imports in U.S. consumption. In addition, using trade flows of twenty-six economies, all members of the Organization for Economic Cooperation and Development (OECD), they suggest that Chinese exports lowered annual import price inflation by 0.25 of a percentage point or less, on average, since 1993. However, they only investigate the role of import prices as the channel of transmission of disinflationary pressures coming from China.

In this paper, we develop a theoretical model which identifies four channels through which globalization in general, and China in particular, may affect inflation in a given country. First, the "supply-side direct effect" accounts for the direct effect of imported goods prices into the domestic consumption basket. Second, the "supply-side indirect effect" captures the competitive pressures coming from two channels: (i) the increased availability of foreign goods that induces a more elastic world demand, which, in turn, reduces the market power of domestic firms, thus affecting their price-setting decisions (the Purchasing Power Parity, or PPP, channel); and (ii) the higher integration of labour markets which reduces the bargaining power of workers and, potentially, labour-cost growth in other parts of the world (the labour-cost channel). Fourth, the "demand-side indirect effect" which measures the effect of global demand and its consequences for domestic CPI inflation − directly, as demand shocks in domestic Phillips curves, and indirectly, through its effect on world oil and non-oil commodities prices. While previous studies have assessed either the supply-side direct effect or the total effect of price-setting conditions in China on the inflation rate of other countries, to our knowledge, no studies have yet been published that account for these four channels.

Using a quarterly dataset for a selection of eighteen OECD countries, we estimate both country-specific and panel versions of the dynamic inflation equation derived from the theoretical model. The estimation results are used in a counterfactual exercise to compute time-varying effects of China on the CPI inflation of other countries. We find that while China's negative effect on global inflation has been quantitatively modest, it has increased in absolute terms since the early 2000s. In addition, we provide evidence that, for most countries examined, competition with domestic suppliers has been the most important channel.

The paper is organized as follows. Section 2 presents a theoretical model for a dynamic inflation equation which accounts for the four channels discussed above. Section 3 presents the reduced-form equation used to estimate the effect of price-and-wage-setting conditions in country j on the inflation rate of country i. Section 4 discusses the estimation results while Section 5 provides estimates of the effect that China exerts on the inflation rate of eighteen OECD countries accounting for the four channels described above. Section 6 concludes and suggests paths for future research.

2 The Model

In this section, we develop a theoretical model for the dynamic process of inflation. As it is usually emphasized in the literature on globalization and inflation, we acknowledge that inflation is ultimately a function of a country's monetary policy framework. Accordingly, the following analysis must be interpreted as being *conditional* on this framework.[6]

Let the consumer price index (CPI) in country i be a composite of price indices for tradable and nontradable goods, and let $\alpha \in [0, 1]$ be the weight of tradable goods in the CPI basket. The

[6] As presented in Section 3, the effect of monetary policy is controlled for in the econometric exercise.

inflation rate of the CPI, π_t, can be expressed as:

$$\pi_t^i = \alpha\pi_t^i(T) + (1-\alpha)\pi_t^i(N), \tag{1}$$

where $\pi_t^i(T)$ and $\pi_t^i(N)$ are the inflation rates of tradable and nontradable goods in country i, respectively.

In the following subsections, we introduce the four channels through which wage and price inflation in country j may affect the inflation rate of country i.

2.1 The Supply-Side Direct Effect

Tradable goods in the CPI basket can be either domestically produced or imported. Let $\pi_t^i(T^d)$ and $\pi_t^i(M)$ denote the inflation rates of domestically produced and imported goods, respectively. Furthermore, let β be the share of domestically produced tradable goods in $\pi_t^i(T)$, which can then be expressed as:

$$\pi_t^i(T) = \beta\pi_t^i(T^d) + (1-\beta)\pi_t^i(M). \tag{2}$$

Let J be a set of countries. For country $i \in J$, assume the foreign component of the inflation of tradable goods is a weighted average of the inflation rate of tradable goods in all trade-partner countries $j \in J - \{i\}$, denoted $\pi_t^j(T)$, plus the growth rate of the bilateral nominal exchange rate, e_t^{ij}.[7] That is:

$$\pi_t^i(M) = \sum_{\forall j \neq i} \theta_t^{ij}\left[e_t^{ij} + \pi_t^j(T)\right]. \tag{3}$$

Note that the contribution of each country j to $\pi_t^i(M)$ is weighted by the share of country i's total imports coming from country j:

$$\theta_t^{ij} = \frac{M_t^{ij}}{M_t^i}, \tag{4}$$

where M_t^{ij} is country i's imports from country j, and $M_t^i = \sum_{\forall j \neq i} M_t^{ij}$.

We refer to the impact of price-setting conditions in country j on $\pi_t^i(T)$, through $\pi_t^i(M)$, as the *supply-side direct effect*.

2.2 The Supply-Side Indirect Effect

The *supply-side indirect effect* of country j on the inflation rate of country i reflects two competition channels which are likely to be stronger the more open country i is to bilateral trade with country j, and the more integrated country i is with the world economy.

[7] Let E_t^{ij} be the (level of the) bilateral nominal exchange rate, defined in units of local (country i's) currency needed to buy one unit of foreign (country j's) currency. Then:

$$e_t^{ij} = \frac{d\log E_t^{ij}}{dt} = \frac{dE_t^{ij}}{dt}\frac{1}{E_t^{ij}}.$$

First, competitive pressures from goods produced in country j may prevent firms in the tradable sector of country i from increasing prices during booms.[8] In other words, exposure to foreign goods may lead to more "contestable" domestic markets by lowering the monopoly power of domestic firms. The effect of world competition on the prices of goods in country i can be roughly summarized by the traditional Purchasing Power Parity (PPP) condition. We assume that the PPP condition holds, although less than perfectly, as the price-setting mechanism for a proportion λ of domestic producers of tradable goods that are assumed to be price-takers.

Second, as domestic markets integrate into the world economy, pressure from low-wage foreign labour markets will begin to erode the bargaining power of domestic workers, thereby reducing (the growth rate of) labour costs in country i. This mechanism, likely to be of second-order importance for price-takers, may be relevant for the remaining share $(1-\lambda)$ of tradable goods producers in country i that set their prices in a monopolistically competitive environment according to demand and supply conditions. In the next two subsections, we describe these channels in more detail.

2.2.1 The Purchasing Power Parity (PPP) Channel

To study the effects of international competition on the domestic market for goods, let $\pi_t^i(T_\lambda^d)$ be the inflation rate of tradable goods that are domestically produced by price-taker firms (a proportion λ of domestic firms) and priced according to the "Law of One Price" or Purchasing Power Parity (PPP) rule.

We consider competition effects coming from two sources. The first effect is specific to bilateral trade, and reflects the direct competition of goods produced in trade-partner country j. Let $\pi_t^{ij}(T_\lambda^d)$ be the part of $\pi_t^i(T_\lambda^d)$ associated with this direct, bilateral effect. We approximate the (i,j) −bilateral PPP condition by:

$$\pi_t^{ij}(T_\lambda^d) = \mu_t^{ij}\left[e_t^{ij} + \pi_t^j(T)\right], \tag{5}$$

where $\mu_t^{ij} \in [0, \mu_{\max}]$ is a measure of bilateral trade openness between countries i and j, introduced to capture potential frictions such as tariffs and trade barriers that are specific to the (i,j) −bilateral trade relationship.

We define μ_t^{ij} as:

$$\mu_t^{ij} = \frac{M_t^{ij} + X_t^{ij}}{Y_t^i}, \tag{6}$$

where M_t^{ij} is the same as in (4), X_t^{ij} is country i's exports to country j, and Y_t^i is a measure of country i's domestic output, such as the Gross Domestic Product (GDP).

[8] Similarly, during recessions, the potential additional sales to foreign customers within a more integrated market may reduce pressures for price reductions.

The second competition effect, rather than being specific to $(i, j)-$bilateral trade, comes from global trade. For instance, if countries i and j are completely closed to bilateral trade but continue to trade with the rest of the world, competitive pressures coming from country j may still reach country i through competition in a third (common) market, provided that j is big enough. Let $\pi_t^i(G)$ be the part of $\pi_t(T_\lambda^d)$ due to indirect competition in third markets. Accordingly, the overall (average) PPP condition is approximated by:

$$\pi_t^i(G) = G_t \left[e_t + \pi_t^*\right], \tag{7}$$

where $G_t \in [0, G_{\max}]$ reflects aggregate, common restrictions to global trade such as set-backs in multilateral agreements. Taking the rest of the world as a reference, e_t and π_t^* are average measures of the rate of (nominal) depreciation of the exchange rate and foreign inflation, respectively.

Using θ_t^{ij} as weights to compute $e_t + \pi_t^*$, we have:

$$\pi_t^i(G) = G_t \pi_t^i(M). \tag{8}$$

The restrictions to global trade are captured by the following measure of globalization, which is a weighted average of trade flows (sum of total imports, M_t^j, and total exports, X_t^j) as a proportion of the GDP from all $j \in J$:

$$G_t = \sum_{\forall j} r_t^j \frac{M_t^j + X_t^j}{Y_t^j}, \tag{9}$$

where r_t^j is country j's share in world GDP:

$$r_t^j = \frac{Y_t^j}{\sum_{\forall j} Y_t^j}. \tag{10}$$

We assume that $\pi_t^{ij}(T_\lambda^d)$ and $\pi_t^i(G)$ enter linearly in the determination of $\pi_t^i(T_\lambda^d)$ according to:

$$\pi_t^i(T_\lambda^d) = \zeta \sum_{\forall j \neq i} \pi_t^{ij}(T_\lambda^d) + \gamma \pi_t^i(G), \tag{11}$$

where ζ and γ are sensitivity parameters that determine the relative importance of the direct (bilateral) and indirect (globalization) competition channels on $\pi_t^i(T_\lambda^D)$, respectively.

Combining (5), (8), and (11) gives:

$$\pi_t^i(T_\lambda^d) = \zeta \sum_{\forall j \neq i} \mu_t^{ij} [e_t^{ij} + \pi_t^j(T)] + \gamma G_t \sum_{\forall j \neq i} \theta_t^{ij} \left[e_t^{ij} + \pi_t^j(T)\right]. \tag{12}$$

Note that a lack of bilateral trade between i and j (i.e., $\mu_t^{ij} = 0$) implies that competition coming from j has no effect on $\pi_t^i(T_\lambda^d)$ through $\pi_t^{ij}(T_\lambda^d)$. Similarly, with no integration in global markets (i.e., $G_t = 0$), competition in third markets do not affect $\pi_t^i(T_\lambda^d)$. We refer to the effect of $\pi_t^j(T)$ on $\pi_t^i(T)$ through $\pi_t^i(T_\lambda^d)$, as the *supply-side indirect effect* of country j on the inflation of country i *due to the PPP channel*.

