INTERNATIONAL JOURNAL OF FINANCE AND ECONOMICS
Int. J. Fin. Econ. **17**: 321–336 (2012)
Published online 21 March 2012 in Wiley Online Library
(wileyonlinelibrary.com). DOI: 10.1002/ijfe.1451

TRADE OPENNESS, MARKET COMPETITION, AND INFLATION: SOME SECTORAL EVIDENCE FROM OECD COUNTRIES

MAHIR BINICI[a,b,*,†], YIN-WONG CHEUNG[a,c] and KON S. LAI[d]
[a]*University of California, Santa Cruz, CA 95064, USA*
[b]*Central Bank of Turkey, Ankara, Turkey*
[c]*City University of Hong Kong, Kowloon, Hong Kong*
[d]*California State University, Los Angeles, CA 90032, USA*

ABSTRACT

This study evaluates the role market competition plays in determining inflation based on sector-level data from OECD countries. In theory, trade openness can affect inflation through changes in market competitiveness and productivity. Nonetheless, previous empirical studies often fail to account for productivity effects, and their results may overstate the role of market competition. This study shows that inflation decreases with greater market competitiveness even after controlling for productivity effects. Indeed, when market competition and productivity effects are both accounted for, trade openness becomes insignificant in explaining inflation. The results support that changes in market competitiveness and productivity are the main channels through which trade openness affects inflation. Copyright © 2012 John Wiley & Sons, Ltd.

Received 12 January 2010; Revised 20 November 2011; Accepted 16 December 2011

JEL CODE: C23; E31; L16

KEY WORDS: trade openness; inflation; market structure; static panel; dynamic panel

1. INTRODUCTION

The behaviour of inflation dynamics is a longstanding issue in economics. In addition to considering such usual economic factors as money supply and GDP changes, many early studies explore the role of institutional factors and analyse in particular the impact of central bank independence on inflation. According to the standard time-inconsistency theory (Kydland and Prescott, 1977; Barro and Gordon, 1983), discretionary policymaking has an inflationary bias. This leads to the proposition that greater central bank independence reduces inflation (Rogoff, 1985), and its empirical relevance is a subject of much research (Cukierman, 1992; Alesina and Summers, 1993; Campillo and Miron, 1997; Fuhrer, 1997; Brumm, 2000).[1] With the global economy being increasingly integrated and having soaring cross-border trade and capital flows, much attention has been directed in recent studies to examining the effects of trade openness on inflation (Rogoff, 2003; Sachsida *et al*., 2003; Loungani and Razin, 2005; Ball, 2006; Helbling *et al*., 2006; Pain *et al*., 2006; Borio and Filardo, 2007; Cox, 2007; Sbordone, 2008).

In theory, trade openness may affect inflation through different channels, albeit empirical evidence on their relative importance remains limited. The most often cited channel involves changes in market competition. Greater openness to trade intensifies market competition and reduces the pricing power of firms, thereby dampening inflation. Stronger market competition also influences policy incentives and makes monetary policy more prudent and less inflationary.[2] Instead of estimating the general relationship between trade openness and inflation, Neiss (2001) presents the first direct study of the role of market competition in explaining inflation for OECD countries. The empirical results support that greater market competition tends to reduce inflation.

*Correspondence to: Mahir Binici, Central Bank of Turkey, Istiklal Cad. No: 10 Ulus, 06100 Ankara, Turkey.
†E-mail: mahir.binici@tcmb.gov.tr

Besides operating through increased competition, several recent studies have presented models in which trade openness can lower inflation by bolstering productivity. According to Cox (2007), greater trade openness and higher trade growth promote more specialization in producing goods with comparative advantage, thus inducing reallocation of resources toward more efficient sectors. In addition, increasing trade—coupled with rising foreign direct investment—can facilitate international technology diffusion, which fosters productivity growth (Keller, 2004). Favourable productivity effects can come through changes in market structure at the same time. Facing rising competition and pressure on profit margins, firms are compelled to hold down costs and be more productive. The intense competition can further force out inefficient firms, thereby raising industry productivity (Melitz and Ottaviano, 2008; Chen *et al*., 2009). A proper evaluation of the market competition effects should thus account for productivity effects as well.