2.2.2 The Labour-Cost Channel

In this section, we turn to the effects of international competition on labour markets. Recall that, rather than being price-takers, a proportion $(1-\lambda)$ of domestic firms in country i's tradable goods sector set their prices, denoted $p_t^i(T_{1-\lambda}^d)$, in a monopolistically competitive environment. Assuming that these firms face a negatively sloped Dixit-Stiglitz demand function and generate output from labour inputs according to a linear production function, profit maximization requires the familiar condition whereby prices are set as a constant mark-up over unit labour costs, normalized for productivity:

$$p_t^i(T_{1-\lambda}^d) = v\left(\frac{W_t^i(T^d)}{A_t^i(T^d)}\right), \tag{13}$$

where v is the mark-up (the inverse of the elasticity of substitution), $W_t^i\left(T^D\right)$ is the (nominal) wage rate and $A_t^i(T^d)$ is productivity in the tradable goods sector in country i.[9]

By taking natural logs on both sides and differentiating with respect to time, a dynamic version of the above condition is:

$$\pi_t^i(T_{1-\lambda}^d) = w_t^i(T^d) - a_t^i(T^d), \tag{14}$$

where $w_t^i(T^d)$ and $a_t^i(T^d)$ are the growth rates of nominal wages and productivity, respectively.

Assume that a fraction η of workers in the tradable sector set their wages according to the average domestic wage rate, while $(1-\eta)$ are exposed to international competition. Wages affected by international competition grow according to a function of foreign wage inflation converted to domestic currency. The wage setting conditions in the tradable sector are then expressed as:

$$w_t^i(T^d) = \eta w_t^i + (1-\eta)\varsigma \sum_{\forall j \neq i} \chi_t^{ij}(e_t^{ij} + w_t^j), \tag{15}$$

[9] For instance, consider the following demand function:

$$y_t^i(T_{1-\lambda}^d) = \left(\frac{p_t^i(T^d)}{p_t^i(T_{1-\lambda}^d)}\right)^{\frac{1}{1-q}} Y_t^i(T^d),$$

where q is the elasticity of substitution between differentiated goods in the industry, while $p_t^i(T^d)$ and $Y_t^i(T^d)$ are the (average) industry-level price and output (demand), respectively.

As for the production function:

$$y_t^i(T_{1-\lambda}^d) = A_t^i h_t^i(T_{1-\lambda}^d),$$

where $A_t^i(T^d)$ is an exogenous productivity factor, and $h_t^i(T_{1-\lambda}^d)$ is the required labour input to produce $y_t^i(T_{1-\lambda}^d)$ units of goods.

where w_t^i and w_t^j are the growth rates of nominal wages in countries i and j, respectively, and $\chi_t^{ij} = (M_t^{ij} + X_t^{ij})/(M_t^i + X_t^i)$ is a proxy for job market integration between i and j, which will filter the effect of the competition of country j's wages on country i's wages.[10] Parameter ς determines the sensitivity of domestic wage inflation in the tradable goods sector to international labour markets.

In addition, assume that productivity growth in the tradable sector is proportional to the overall productivity growth of the economy:

$$a_t^i(T^d) = \delta a_t^i. \tag{16}$$

To obtain a dynamic link between the growth rate of unit labour costs in trade-partner country j and inflation in country i, combine (14), (15), and (16) to write:

$$\pi_t^i(T_{1-\lambda}^d) = \eta w_t^i + (1-\eta)\varsigma \sum_{\forall j \neq i} \chi_t^{ij}(e_t^{ij} + w_t^j) - \delta a_t^i. \tag{17}$$

We refer to the effect of w_t^j on $\pi_t^i(T)$, through $\pi_t^i(T_{1-\lambda}^d)$, as the *supply-side indirect effect* of country j on the inflation of country i *due to the labour-cost channel.*

2.3 The Demand-Side Effect

The *demand-side effect* of country j on the inflation of country i is discussed in this subsection. We consider two separate channels. First, a foreign country j may exert a direct demand-pull effect on domestic activity in country i. Second, demand pressures coming from country j may affect world prices of oil and non-oil commodities, and indirectly translate into additional cost-push factors relevant for country i.[11]

As suggested by Borio and Filardo (2007), measures of economic slack based only on domestic variables (i.e., domestic output gap) may no longer be sufficient, or even relevant, to assess potential demand pressures believed to affect inflation. They suggest that, given the increasing integration of national markets, foreign output gaps may also play a role as an indicator of slackness. To take that into account, we assume the economy may be hit by demand shocks, ϵ_t^D, which are in part explained by current and past values of foreign output gaps, $\widehat{u}_t$, as well as by an exogenous process, $\varepsilon_t^D \sim N(0, \sigma_D)$, as follows:

$$\epsilon_t^D = k_0^D + \sum_{n=0}^{N_u} k_n^u \widehat{u}_{t-n} + \varepsilon_t^D, \tag{18}$$

[10] Although χ_t^{ij} maybe an imperfect measure of job market integration, there are two main motivations for its use. First, in terms of data availability, given the 25 countries in our sample, it is more readily available than measures such as bilateral immigration flows, for example. Second, from a theoretical perspective, the Theorem of Factor Price Equalization (for a rigorous mathematical proof and critical discussion, see Dixit and Norman 1980) provides a link between trade and equalization of wage rates (which can be a measure of job market integration) *even in the absence of labour mobility.*

[11] Morrison and Swann (2003) and Kilman (2003) are among the studies suggesting that China's growing demand for raw materials used in expanding its infrastructure and manufacturing capacity has exerted upward pressure on the prices of many key commodities.

where $\widehat{u}_t$ is defined as a weighted-average percentage deviation of GDP from its trend, using as weights the proportion of country j's GDP in world GDP, as defined in (10):

$$\widehat{u}_t = \sum_{\forall j} r_t^j \widehat{u}_t^j. \tag{19}$$

On the supply-side, assume the economy faces cost–push shocks, ϵ_t^S. We model ϵ_t^S as a function of current and lagged growth rates of world oil prices and non-oil commodity prices $-$ $\pi_t(oil)$, and $\pi_t(com)$, respectively $-$ as well as current and past values of domestic productivity growth, a_t. That is:

$$\epsilon_t^S = k_0^S + \sum_{n=0}^{N_{oil}} k_n^{oil} \pi_{t-n}^{oil} + \sum_{n=0}^{N_{com}} k_n^{com} \pi_{t-n}^{com} + \sum_{n=0}^{N_a} k_n^a a_{t-n} + \varepsilon_t^S, \tag{20}$$

where $\varepsilon_t^S \sim N(0, \sigma_S)$ is an exogenous process.

Oil and non-oil commodity prices are determined in world markets. Let g_t^* be the growth rate of the world economy, as measured by a weighted cross-country average of GDP.[12] We assume that $\pi_t(oil)$ and $\pi_t(com)$ are linear functions of their own lagged values plus current and lagged values of both $\widehat{u}_t$ and g_t^*. The first captures the (transitory) effects of "global excess demand," and the latter is associated with more permanent effects of world trend growth. The following equations refer to oil-price inflation and non-oil commodity-price inflation, respectively:

$$\pi_t^{oil} = \rho_0^{oil} + \sum_{r=1}^{R_{oil}} \rho_r^{oil} \pi_{t-r}^{oil} + \sum_{r=0}^{R_u} \rho_r^u \widehat{u}_{t-r} + \sum_{r=0}^{R_g} \rho_r^g g_{t-r}^* + \varepsilon_t^{oil} \tag{21}$$

and

$$\pi_t^{com} = \rho_0^{com} + \sum_{r=1}^{R_{com}} \rho_n^{com} \pi_{t-n}^{com} + \sum_{r=0}^{R_u} q_r^u \widehat{u}_{t-r} + \sum_{n=0}^{R_g} q_r^g g_{t-r}^* + \varepsilon_t^{com}. \tag{22}$$

The demand-side effect of country j can then be determined by its contribution to $\widehat{u}_t$, which in turn will affect ϵ_t^D (directly) and ϵ_t^S (indirectly, through π_t^{oil} and π_t^{com}).

2.4 A Dynamic Equation for Inflation

In this section, we complete our description of CPI inflation. We need an expression for the inflation of tradable goods. Note that the proportions of price-takers and price-setters among domestic producers of tradable goods imply:

$$\pi_t^i(T^D) = \lambda \pi_t^i(T_\lambda^D) + (1-\lambda)\pi_t^i(T_{1-\lambda}^D). \tag{23}$$

[12] As discussed in the next section, we use r_t^j as weights in the empirical application of the model.

Substitute (12) and (17) into (23), and substitute the result into (2) to obtain:

$$\begin{aligned}\pi_t^i(T) &= \beta\lambda\zeta\sum_{\forall j\neq i}\mu_t^{ij}[e_t^{ij}+\pi_t^j(T)]+\beta\lambda\gamma G_t\pi_t^i(M)+\beta(1-\lambda)\eta w_t^i+ \\ &\quad +\beta(1-\lambda)(1-\eta)\varsigma\sum_{\forall j\neq i}\chi_t^{ij}(e_t^{ij}+w_t^j)-\beta(1-\lambda)\delta a_t^i+(1-\beta)\pi_t^i(M)\,. \end{aligned} \tag{24}$$

Equation (24) describes $\pi_t^i(T)$ as a function of foreign inflation rates, nominal depreciation, foreign and domestic wage-inflation rates, productivity growth, trade openness (bilateral and global) and labour market integration. It contains terms from both the supply-side direct and indirect effects.

Assume that inflation of nontradable goods, $\pi_t^j(N)$, is determined by a traditional Keynesian trade-off between the output gap ($\hat{y}^j$) and inflation, according to the following Phillips-curve equation:

$$\pi_t^i(N)=\phi_0+\sum_{n=1}^{N_\pi}\phi_n^\pi\pi_{t-n}^i+\sum_{n=0}^{N_y}\phi_n^y\hat{y}_{t-n}^i. \tag{25}$$

To obtain an expression for CPI inflation, first assume that w_t^i can be well approximated by the following AR(N_w) process:[13]

$$w_t^i=k_0^w+\sum_{n=1}^{N_w}k_n^w w_{t-n}+\varepsilon_t^w, \tag{26}$$

then insert (26) into (24), combine the above result with (25) and place into (1), and add the demand and supply shocks in (18) and (20), respectively. The result is:

$$\begin{aligned}\pi_t^i &= \varphi_0+\sum_{n=0}^{N_\pi}\varphi_n^\pi\pi_{t-n}^i+\sum_{n=0}^{N_y}\varphi_n^y\hat{y}_{t-n}^i+\sum_{n=1}^{N_w}\varphi_n^w w_{t-n}+\sum_{n=0}^{N_a}\varphi_n^a a_{t-n}+ \\ &\quad +\sum_{n=0}^{N_{oil}}k_n^{oil}\pi_{t-n}^{oil}+\sum_{n=0}^{N_{com}}k_n^{com}\pi_{t-n}^{com}+\sum_{n=0}^{N_u}k_n^u\widehat{u}_{t-n}+ \\ &\quad +\Psi_1\sum_{\forall j\neq i}\theta_t^{ij}\left[e_t^{ij}+\pi_t^j(T)\right]+\Psi_2\sum_{\forall j\neq i}\mu_t^{ij}[e_t^{ij}+\pi_t^j(T)]+ \\ &\quad +\Psi_3 G_t\sum_{\forall j\neq i}\theta_t^{ij}\left[e_t^{ij}+\pi_t^j(T)\right]+\Psi_4\sum_{\forall j\neq i}\chi_t^{ij}(e_t^{ij}+w_t^j)+\varepsilon_t,\end{aligned} \tag{27}$$

where $\varepsilon_t=\varepsilon_t^D+\varepsilon_t^S+\varepsilon_t^w$. Reduced-form parameters can be expressed as functions of structural parameters as follows:

[13] This assumption, while not innocuous, is particularly important in the econometric analysis. It eliminates potential endogeneity bias coming from feed-back contemporaneous effects of π_t^i on w_t^i.

$$\varphi_0 = (1-\alpha)\phi_0 + k_0^D + k_0^S + \alpha\beta(1-\lambda)\eta k_0^w$$
$$\varphi_n^\pi = (1-\alpha)\phi_n^\pi$$
$$\varphi_n^y = (1-\alpha)\phi_n^y$$
$$\varphi_n^w = \alpha\beta(1-\lambda)\eta k_n^w$$
$$\varphi_0^a = -\alpha\beta(1-\lambda)\delta + k_0^a$$
$$\varphi_n^a = k_n^a, \text{ for } n \geq 1$$
$$\Psi_1 = \alpha(1-\beta)$$
$$\Psi_2 = \alpha\beta\lambda\zeta$$
$$\Psi_3 = \alpha\beta\lambda\gamma$$
$$\Psi_4 = \alpha\beta(1-\lambda)(1-\eta)\varsigma$$

Figure 4 displays a schematic representation of the model's structure.

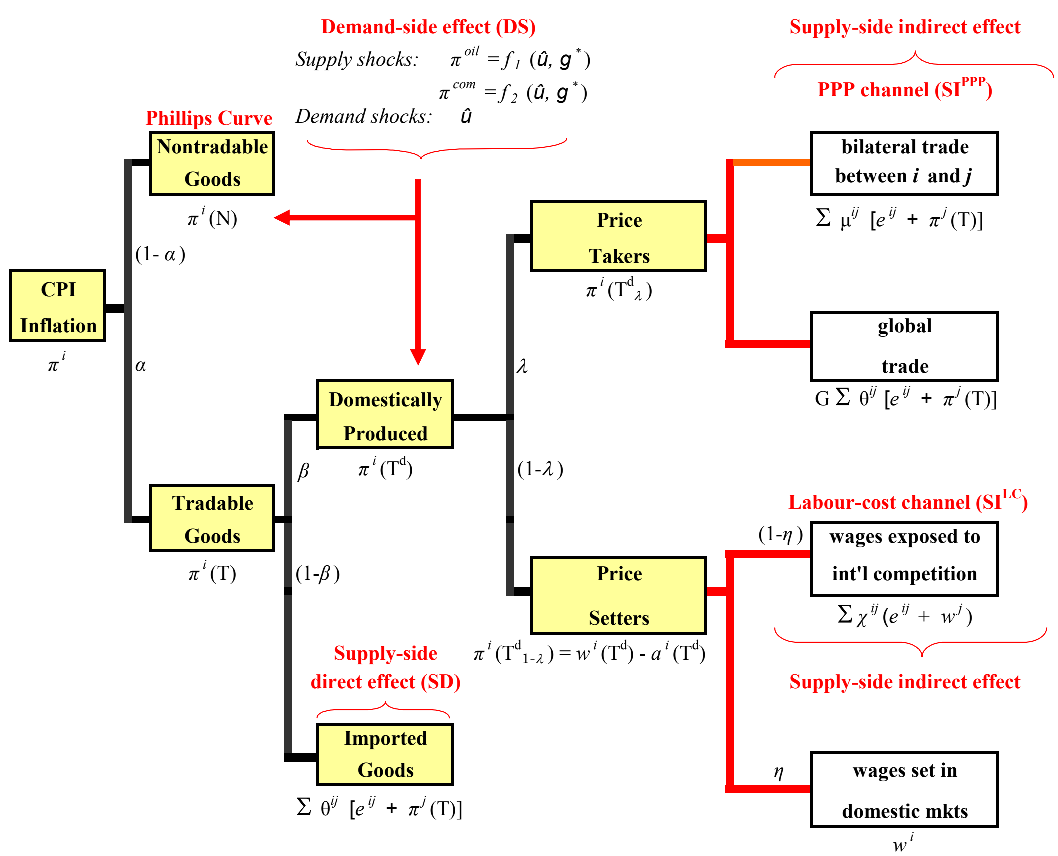

Figure 4

3 The Reduced-Form Model

In this section, we present the reduced-form equation used to estimate the effects of price- and wage-setting conditions in country j on the inflation rate of country i, controlling for monetary policy. First, we define the following composite variables:

$$\begin{aligned}
\mathbf{EPI}_t &= \pi_t^i(M) = \sum_{\forall j \neq i} \theta_t^{ij}\left[e_t^{ij} + \pi_t^j(T)\right] && (28)\\
\mathbf{MUEPI}_t &= \sum_{\forall j \neq i} \mu_t^{ij}\left[e_t^{ij} + \pi_t^j(T)\right] && (29)\\
\mathbf{GEPI}_t &= G_t \sum_{\forall j \neq i} \theta_t^{ij}\left[e_t^{ij} + \pi_t^j(T)\right] = G_t \times \mathbf{EPI}_t && (30)\\
\mathbf{CHIEW}_t &= \sum_{\forall j \neq i} \chi_t^{ij}(e_t^{ij} + w_t^j). && (31)
\end{aligned}$$

EPI and **CHIEW** summarize the supply-side direct effect (SD), and the supply-side indirect effect due to the labour-cost channel $\left(\mathrm{SI}^{LC}\right)$, respectively, while **MUEPI** and **GEPI** capture the supply-side indirect effect due to the PPP channel $\left(\mathrm{SI}^{PPP}\right)$ associated with the bilateral and global competition channels, respectively.

As discussed in section 2.1, the supply-side direct effect captures the effect that the prices of imported goods have on the domestic consumption basket. Data on the actual price *level* of tradables on a cross-country basis is usually not available. Price indices must be used instead. However, cross-country differences in the long-run equilibrium level of prices of a particular good, rather than in their growth rates, may directly affect CPI inflation in a given country.

To account for this measurement effect, let $\mathrm{HP}(x)$ be the long-run equilibrium value of nonstationary variable x, assumed to be approximated by its Hodrick-Prescott trend. Then define:

$$\mathbf{L}_t^{ij} = \left(\theta_t^{ij} \frac{E_t^{ij} p_t^j(T)}{p_t^i(T)}\right) - \mathrm{HP}\left(\theta_t^{ij} \frac{E_t^{ij} p_t^j(T)}{p_t^i(T)}\right) \quad (32)$$

as a measure of the relative price level of tradable goods from its long-run equilibrium, adjusted by the import-penetration measure, θ_t^{ij}. [14]

Finally, in order to take equation (27) to the data, we need to control for the effects of monetary policy. We propose two control-variables. First, following the insights in de Resende (2007), we

[14] If there is any correlation between price level differentials, measured by the ratio $E_t^{ij} p_t^j(T)/p_t^i(T)$, and inflation in country i, using the ratio between price indices instead of that between price levels still produces the right sign for the estimated coefficient. However, there is a scaling issue, since indices are one type of normalization of price levels. If the ratio between price levels is scaled up by the use of price indices, then the (absolute) value of the estimated coefficient would be scaled down accordingly. The extra layer of normalization introduced by the HP filter is needed to avoid a nonstationnary regressor.

define $CBI_t^i = \left(m_t^i/g_t^i\right)^{-1}$ as a time-varying proxy for central bank independence and monetary policy credibility, given by the ratio of the monetary base $\left(m_t^i\right)$ to government spending $\left(g_t^i\right)$.[15] The higher the proportion of government spending that is financed with seigniorage revenue, the less credible the monetary authority will be in attempting to control inflation. Second, to control for the widespread adoption of inflation-targeting regimes implemented by a number of countries since the early 1990s, we use the binary variable, IT_t^i, which takes the value of 1 if country i is an inflation-targeter at time t, or 0 otherwise.

The empirical counterpart of equation (27) is as follows:[16]

$$\begin{aligned}\pi_t^i \;=\;& \varphi_0 + \sum_{n=0}^{N_\pi} \varphi_n^\pi \pi_{t-n}^i + \sum_{n=0}^{N_{yu}} \varphi_n^y \hat{y}_{t-n}^i + \sum_{n=1}^{N_{wa}} \varphi_n^w w_{t-n} + \sum_{n=0}^{N_{wa}} \varphi_n^a a_{t-n} + \sum_{n=0}^{N_s} k_n^{oil} \pi_{t-n}^{oil} + \sum_{n=0}^{N_s} k_n^{com} \pi_{t-n}^{com} + \\ & + \sum_{n=0}^{N_{yu}} \rho_n^u \widehat{u}_{t-n} + \sum_{n=1}^{N_0} \psi_{0,t-n} \mathbf{EPI}_{t-n} + \sum_{n=1}^{N_1} \psi_{1,t-n} \mathbf{L}_{t-n}^{i,Chn} + \sum_{n=1}^{N_2} \psi_{2,t-n} \mathbf{MUEPI}_{t-n} + \\ & + \sum_{n=1}^{N_3} \psi_{3,t-n} \mathbf{GEPI}_{t-n} + \sum_{n=1}^{N_4} \psi_{4,t-n} \mathbf{CHIEW}_{t-n} + \sum_{n=0}^{N_5} \xi_n CBI_{t-n}^i + \kappa IT_t^i + \varepsilon_t, \end{aligned} \tag{33}$$

where $\mathbf{L}_t^{i,Chn}$ refers to the definition (32) computed for the pair of countries i and China.