This study expands Neiss's (2001) analysis in various ways. Instead of just examining the significance of market competition as a determinant of inflation, we analyse whether market competition and productivity changes are the main channels through which trade openness affects inflation. Moreover, this study uses sectoral data. Although most previous studies examine aggregate national data, a few recent studies begin to look at sector-level data as well (Przybyla and Roma, 2005; Chen *et al*., 2009). Complementing the aggregate national approach, the sectoral approach appears attractive. Market competitiveness can vary considerably across sectors even within the same country, and so can productivity changes. Different sectors can also be subject to rather different degrees of openness to trade. The presence of such cross-sector heterogeneity naturally calls for the use of more disaggregate data. Indeed, the cross-sector heterogeneity may offer potentially useful information that can be exploited in data analysis. Given that the sectoral evidence of either market structure or productivity effects on inflation is so limited in the literature, it is interesting to examine sector-level data.

Our study recognizes that market structure changes can take place independently of the effects of globalization, and so can productivity changes. In addition to the analysis related to trade openness, this study further shows that even after accounting for the contributions of these two important sources, increased globalization (measured by a broader composite index than trade openness) is still found to reduce inflation, suggesting that globalization can affect inflation through other channels beyond trade-related channels.

2. THE DATA

Our sector-level data are mainly drawn from the OECD Structural Analysis (STAN) Industry Database, an extensive database for analysing industry structure and performance within and across countries.[3] By providing detailed measures of production, labour input and international trade, the database enables users to construct industry-level indexes for market competitiveness and productivity changes. In this study, we examine annual data on manufacturing sectors in 12 OECD countries (Austria, Belgium, Canada, Denmark, Finland, Germany, Italy, Japan, the Netherlands, Norway, UK and USA) over the period 1970–2008. The country and sector coverage is governed by data availability. The data are for 10 manufacturing sectors with their corresponding 2-digit ISIC Revision 3 codes given in parentheses as follows: food products, beverages and tobacco (15–16); textiles, textile products, leather and footwear (17–19); wood and products of wood and cork (20); pulp, paper, paper products, printing and publishing (21–22); chemical, rubber, plastics and fuel products (23–25); other non-metallic mineral products (26); basic metals and fabricated metal products (27–28), machinery and equipment (29–33); transport equipment (34–35); and other manufacturing (36–37). These different classified sectors cover all manufacturing industries in a country. The STAN database contains data for service industries as well. But because of restricted availability of data for many service sectors, our analysis focuses on manufacturing sectors.

At the sectoral level, the inflation rate is measured as the change in the logarithm of value added deflator. As shown in Table 1a, inflation rates can vary a lot across countries and across sectors within each country. With regard to sectoral heterogeneity, Japan has the largest range in inflation rates across sectors, whereas Italy has the smallest. Averaging over all the countries under study, the sector of other manufacturing (ISIC 36–37) has the highest inflation rate (4.66%), whereas the sector of machinery and equipment (ISIC 29–33) has the lowest (2.14%).

To explain the inflation behaviour across sectors and countries, a number of economic variables are used. The main variables are described as follows:

Table 1a. Inflation rate (sample averages in % and their inter-sector range values)

Country	Sector code (ISIC) 15–16	17–19	20	21–22	23–25	26	27–28	29–33	34–35	36–37	All	Range
Austria	1.69	1.82	2.15	0.32	−0.02	3.18	1.75	1.49	2.20	2.54	1.71	3.20
Belgium	3.18	2.36	0.54	3.02	0.40	3.01	2.32	2.64	2.33	4.59	2.44	4.19
Canada	5.28	3.58	4.83	5.19	3.47	4.41	4.38	2.26	3.29	4.66	4.14	3.03
Denmark	4.43	3.32	4.47	5.27	3.73	5.68	5.19	3.97	6.24	5.55	4.79	2.92
Finland	3.65	4.43	4.22	4.27	4.88	5.00	3.99	1.78	4.84	4.74	4.18	3.22
Germany	2.97	1.76	2.94	3.15	1.52	1.73	2.70	1.96	2.94	4.36	2.60	2.84
Italy	7.01	7.10	6.86	6.39	5.03	6.28	6.31	6.32	7.81	7.19	6.63	2.78
Japan	3.16	1.85	2.65	3.92	2.03	2.36	1.76	−3.15	0.44	1.17	1.62	7.07
Netherlands	2.47	1.92	4.78	3.05	1.35	2.63	2.31	1.25	2.00	3.99	2.58	3.53
Norway	7.17	4.08	4.93	6.07	5.36	6.14	5.92	5.00	6.25	4.76	5.57	3.09
UK	5.76	5.13	6.21	6.79	5.16	6.42	5.69	4.72	5.81	8.58	6.03	3.86
USA	2.90	1.27	2.78	3.12	3.35	3.30	2.82	−3.98	2.52	3.03	2.11	7.33
All	4.19	3.27	3.99	4.28	3.06	4.21	3.81	2.14	3.95	4.66	3.76	2.52