4 Estimation Results

In this section, we present the estimation results of both country-specific and panel versions of equation (33) for a selection of eighteen OECD countries.[17] For the construction of the relevant time-series, we use quarterly data from the IMF, the Bank of International Settlements (BIS), and the OECD covering the 1980Q1−2006Q4 period for the following twenty-five countries: Australia, Austria, Belgium, Brazil, Canada, China, Denmark, Germany, Finland, France, Hong Kong, Indonesia, Italy, Japan, South Korea, Mexico, Malaysia, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.[18] All variables used in the regressions are found to be stationary according to Augmented Dickey-Fuller tests. In the case of π_t^i and w_t^i, whenever a unit root is found, we use the deviations from a trend obtained from the Hodrick-Prescott filter with a smoothness parameter of 1600. Additional details regarding the data are discussed in the Appendix.

[15] Resende (2007) suggests that central bank independence is negatively related to the proportion of the (intertemporal) government budget that is financed by money creation.

[16] Given our interest in measuring the effect of China on π_t^i, the variable $\mathbf{L}_t^{ij}$ was only computed for $j =$ China.

[17] Due to country-specific data availability issues over the 1984-2006 period, unbalanced panel estimation with fixed effects is used.

[18] Although equation (33) is estimated only for eighteen OECD countries, the right-hand side variables $\widehat{u}_t$, $\mathbf{EPI}_t$, $\mathbf{MUEPI}_t$, $\mathbf{GEPI}_t$, and $\mathbf{CHIEW}_t$ are computed using information from all twenty-five countries in the sample. See the Appendix for details.

In the estimations of equation (33), we discard contemporaneous values of right-hand-side variables that may cause endogeneity problems, in the form of feedback effects from π_t^i to regressors that are simultaneously determined.[19] For each of the nineteen regressions (eighteen country-specific and one panel regression), the lag structure in the dynamic specification is optimally selected according to a two-step procedure. In the first step, based on the minimization of the Akaike Information Criterion, we consider values between 0 and 4 to select, among all possible combinations, the truncation values N_π, N_{yu}, N_{wa}, N_s, N_0, N_1, N_2, N_3, N_4, and N_5. In the second step, we sequentially eliminate the variables for which the estimated parameters are not statistically significant at the 10 per cent level, starting with the least significant.

The estimation results, using the Ordinary Least Squares (OLS) estimator, are reported in Tables 2(a) and 2(b). With the exception of the constant and the binary variable IT_t^i, the estimated coefficients associated with all regressors in equation (33), refer to the sum of coefficients for all lags that remain in the optimal specification following the two-step procedure described above. Accordingly, the $p-$values (in brackets) refer to the test of the null hypothesis that the sum of coefficients is zero.[20] For example, the reported coefficient associated with lagged inflation for the case of Australia corresponds to $\sum_{n=0}^{N_\pi} \widehat{\varphi}_n^\pi = 0.1638$, where $\widehat{\varphi}_n^\pi$ is the OLS estimator for φ_n^π. In this case, the coefficient (sum) is found to be significant at the five per cent level. For simplicity, in the rest of the paper unless stated otherwise, the terms "estimated parameter" or "estimated coefficient" will refer to the sum of the estimated parameters on the explanatory variables as presented in Tables 2(a) and 2(b).

The first seven rows of Tables 2(a) and 2(b) correspond to the variables usually considered in empirical estimations of the traditional Phillips curve augmented with unit labour costs and commodity price inflation. The estimated coefficients are of the expected signs in the panel regression and in most of the country-specific regressions, as shown in the last column of Table 2(b). For example, in the case of the domestic output gap, considering only the cases in which this variable remains in the optimal specification, the associated estimated coefficients are positive in fifteen out of sixteen regressions, and statistically significant at less than the five per cent level in fourteen of them. In the case of lagged wage-inflation, positive and statistically significant parameters are found in all thirteen regressions for which this variable is part of the final specification. Results are also in accordance with our priors in the case of productivity growth (eight out of nine regressions), despite the fact that the sum of estimated parameters is unexpectedly positive for Switzerland, although

[19] A Generalized Method of Moments estimator was also used to account for endogeneity. However, potential colinearity problems $-$ mainly due to the definitions of composite variables **EPI**, **CHIEW**, **MUEPI**, and **GEPI** $-$ made it very difficult to find good instruments. Very often the $J-$statistic did not allow us to validate the overidentifying restrictions needed when there are more instruments than parameters to estimate. See Newey and West (1987).

[20] Consistent with robust-standard-errors. See Hayashi (2000).

not statistically significant.

Also notice that oil price inflation does not have the expected positive effect on inflation in Australia, Austria, Japan, The Netherlands, Portugal, and the U.K. – for which the variable is not even in the optimal specification – as well as in Norway and Spain, for which unexpected negative signs are found. Positive and statistically significant coefficients are obtained in the remaining eleven regressions. In the case of coefficients associated with the non-oil commodity price inflation, all but four regressions display the expected positive sign. However, only two regressions display an unexpected negative and statistically significant (five per cent) coefficient.

Table 2(a)
Estimation Results

Dependent Variable: π^i

Variable	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Italy	Japan
Constant	0.0686	0.0006	0.0128	0.0256	0.0251	0.0104	0.0060	-0.0179	0.0070	0.0000
	[0.03]	[0.88]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.04]	[0.00]	[0.98]
π^i_{t-n}	0.1638	-0.4073	0.2399	0.1896		-0.3956	0.6549	-0.2890	0.5134	-0.3530
	[0.05]	[0.00]	[0.00]	[0.04]		[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
y^i	0.2692	0.0743	0.1636		0.0643	0.1359		0.0509	0.1633	0.1931
	[0.00]	[0.15]	[0.00]		[0.03]	[0.00]		[0.00]	[0.00]	[0.00]
w^i_{t-n}	0.3309	0.4520			0.2684				0.1281	0.8022
	[0.00]	[0.00]			[0.00]				[0.03	[0.00]
a^i	-0.9129	-0.2102		-0.3769	-0.1746		-0.1050		-0.0169	
	[0.00]	[0.00]		[0.00]	[0.03]		[0.09]		[0.60]	
π^{oil}			0.0124	0.0167	0.0632	0.0123	0.0101	0.0057	0.0081	
			[0.00]	[0.00]	[0.13]	[0.00]	[0.00]	[0.00]	[0.02]	
π^{com}	0.0440					0.0121		-0.0126		
	[0.00]					[0.39]		[0.09]		
EPI^i	-0.1911	0.1940	0.3224	0.2746	0.7583	0.4402	0.1321		0.2647	0.1706
	[0.00]	[0.00]	[0.00]	[0.04]	[0.00]	[0.02]	[0.06]		[0.00]	[0.00]
L^{i,Chn}	-0.1930	-0.0095	-0.0494	-0.5316	0.1107	0.3291	-0.0857	0.0130		0.0561
	[0.03]	[0.88]	[0.71]	[0.02]	[0.09]	[0.00]	[0.12]	[0.85]		[0.00]
MUEPI^i	-1.0133			-0.4214	-0.8353			0.4025		
	[0.00]			[0.05]	[0.00]			[0.00]		
GEPI^i		-0.8195	-1.0518			-1.2845	-0.7050	-0.4353	-0.5275	-0.2575
		[0.01]	[0.00]			[0.08]	[0.01]	[0.01]	[0.04]	[0.00]
CHIEW^i	0.4658	0.2320				-0.0462			-0.0898	-0.1032
	[0.00]	[0.00]				[0.52]			[0.06]	[0.01]
$\hat{u}$	0.1739		-0.1720		-0.1413	-0.1782			-0.1611	0.0285
	[0.20]		[0.00]		[0.01]	[0.02]			[0.00]	[0.63]
CBI^i	-0.0532	0.0041		-0.0122		0.0054	-0.0028	-0.0385	-0.0071	0.0015
	[0.05]	[0.57]		[0.01]		[0.00]	[0.01]	[0.04]	[0.00]	[0.78]
IT^i				-0.0031		-0.0105	-0.0013			
				[0.01]		[0.00]	[0.02]			
Adj R^2	0.70	0.37	0.63	0.50	0.73	0.75	0.78	0.32	0.90	0.61

Table 2(b)
Estimation Results (cont.)

Dependent Variable: π^i

Variable	Netherlands	Norway	Portugal	Spain	Sweden	Switzerland	U.K.	U.S.	Panel	Right Sign
Constant	0.0091	0.0040	0.0176	0.0035	0.0061	0.0010	0.0597	0.0587	0.0013	18/19
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.13]	[0.00]	[0.00]	[0.20]	
π^i_{t-k}				0.5809	0.4599	-0.2269		0.1480	0.4289	9/14
				[0.00]	[0.00]	[0.14]		[0.04]	[0.00]	
y^i		0.0907	0.1634	0.0851	-0.2261	0.1209	0.1204	0.0563	0.0400	15/16
		[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.02]	[0.00]	
w^i_{t-n}	0.2185	0.3435	0.0675		0.2143	0.9617	0.3861	0.3885	0.3896	13/13
	[0.00]	[0.00]	[0.05]		[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	
a^i					-0.6431	0.0175			-0.0507	8/9
					[0.00]	[0.72]			[0.00]	
π^{oil}		-0.0108		-0.0052	0.0237	0.0285		0.0270	0.0061	11/13
		[0.0937]		[0.03]	[0.00]	[0.00]		[0.00]	[0.01]	
π^{com}	-0.0192	0.0424			-0.0006	-0.0054	-0.0297	-0.0117	0.0115	4/10
	[0.07]	[0.00]			[0.96]	[0.54]	[0.01]	[0.05]	[0.01]	
EPI^i	0.3645	0.4570	1.1594		0.0539		-0.5501		0.0133	13/15
	[0.00]	[0.00]	[0.00]		[0.0030]		[0.00]		[0.01]	
L^{i,Chn}			-0.7813		-0.2291			-0.0240	-0.0031	9 (-) , 4 (+)
			[0.02]		[0.01]			[0.68]	[0.36]	
MUEPI^i			-0.4682	1.1865	-0.5938	0.2171	1.4524	1.9167	0.0645	5 (-) , 6 (+)
			[0.44]	[0.01]	[0.06]	[0.10]	[0.00]	[0.00]	[0.00]	
GEPI^i	-1.2647	-1.8052	-3.8725	-1.2649				-1.0726	-0.2291	13 (-) , 0 (+)
	[0.00]	[0.00]	[0.00]	[0.01]				[0.00]	[0.05]	
CHIEW^i			0.3128	0.0555		-0.0612			0.0615	4 (-) , 5 (+)
			[0.01]	[0.00]		[0.33]			[0.00]	
$\hat{u}$		0.0257	0.2502		0.3674	-0.2296				5/10
		[0.79]	[0.02]		[0.00]	[0.01]				
CBI^i	-0.0072		-0.0166	-0.0473			-0.0494	-0.0440	-0.0001	11/14
	[0.05]		[0.00]	[0.08]			[0.00]	[0.00]	[0.86]	
IT^i	0.0016	-0.0030			-0.0038	-0.0028			-0.0007	7/8
	[0.04]	[0.01]			[0.01]	[0.00]			[0.05]	
Adj R^2	0.32	0.60	0.51	0.60	0.68	0.77	0.64	0.70	0.78	

Rows eight to twelve in Tables 2(a) and 2(b) show the estimated coefficients for the variables that capture the supply-side direct (**EPI** and $\mathbf{L}^{i,Chn}$) and indirect effects (**CHIEW**, **MUEPI**, and **GEPI**). Taking into account movements in the weighted average bilateral exchange rate, the model predicts a positive association between foreign tradable goods inflation and domestic CPI inflation. In terms of equation (33), the implication for the estimated parameter associated with **EPI** is that $\sum_{n=1}^{N_0} \widehat{\psi}_{0,t-n} > 0$. Among the fifteen regressions in which **EPI** is part of the optimal specification, results are consistent with the model's prediction in the panel regression as well as in all countries, with the exception of Australia and the United Kingdom.

The composite variable, $\mathbf{L}^{i,Chn}$, introduced to account for differences in the absolute price level of tradable goods between country i and China, while taking into account the import penetration of Chinese goods, has an ambiguous effect on π^i_t. According to definition (32), changes in $\mathbf{L}^{i,Chn}$ may come from two sources (in deviations from their long-run trends): 1) the share of imports from China in total imports of country i, as measured by $\theta^{i,Chn}$, and 2) the relative price of Chinese goods measured in units of country's i currency. On the one hand, to the extent that Chinese goods are cheaper, increases in $\theta^{i,Chn}$ should exert downward pressure on the prices of tradable goods in country i and, as a consequence, reduce π^i. On the other hand, for a given $\theta^{i,Chn}$, higher Chinese prices should have a positive impact on π^i. The sign of the estimated parameter $\sum_{n=1}^{N_1} \widehat{\psi}_{1,t-n}$, associated with $\mathbf{L}^{i,Chn}$, should reflect the relative importance of these two opposite forces. As shown in Tables 2(a) and 2(b), $\sum_{n=1}^{N_1} \widehat{\psi}_{1,t-n}$ is statistically significant in eight out of thirteen regressions for which this variable stays in the final specification of (33), being negative in five countries (i.e., Australia, Canada, France, Portugal, and Sweden), and positive in Denmark, Finland, and Japan.

The estimated parameter, $\sum_{n=1}^{N_2} \widehat{\psi}_{2,t-n}$, associated with the composite variable **MUEPI** that captures the contribution of bilateral trade openness to the supply-side indirect effect due to the PPP channel, has also an ambiguous expected sign. Recall that **MUEPI** is constructed from interacting foreign tradable goods inflation measured in domestic currency (i.e., taking into account the bilateral exchange rate) with the degree of bilateral trade openness, μ_t^{ij}. While foreign inflation should have a positive impact on π^i, increasing trade openness should produce the opposite effect. Note that the estimated coefficient is found to be positive and statistically significant in five countries (Germany, Spain, Switzerland, the United Kingdom, and the United States) and in the panel regression, while it is negative and significant in four others (Australia, Canada, Denmark, and Sweden).

The other variable that reflects the supply-side indirect effect due to the PPP channel is **GEPI**, which is obtained from the interaction between G_t, our measure of globalization defined in (9), and **EPI**. Similarly to **MUEPI**, the effect of **GEPI** on π^i is expected to be ambiguous. Again, other things being equal, higher foreign inflation implies a higher level of π^i, while the acceleration in the process of integration of national markets for goods should reduce π^i. However, as displayed in Tables 2(a) and 2(b), the estimated parameter $\sum_{n=1}^{N_3} \widehat{\psi}_{3,t-n}$ is found to be negative and statistically significant for all thirteen regressions for which **GEPI** belongs to the optimal specification. This result suggests an important downward pressure coming from increased globalization to domestic CPI inflation, and is consistent with the findings recently reported by Borio and Filardo (2007).

The supply-side indirect effect due to the labour-cost channel is captured by **CHIEW**, which encompasses the combined effects of foreign wage-inflation and the degree of (bilateral) job market integration as measured by χ_t^{ij}. As in the composite variables discussed above, **CHIEW** should have a positive, or negative, effect on π^i depending on whether the effect of foreign wage-inflation dominates, or is dominated by that of job market integration. The estimated parameter

$\sum_{n=1}^{N_4} \widehat{\psi}_{4,t-n}$ is found to be positive and statistically significant in four countries (Australia, Austria, Portugal, and Spain) and in the panel regression. It is negative in the other four countries, but statistically significant in only two cases (Italy and Japan).

Along with oil and non-oil price inflation, our measure of global slackness is important for the demand-side effect. According to Tables 2(a) and 2(b), this variable is not a part of the final specification of (33) in nine regressions, including the panel estimation. Among the remaining ten country-specific regressions, the parameter $\sum_{n=0}^{N_{yu}} \rho_n^u$, associated with our measure of world output gap, $\widehat{u}_{t-n}$, is positive, as expected, in only half of them. Only in Portugal and Sweden are the positive coefficients also statistically significant. These results are in line with both Ball (2006) and Ihrig et al. (2007), but contradict Borio and Filardo's (2007) "globe-centric" approach to estimated Phillips curves.

The coefficients associated with the two control-variables, CBI^i and IT^i $-$ that account for the anti-inflation stance derived from central bank independence, and the presence of explicit inflation-targeting frameworks, respectively $-$ generally display the expected sign whenever those variables are found to remain in equation (33)'s final specification. Note that in eleven out of fourteen regressions, CBI^i has the expected negative impact on π^i, although it is not statistically significant in the panel specification. Additionally, out of fifteen inflation-targeting countries considered, IT^i is found to be relevant in seven and, among them, the associated estimated parameter is negative, as expected, and statistically significant, at the five per cent level in six countries (Canada, Finland, France, Norway, Sweden, and Switzerland). IT^i is also negative and significant in the panel regression.

Given that some of the unexpected sign reversals observed in estimated coefficients from country-specific regressions may be, in part, caused by small-sample problems, we interpreted the results from the panel estimation as providing further evidence that the model explains the data well.[21] The additional degrees of freedom afforded by combining the cross-sectional and time-series dimensions in a pooled regression yield more efficient estimated parameters and help reduce small-sample bias in statistical inference. Unlike the estimation results for some individual countries, the panel estimation results are consistent with our priors and, for the most part, are statistically significant at less than the five per cent level. Notice that the results of the panel estimation, displayed in the last column of Table 2(b), indicate that out of fourteen variables considered in the estimation of (33), only $\widehat{u}_t$ is not present in the optimal specification. In addition, the estimated coefficients associated with all remaining variables are of the expected sign and, with the exception of $\mathbf{L}^{i,Chn}$ and CBI_t^i, statistically significant.

[21] For instance, the adjusted R^2 $(= 0.78)$ in the panel estimation suggests that the regressors derived from the theoretical model have a high explanatory power over the variance of CPI inflation.

5 The Role of China

This section computes the time-varying effect of price- and wage-setting conditions in China on the CPI inflation rate of eighteen OECD countries, using the estimation results reported in the previous section. For each of the four channels discussed in Section 2, we compute the effects using a counterfactual exercise as follows.[22]

Counterfactual values of the regressors are computed under the assumption that both China's importance in the world economy (as a producer and exporter of goods) and its bilateral economic integration with the other countries in the sample are kept constant at a reference date. More specifically, the following steps are used:

1) We first create counterfactual values for the relevant variables associated with each particular effect, under the assumption that shares $\theta_t^{i,Chn}$, $\mu_t^{i,Chn}$, $\chi_t^{i,Chn}$, and r_t^{Chn} are held constant at at their 1990Q1 values.[23] For instance:

- The counterfactual values of **EPI** and $\mathbf{L}^{i,Chn}$ are obtained with $\theta_t^{i,Chn} = \theta_{1990Q1}^{i,Chn}$; similarly, counterfactual values of **MUEPI** and **CHIEW** are computed with $\mu_t^{i,Chn} = \mu_{1990Q1}^{i,Chn}$ and $\chi_t^{i,Chn} = \chi_{1990Q1}^{i,Chn}$, respectively.

- We compute counterfactual values for G_t, using $r_t^{Chn} = r_{1990Q1}^{Chn}$, and multiply the result by the counterfactual **EPI** discussed above in order to obtain counterfactual values for **GEPI**.

- We also freeze $r_t^{Chn} = r_{1990Q1}^{Chn}$to generate counterfactual values for the world output gap, $\widehat{u}_t$, and for the growth rate of the world economy, g_t^*.[24] These values are then used in estimated versions of equations (21) and (22) to obtain counterfactual values of π_t^{oil} and π_t^{com}, respectively.

2) Using the estimated coefficients and the residuals, $\widehat{\varepsilon}_t$, from the country-specific versions of equation (33), along with the counterfactual variables, we construct counterfactual values for CPI

[22] One could also try to identify the effect of China on country's j inflation using the total differentiation of equation (33), taking into account the definitions of the shares θ_t^{ij}, μ_t^{ij}, χ_t^{ij}, and r_t^j, as well as variables **EPI**, $\mathbf{L}^{i,Chn}$, **MUEPI**, **GEPI**, **CHIEW**, π^{oil}, π^{com}, and $\widehat{u}$, for all relevant lags in the optimal specification. The effects according to such "total differential approach" (available upon request) are not statistically different from zero, mainly due to the use of mean reverting, stationary regressors in the estimation of (33). This means that shocks to the right-hand side variables only have temporary, and not very persistent, effects on the dependent variable π_t^i, biasing the average effects towards zero.