2.1. *Market competitiveness and productivity measures*

As a proxy for the intensity of market competition, the price–cost margin (PCM) has widely been used to measure the monopolistic markup (Campa and Goldberg, 1995). The PCM for sector k in country j is given by

$$\mathrm{PCM}_{jk} = \frac{\mathrm{OV}_{jk} - M_{jk} - W_{jk}}{\mathrm{OV}_{jk}} = \frac{\mathrm{VA}_{jk} - W_{jk}}{\mathrm{OV}_{jk}} \tag{1}$$

where OV_{jk} is the value of total output, M_{jk} is the materials cost, W_{jk} is the labour compensation and VA_{jk} ($=\mathrm{OV}_{jk}-M_{jk}$) is the value added. Because the PCM can be constructed from accounting data directly, it is a popular measure of market competitiveness.[4] A high PCM suggests a low level of market competition. The data confirm that PCM values can vary considerably both across and within countries (Table 1b). With regard to sectoral heterogeneity, Japan has the largest range in PCM values across sectors, whereas Germany has the smallest. Averaging over all the countries, the sector of other non-metallic mineral products sector (ISIC 26) has the highest PCM, whereas the sector of transport equipment (ISIC 34–35) has the lowest.

Labour productivity is measured as the real value added divided by total employment in the sector. The data on productivity changes (in logarithm) also show considerable variation across sectors (Table 1c). The USA is at the top in terms of cross-sector variation in productivity growth, whereas Canada is at the bottom. Averaging over the

Table 1b. Price–cost margin (sample averages in% and their inter-sector range values)

Country	Sector code (ISIC) 15–16	17–19	20	21–22	23–25	26	27–28	29–33	34–35	36–37	All	Range
Austria	11.28	9.66	16.93	11.73	11.56	15.63	12.97	10.46	11.29	10.59	12.21	7.28
Belgium	9.25	5.61	10.24	11.47	9.44	11.41	6.55	8.22	3.52	7.32	8.30	7.95
Canada	13.60	10.85	11.22	10.64	12.34	17.59	10.41	13.14	9.28	11.64	12.07	8.31
Denmark	7.38	9.77	11.82	9.65	11.89	13.05	9.50	9.26	5.29	12.01	9.96	7.76
Finland	9.18	11.23	9.44	13.79	14.82	16.99	10.74	14.75	7.05	14.43	12.24	9.94
Germany	10.08	9.87	11.23	14.89	11.98	15.51	10.06	11.38	9.49	10.51	11.50	6.02
Italy	11.68	13.78	21.21	14.20	10.54	18.51	14.33	14.03	7.53	16.23	14.20	13.68
Japan	22.90	7.33	9.21	17.40	22.28	19.86	14.48	15.83	13.39	9.03	15.17	15.57
Netherlands	10.04	11.56	10.66	14.30	11.57	15.64	11.32	6.87	4.36	9.68	10.35	11.29
Norway	5.77	8.78	8.25	9.05	10.05	12.80	10.37	7.83	3.93	10.02	8.69	8.87
UK	10.78	12.05	11.84	12.22	13.71	13.91	10.12	11.85	5.04	13.60	11.51	8.87
USA	12.91	9.17	11.22	15.49	14.29	14.86	10.93	9.46	6.66	12.09	11.71	8.83
All	11.20	9.97	12.00	12.90	12.86	15.45	10.98	11.07	7.21	11.43	11.49	8.24

DOI: 10.1002/ijfe

Table 1c. Labour productivity growth rate (sample averages in % and their inter-sector range values)