[23] Later in the paper, we do a sensitivity analysis for Canada to show how the estimated effects change with different reference dates.

[24] Note that freezing the share of China in world GDP as that observed in 1990Q1 to generate the counterfactual value of g_t^* is equivalent to assuming that Chinese GDP grew at the same rate as the rest of world's GDP.

inflation. Let $\pi_t^i\,(\text{SD})$, $\pi_t^i\left(\text{SI}^{PPP}\right)$, $\pi_t^i\left(\text{SI}^{LC}\right)$ and $\pi_t^i\,(\text{DS})$ be the counterfactual inflation rates associated with the supply-side direct, supply-side indirect−PPP, supply-side indirect−labour channel, and demand−side effects, respectively. We compute $\pi_t^i\,(\text{SD})$ by replacing the actual time-series of **EPI** and $\mathbf{L}^{i,Chn}$ by their counterfactual values. Similarly, $\pi_t^i\left(\text{SI}^{PPP}\right)$ requires counterfactual values of **MUEPI** and **GEPI**, while $\pi_t^i\left(\text{SI}^{LC}\right)$ is obtained by using the counterfactual **CHIEW**, and $\pi_t^i\,(\text{DS})$ requires counterfactual values for $\widehat{u}_t$, π_t^{oil} and π_t^{com}.

3) We then compute country-specific time-varying effects of China using $\text{e}_t = \pi_t^i - \pi_t^i\,(\text{e})$, as the difference between actual and counterfactual inflation rates, for e = SD, SI^{PPP}, SI^{LC}, and DS. The total effect is the sum of the effects coming from the four channels.

Table 3
Estimated Average Effect of China
Percentage Points Per Year (1990 - 2006)

Country	π	SD	SI^{PPP}	SI^{LC}	DS	Total	Only Significant
Australia	2.62	-0.6979	-0.0220	0.3023	-0.0134	-0.4311	-0.3957
		[0.00]	[0.56]	[0.00]	[0.64]	[-0.5973, -0.2348]	
Austria	2.17	-0.0722	-0.1031	0.0000	0.0000	-0.1754	-0.1754
		[0.10]	[0.00]	[1.00]	[1.00]	[-0.2786, -0.0721]	
Belgium	2.06	-0.0005	-0.1884	0.0000	-0.0050	-0.1939	-0.1884
		[0.99]	[0.02]	[1.00]	[0.85]	[-0.3513, -0.0365]	
Canada	2.15	-0.3373	-0.0013	0.0000	-0.0031	-0.3417	-0.3373
		[0.00]	[0.86]	[1.00]	[0.92]	[-0.4343, -0.2492]	
Denmark	2.02	0.0041	-0.0301	0.0000	-0.0052	-0.0311	0.0000
		[0.71]	[0.33]	[1.00]	[0.94]	[-0.1705, 0.1084]	
Finland	1.79	0.2873	-0.2075	-0.0094	-0.0179	0.0525	0.0798
		[0.00]	[0.06]	[0.56]	[0.50]	[-0.1913, 0.2963]	
France	1.77	-0.0602	-0.1129	0.0000	-0.0040	-0.1772	-0.1731
		[0.04]	[0.00]	[1.00]	[0.85]	[-0.2633, -0.0910]	
Germany	2.10	-0.0042	-0.0113	0.0000	0.0026	-0.0128	0.0000
		[0.91]	[0.91]	[1.00]	[0.85]	[-0.2073, 0.1817]	
Italy	3.23	0.0021	-0.0784	-0.0153	-0.0031	-0.0947	-0.0937
		[0.36]	[0.04]	[0.00]	[0.88]	[-0.1795, -0.0099]	
Japan	0.47	0.1513	-0.0761	-0.1157	0.0010	-0.0395	-0.0405
		[0.00]	[0.07]	[0.00]	[0.50]	[-0.1901, 0.1111]	
Netherlands	2.32	0.0059	-0.1757	0.0000	0.0027	-0.1672	-0.1757
		[0.72]	[0.07]	[1.00]	[0.81]	[-0.3298, -0.0045]	
Norway	2.11	0.0022	-0.0640	0.0000	0.0137	-0.0481	0.0000
		[0.76]	[0.23]	[1.00]	0.7700	[-0.1663, 0.0701]	
Portugal	4.40	0.0047	-0.0982	0.0141	0.0013	-0.0781	-0.0841
		[0.55]	[0.01]	[0.00]	[0.87]	[-0.1449, -0.0113]	
Spain	3.59	0.0000	-0.0274	0.0084	0.0017	-0.0173	-0.0190
		[1.00]	[0.11]	[0.00]	[0.88]	[-0.0554, 0.0209]	
Sweden	2.30	-0.2070	-0.0084	0.0000	-0.0018	-0.2172	-0.2070
		[0.00]	[0.53]	[1.00]	[0.97]	[-0.3817, -0.0527]	
Switzerland	1.59	0.0000	0.0028	-0.0070	-0.0205	-0.0247	0.0000
		[1.00]	[0.65]	[0.34]	[0.56]	[-0.0936, 0.0443]	
U.K.	2.46	-0.0019	0.0060	0.0000	0.0063	0.0105	0.0000
		[0.67]	[0.67]	[1.00]	[0.71]	[-0.0259, 0.0468]	
U.S.	2.79	-0.0305	-0.0361	0.0000	-0.0174	-0.0839	-0.0666
		[0.13]	[0.08]	1.0000	[0.56]	[-0.1687, 0.0009]	
Average	2.33	-0.0530	-0.0685	0.0099	-0.0034	-0.1150	-0.1042

Note : Confidence intervals in the last column refer to the 10% significance level.

Results for the 1990Q1-2006Q4 period, expressed in percentage points per year (p.p./year), are displayed in Table 3. Four main points deserve our attention.[25] First, note that increased shares $\theta_t^{i,Chn}$, $\mu_t^{i,Chn}$, $\chi_t^{i,Chn}$, and r_t^{Chn} since 1990Q1 are estimated to have reduced CPI inflation in sixteen out of the eighteen countries considered. The two exceptions are Finland and the U.K, although the positive values are not statistically significant. The expected negative average value for the total "China-effect" is statistically different from zero for Australia, Austria, Belgium, Canada, France, Italy, The Netherlands, Portugal, and Sweden. Among these countries, the largest average total effect is that estimated for Australia (-0.43 p.p./year), and the smallest for Portugal (-0.08 p.p./year). The average estimate for Canada falls in between (-0.34 p.p./year).

Second, note that in several countries for which the total effect is not found to be statistically significant, estimates of some individual channels are.[26] This is the case for Finland, Japan, Spain, and the United States. For example, the supply-side indirect effect for the United States is estimated to be about -0.04 of a percentage point, although the estimated total effect (-0.08 p.p./year) is marginally insignificant at the ten per cent level. For the United States, the supply-side direct effect is statistically significant at the 13 per cent level. These results for the U.S. are in line with previous findings by Kamin, Marazzi, and Schindler (2006).

Third, we find that the supply-side direct effect is smaller than the supply-side indirect effect, on average. Amongst the two components of the supply-side indirect effect, the PPP channel appears, on average, to be more important than the labour-cost channel as a source of downward pressure on global inflation.

Fourth, the demand-side effect does not seem to have contributed to increasing the inflation rate in the countries examined. The average estimate is not statistically significant for any of the countries in the sample. This result is at odds with the widespread opinion (for example, IMF 2007, pp. 40-47), usually based on simple descriptive statistics of cross-country shares on the incremental world demand for oil and non-oil commodities, that China is a major factor in explaining the price changes in these markets.

[25] We also compute the effects of China on the CPI inflation of other countries in the sample using the estimated coefficients from the panel specification of equation (33). Unlike the results obtained using the county-specific regressions (see Table 3), that exercise implies negligible country-specific effects (available from the authors upon request). The main reason for this is that our panel estimation (pooled regression) imposes homogeneous parameters across countries. As shown in Table 2(b), country-specific regressions produce several estimated parameters found to be zero, which explains why their counterparts in the panel regression are much lower in absolute values. These results suggest that parameter homogeneity may be an unreasonable restriction and that the sensitivity of CPI inflation to the right-hand-side variables displays important cross-country heterogeneity.

[26] This is possible because we first obtain a time-series of the total effect by adding the values of the four effects, and then we test the null hypothesis that the mean of the resulting time-series is zero.

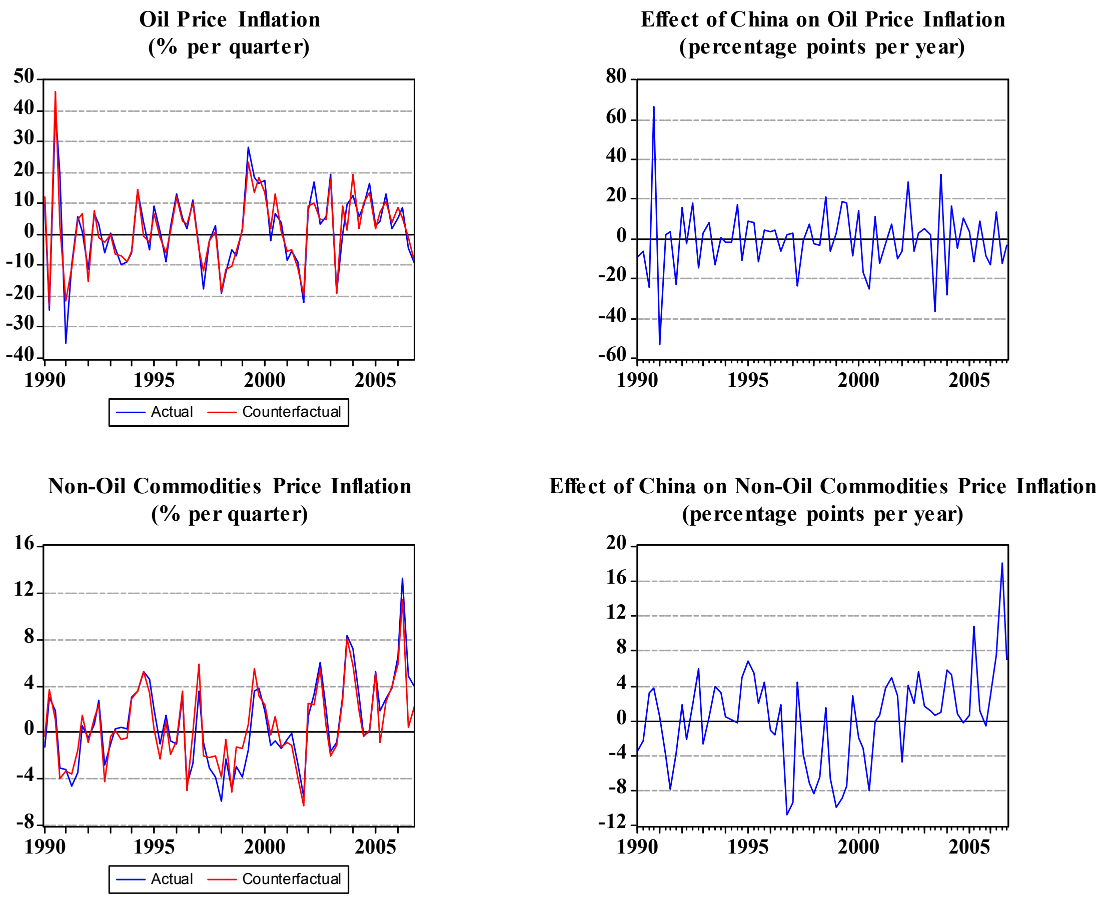

Figure 5

Figure 5 displays the actual and counterfactual oil and non-oil price inflation computed from the estimation of equations (21) and (22). Note that our methodology is unable to clearly identify a positive effect of China on oil-price inflation. Although the difference between the actual and counterfactual inflation rates of oil prices (upper-right chart) reaches two-digit figures in absolute value in several instances, the average and median values are not statistically different from zero. On the other hand, in the case of non-oil commodity price inflation, we cannot reject the hypothesis that the median effect of China is positive. In addition, the average is clearly positive for the 2000−2006 period, in accordance with the priors of practitioners and in line with the anecdotal evidence. When the counterfactual oil and non-oil price inflation rates are used in the country-specific counterfactual inflation, the small measurable effect of China on world markets combined with the estimated coefficients for π_t^{oil} and π_t^{com} in equation (33) produces an average demand-side effect that is not statistically different from zero.

This result may be explained by the fact that the oil and non-oil commodity price inflation rates are too volatile due to the hybrid nature of commodities as both goods and assets. The regressors in the estimation of equations (21) and (22) have low explanatory power.[27] In addition, the presence of China as a major player in world commodity markets is a relatively recent phenomena and econometric models still have difficulties in identifying it due to an insufficient number of observations. Future research is needed to address this point.

Table 4
Estimated Average Effect of China
Percentage Points Per Year

Country	Sample	π	SD	SI^{PPP}	SI^{LC}	DS	Total
Australia	*1990 - 2006*	2.62	-0.70	-0.02	0.30	-0.01	-0.43
	2001 - 2006	2.74	-0.91	-0.01	0.52	0.08	-0.33
Austria	*1990 - 2006*	2.17	-0.07	-0.10	0.00	0.00	-0.18
	2001 - 2006	1.75	-0.11	-0.20	0.00	0.00	-0.31
Belgium	*1990 - 2006*	2.06	0.00	-0.19	0.00	0.00	-0.19
	2001 - 2006	1.95	-0.04	-0.25	0.00	-0.01	-0.30
Canada	*1990 - 2006*	2.15	-0.34	0.00	0.00	0.00	-0.34
	2001 - 2006	2.11	-0.32	0.01	0.00	-0.01	-0.32
Denmark	*1990 - 2006*	2.02	0.00	-0.03	0.00	-0.01	-0.03
	2001 - 2006	1.90	-0.01	-0.03	0.00	-0.03	-0.07
Finland	*1990 - 2006*	1.79	0.29	-0.21	-0.01	-0.02	0.05
	2001 - 2006	1.19	0.32	-0.27	-0.02	0.00	0.04
France	*1990 - 2006*	1.77	-0.06	-0.11	0.00	0.00	-0.18
	2001 - 2006	1.74	-0.06	-0.17	0.00	-0.01	-0.25
Germany	*1990 - 2006*	2.10	0.00	-0.01	0.00	0.00	-0.01
	2001 - 2006	1.56	-0.05	0.05	0.00	-0.04	-0.03
Italy	*1990 - 2006*	3.23	0.00	-0.08	-0.02	0.00	-0.09
	2001 - 2006	2.20	0.00	-0.12	-0.02	0.00	-0.14
Japan	*1990 - 2006*	0.47	0.15	-0.08	-0.12	0.00	-0.04
	2001 - 2006	-0.29	0.22	-0.23	-0.25	0.00	-0.26
Netherlands	*1990 - 2006*	2.32	0.01	-0.18	0.00	0.00	-0.17
	2001 - 2006	2.12	-0.01	-0.16	0.00	-0.05	-0.22
Norway	*1990 - 2006*	2.11	0.00	-0.06	0.00	0.01	-0.05
	2001 - 2006	1.51	-0.01	-0.07	0.00	0.16	0.08
Portugal	*1990 - 2006*	4.40	0.00	-0.10	0.01	0.00	-0.08
	2001 - 2006	2.78	0.00	-0.16	0.02	0.00	-0.14
Spain	*1990 - 2006*	3.59	0.00	-0.03	0.01	0.00	-0.02
	2001 - 2006	2.94	0.00	-0.04	0.01	0.01	-0.03
Sweden	*1990 - 2006*	2.30	-0.21	-0.01	0.00	0.00	-0.22
	2001 - 2006	1.36	-0.17	0.00	0.00	-0.01	-0.19
Switzerland	*1990 - 2006*	1.59	0.00	0.00	-0.01	-0.02	-0.02
	2001 - 2006	0.66	0.00	0.00	-0.01	-0.07	-0.08
U.K.	*1990 - 2006*	2.46	0.00	0.01	0.00	0.01	0.01
	2001 - 2006	1.70	0.00	0.00	0.00	-0.07	-0.07
U.S.	*1990 - 2006*	2.79	-0.03	-0.04	0.00	-0.02	-0.08
	2001 - 2006	2.52	-0.04	-0.14	0.00	-0.06	-0.25

Although the total effect of China on the inflation rates of other countries has been quantitatively modest, it has increased in absolute terms since the early 2000s. As reported in Table 4, the average estimates for the total effect have increased over the 2001-2006 period, compared with the entire 1990-2006 period, for thirteen of the eighteen countries examined. This suggests that the effect is

[27] The adjusted R^2 are 0.23 and 0.47, respectively.

getting stronger as China continuously deepens its trade relations and increases its share in world markets and in the world economy.

Table 5
Effect of China on Global Inflation
Percentage Points Per Year

	SD	SI^{PPP}	SI^{LC}	DS	Total
1990 - 2006	-0.0079	-0.0488	-0.0179	-0.0073	-0.0818
2001 - 2006	-0.0120	-0.1179	-0.0387	-0.0372	-0.2058
Only significant effects					
1990 - 2006	-0.0076	-0.0478	-0.0177	0.0000	-0.0731
2001 - 2006	-0.0070	-0.1231	-0.0384	0.0000	-0.1686

The effect of China on global inflation based on the Counterfactual Approach is presented in Table 5. Results for each channel are computed as the cross-country weighted average of the same time-series used to construct Tables 3 and 4. The time-varying country-specific shares in world real GDP are used as weights. In the upper panel of Table 5, we show the effect of China on global inflation computed from all country-specific effects. In the lower panel, the effect on global inflation is computed only with country-specific effects found to be statistically significant at the ten per cent level. Focusing on these results, the effect of China is estimated to have reduced global inflation by about -0.07 of a percentage point over the 1990-2006 period, and by -0.17 of a percentage point, on average, from 2001 to 2006. Moreover, the supply-side indirect effect is estimated to have been more important than the supply-side direct effect (about sixteen times stronger, on average).[28]

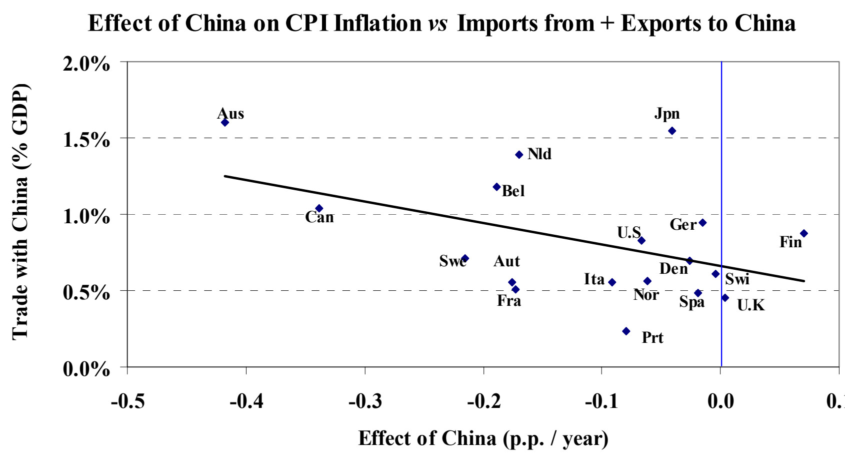

Figure 6

[28] Although collinearity between explanatory variables associated with each channel does not bias the estimated coefficients in (33), it makes identification more difficult and may play a role in determining which channel seems to matter most. For instance, there is a possibility that the supply-side direct effect also captures some of the indirect effects, and vice-versa.

In order to assess the relevance of China's bilateral trade relations in the estimated effects on the CPI inflation of other countries, Figure 6 plots the country-specific sum of the average effects (over the sample period) coming from the supply-side direct and indirect effects against bilateral trade flows with China as a percentage of the GDP. Note the negative slope of the regression line, indicating that stronger effects (more negative values) coming from China to domestic CPI inflation are associated with higher levels of bilateral trade flows.

Table 6
Canada: Sensitivity to the Reference Period
Percentage Points Per Year

Reference	Sample	SD	SI^{PPP}	SI^{LC}	DS	Total
1985Q1	1985 - 2006	-0.4638	-0.0016	0.0000	-0.0003	-0.4657
	1990 - 2006	-0.4598	-0.0013	0.0000	-0.0031	-0.4642
	2001 - 2006	-0.4438	0.0085	0.0000	-0.0062	**-0.4415**
1990Q1	1990 - 2006	-0.3373	-0.0013	0.0000	-0.0031	-0.3417
	2001 - 2006	-0.3212	0.0085	0.0000	-0.0062	**-0.3189**
2001Q1	2001 - 2006	-0.2762	0.0085	0.0000	-0.0062	**-0.2739**

Admittedly, the estimated China effect based on the "Counterfactual" approach may be sensitive to the reference period, that is, to the point in time at which the values of the shares $\theta_t^{i,Chn}$, $\mu_t^{i,Chn}$, $\chi_t^{i,Chn}$, and r_t^{Chn} are held constant. To assess the sensitivity of our main results, we re-calculate the total effect of China on Canadian CPI inflation using different reference periods. Results are presented in Table 6. In the first and third panels, the shares are held constant at their 1985Q1 and 2001Q1 values, respectively. For convenience, in the second panel, we repeat the estimated effects for Canada as reported in Table 3 (shares at their 1990Q1 values). Overall, when we use 1990Q1 instead of 1985Q1 as the reference period, the estimated effect of China on the Canadian CPI inflation over the 2001-2006 period is reduced from -0.44 to -0.32 of a percentage point per year. The total effect is further reduced from -0.32 to -0.27 percentage points per year when 2001Q1 is used as the reference period. The associated standard errors (not shown in Table 6) imply that the total effect remains statistically significant at the ten per cent level regardless of the reference period. Moreover, for Canada, the earlier the reference period, the larger is the estimated effect of China − approximately 0.1 p.p./year higher per decade. These results confirm that the estimated effects based on the Counterfactual Approach are sensitive to the choice of the reference period, should be taken with caution and interpreted not as an absolute measurement of the effect of China on other countries' inflation rates. The results must be understood as conditional to the reference period. Also note that after accounting for differences in methodology, our results for Canada are consistent with those reported in Morel (2007).[29]

[29] More specifically, we use the share of imports from China on total imports, $\theta_t^{i,Chn}$, to define the supply-side

6 Conclusions

In this paper, we have developed a structural model to estimate the effects of price- and wage-setting conditions in country j on the inflation rate of country i. Although our methodology is general enough to be applied to any pair of countries, the paper focuses on the effect of China on the inflation rate of other countries. With the proposed structural model, we identify and quantify four channels through which globalization in general, and China in particular, may affect inflation in a given country: 1) the *supply-side direct effect*, based on the direct effect of presumably cheaper goods imported from China on a country's consumption basket; 2) two *supply-side indirect effects*, that capture the impact of increasing competitive pressures coming from (i) Chinese goods (the PPP channel) and (ii) Chinese wages (the labour-cost channel); and 3) the *demand-side effect*, that measures the effect of Chinese economic slackness and growth on domestic aggregate demand and world oil and non-oil commodity price inflation.

We use quarterly data from twenty-five countries over the 1984–2006 period to estimate a dynamic inflation equation derived from the structural model. Both country-specific and fixed-effect panel regressions are estimated. Based on the estimated coefficients from the country-specific regressions, we compute the time-varying effect of China on the CPI inflation of other countries using a counterfactual exercise in which we compare the actual inflation rates with a counterfactual measure of inflation calculated under the assumption that both China's share in the world economy and its bilateral economic integration with other economies are held constant at their 1990Q1 values. Sensitivity of the results to different reference dates is presented for the case of Canada.

Results suggest that increased economic integration and economic growth from China since 1990Q1 have reduced CPI inflation in thirteen of the eighteen countries considered. Price- and wage-setting conditions in China are estimated to have reduced global inflation by about -0.07 of a percentage point per year over the 1990-2006 period, and by -0.17 of a percentage point per year from 2001 to 2006. Moreover, we find evidence that, for most countries, the supply-side indirect effect due to competition pressures through the PPP channel appears to be the most important channel. The impact of the demand-side effect on the inflation rate is not statistically significant in the eighteen countries examined.

We also detect important cross-country heterogeneity in the estimated effects. For instance, the effect of China on domestic CPI inflation is the largest for Australia and the smallest for Portugal.

direct effect, while Morel (2007) uses the share of imports from China in the CPI basket. Also, Morel (2007) does not consider the effect of relative price changes, which are held constant at their 2001 values. Both studies produce the same 0.2 p.p/year reduction in Canadian CPI inflation due to the supply-side direct effect when considering the same sample (2001-2006), the same $\theta_t^{i,Chn}$, and treat relative prices the same way.

Overall, stronger negative effects coming from China to domestic CPI inflation are associated with higher levels of bilateral trade flows. In addition, while the supply-side indirect effect due to the PPP channel is found to be, on average, the most important channel, there are important exceptions such as Australia, Canada, and Sweden, for which the supply-side direct effect dominates.

Finally, a few points should be noted regarding the direction of future research. First, our empirical results show that panel estimation based on standard pooled regression with fixed effects may not adequately capture country-specific inflation dynamics. Allowing for some cross-sectional heterogeneity in the sensitivity of CPI inflation to the right-hand side variables should be an important extension. Second, different proxies for trade openness and economic integration (effective tariff rates, for example) could provide a better measure of potential economic linkages than those based on outcomes from trade flows. Finally, a richer model structure for oil and non-oil commodity price inflation may be needed.

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Appendix: Data Description

This section provides details on the data used required for the estimation of equation (33). We need to generate time series to represent the following variables: π_t^i, $\hat{y}_t^i$, w_t, a_t, π_t^{oil}, π_t^{com}, $\widehat{u}_t$, $\mathbf{EPI}_t$, $\mathbf{L}_t^{i,Chn}$, $\mathbf{MUEPI}_t$, $\mathbf{GEPI}_t$, $\mathbf{CHIEW}_t$, and CBI_t^i.

We use quarterly seasonally adjusted data from twenty-five countries that account for about seventy per cent of world GDP over the period 1984 to 2006.[30,31] The sample includes eighteen developed economies that are members of the OECD − Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States − and seven emerging-market economies − Brazil, Mexico, Indonesia, Malaysia, Hong Kong, South Korea, and China.

All growth rates, including inflation rates, are calculated using the log-difference of the variables in levels. Inflation rates π_t^i, π_t^{oil}, and π_t^{com} are computed from the consumer prices index (series 64...ZF), West Texas Intermediate spot price index (series 11176AADZFM17), and non-fuel commodities prices index (series 00176NFDZF), respectively. All three series are obtained from the *International Financial Statistics* dataset compiled by the International Monetary Fund (IFS/IMF). The producer price index (PPI), also obtained from the IMF/IFS (series 63...ZF), is used as a proxy for the price of tradable goods, $p_t^i(T)$, used in the computation of $\mathbf{L}_t^{i,Chn}$ according to definition (32). Its growth rate, $\pi_t^j(T)$, is then used to compute $\mathbf{EPI}_t$, $\mathbf{MUEPI}_t$, and $\mathbf{GEPI}_t$ according to (28)−(30).

Domestic output gap, $\hat{y}_t^i$, is calculated as the percentage deviation of the GDP at constant prices (IMF/IFS series 99BVPZF), expressed in the logarithmic scale, from its trend. The trend is computed using the Hodrick-Prescott (HP) filter with a smoothness parameter of 1600. Foreign output gap, $\widehat{u}_t$, is then calculated as the average value of $\hat{y}_t^i$ over the twenty-five countries in the sample, as described in (19). Following definition in (10), a GDP series measured at constant prices of a common currency unit (U.S. dollars), is used for the weights, r_t^j, required in the computation of $\widehat{u}_t$.

The wage-inflation rate, w_t, is calculated using average wage earnings available from the IFS/IMF (series 65...ZF), the BIS (series VNBA), or the OCDE (series LCEAIN03)[32], while productivity growth, a_t, is computed from the difference between the growth rates of GDP (constant prices, in local currency) and that of employment. We considered indices of employment or hours-worked from the IFS/IMF (series 63...ZF), the BIS (series UDBA), and the OECD (series EMESCVTT).

[30] We use the X-12 seasonal adjustment program provided by the U.S. Census Bureau.

[31] Using data on a PPP basis from the OECD.

[32] For Canada, we use the average weekly earnings from the CANSIM database available from Statistics Canada.

The shares θ_t^{ij}, μ_t^{ij}, and χ_t^{ij}, the globalization index, G_t, as well as the bilateral measures of nominal exchange rate depreciation, e_t^{ij}, are required for the computation of the composite variables $\mathbf{EPI}_t$, $\mathbf{MUEPI}_t$, $\mathbf{GEPI}_t$, and $\mathbf{CHIEW}_t$. Data on bilateral imports and exports, used to calculate θ_t^{ij}, μ_t^{ij}, χ_t^{ij}, and G_t, are from the *International Trade Statistics* dataset from the IMF (ITS/IMF). Bilateral exchange rates, in levels, are indirectly obtained using the ratio of exchange rates of countries i and j against the U.S. dollar (series AE...ZF). Log-differences in the level of the nominal exchange rate are used to compute e_t^{ij}.

Finally, monetary base, m_t^i, and government spending, g_t^i − needed to generate the proxy for central bank independency and monetary policy credibility indicator, CBI_t^i − are represented by IFS/IMF series 14 and 91...ZF, respectively.[33] The inflation-targeting dummy variable was constructed according to the survey by Paulin (2006). Table 7 summarizes the data description.

Table 7
Data Description

Variables	Symbol	Source of Raw Data
CPI and PPI inflation	π_t^i, $\pi_t^i\,(T)$	IFS/IMF
domestic and "world" output gap	y_t^i, u_t^i	IFS/IMF
wage inflation	w_t^i	IFS/IMF, BIS, OECD
productivity growth	a_t^i	IFS/IMF, BIS, OECD
oil and non-oil commodity-price inflation	$\pi_t\,(oil)$, $\pi_t\,(com)$	IFS/IMF
bilateral nominal exchange rates (growth)	e_t^{ij}	IFS/IMF
bilateral trade flows	M_t^{ij}, X_t^{ij}	ITS/IMF
"central bank independency"	$CBI^i = f\left(g_t^i/m_t^i\right)$	IFS/IMF
IT dummy	IT^i	Paulin (2006)

[33] When IFS series 14 is not available, we use the sum of IFS series 14a, 14c, and 14d, which are disaggregated liabilities of the monetary authority.