	Sector code (ISIC)											
Country	15–16	17–19	20	21–22	23–25	26	27–28	29–33	34–35	36–37	All	Range
Austria	2.34	2.99	2.96	5.41	5.04	1.49	4.11	4.76	4.88	2.81	3.68	3.92
Belgium	3.17	4.92	5.60	3.54	7.33	4.29	4.49	4.37	4.78	2.75	4.52	4.58
Canada	1.38	2.28	2.48	1.38	4.08	2.11	2.01	4.51	4.35	2.09	2.67	3.13
Denmark	2.10	4.90	2.42	2.18	3.82	1.77	2.28	4.19	1.33	2.83	2.78	3.57
Finland	3.06	3.27	5.29	4.29	4.37	3.83	4.12	8.46	3.90	4.23	4.48	5.40
Germany	0.35	3.67	2.17	1.78	3.83	3.00	2.02	3.57	3.30	0.37	2.41	3.48
Italy	1.54	3.68	4.58	3.76	5.31	4.81	3.79	3.86	3.15	2.45	3.69	3.77
Japan	0.02	0.88	0.74	0.19	1.71	1.32	1.74	7.77	4.09	4.31	2.28	7.75
Netherlands	3.00	4.33	0.30	2.63	5.79	1.90	3.72	5.31	4.15	0.83	3.26	5.49
Norway	−0.05	3.91	2.54	1.06	3.83	2.00	2.20	3.27	2.06	2.69	2.35	3.96
UK	1.99	3.72	0.19	1.78	4.80	3.98	3.55	4.73	5.77	0.26	3.08	5.58
USA	1.58	3.41	1.58	2.06	2.70	1.40	1.93	9.60	2.56	2.15	2.90	8.20
All	1.70	3.51	2.73	2.49	4.34	2.71	2.97	5.32	3.63	2.41	3.18	3.62

various countries, the sector of machinery and equipment (ISIC 29–33) displays the fastest growth, whereas the sector of food products, beverages and tobacco (15–16) shows the slowest.

2.2. *Trade openness and globalization indicators*

Additional variables are used to capture other effects of globalization not explained by market structure and productivity changes. These include two alternative indicators of trade openness. One of them is openness to imports, as measured by the ratio of imports to domestic production.[5] A larger share of imports would indicate a greater importance of foreign producers relative to domestic producers. The import openness for sector k of country j is given by

$$\mathrm{IMOPEN}_{jk} = \frac{\mathrm{IM}_{jk}}{\mathrm{OV}_{jk}}. \tag{2}$$

In our data, Norway has the largest variation in import openness across sectors, whereas Japan has the smallest (Table 1d). Averaging over all the countries, the sector of textiles, textile products, leather and footwear (ISIC 17–19) is most open to imports, whereas the sector of food products, beverages and tobacco (ISIC 15–16) is least open.

Table 1d. Openness to imports (sample averages and their inter-sector range values)

	Sector code (ISIC)											
Country	15–16	17–19	20	21–22	23–25	26	27–28	29–33	34–35	36–37	All	Range
Austria	0.18	0.90	0.15	0.27	0.66	0.20	0.35	0.73	1.11	0.40	0.50	0.97
Belgium	0.39	0.88	0.53	0.48	0.73	0.31	0.46	1.27	1.15	1.05	0.72	0.97
Canada	0.13	0.54	0.07	0.13	0.29	0.28	0.25	1.12	0.70	0.36	0.39	1.05
Denmark	0.19	1.33	0.59	0.31	0.78	0.25	0.69	0.73	1.50	0.30	0.67	1.30
Finland	0.12	0.74	0.04	0.04	0.48	0.16	0.26	0.53	0.88	0.29	0.35	0.84
Germany	0.17	0.80	0.20	0.16	0.28	0.14	0.21	0.27	0.25	0.28	0.27	0.66
Italy	0.18	0.13	0.18	0.14	0.25	0.07	0.20	0.26	0.42	0.07	0.19	0.35
Japan	0.10	0.23	0.19	0.03	0.08	0.03	0.05	0.07	0.03	0.10	0.09	0.21
Netherlands	0.23	1.68	0.84	0.29	0.49	0.42	0.56	1.15	1.04	0.47	0.72	1.45
Norway	0.11	2.28	0.21	0.18	0.56	0.28	0.54	1.08	0.86	0.63	0.67	2.17
UK	0.21	0.66	0.41	0.19	0.31	0.14	0.30	0.53	0.48	0.43	0.37	0.52
USA	0.06	0.39	0.14	0.04	0.10	0.09	0.12	0.26	0.22	0.21	0.16	0.34
All	0.17	0.88	0.30	0.19	0.42	0.20	0.33	0.67	0.72	0.38	0.43	0.71

DOI: 10.1002/ijfe

A similar openness indicator is the import penetration index, which shows the share of domestic demand satisfied by imports. This index evaluates the intensity of import competition and is sometimes used as a proxy for a country's trade policy on imports.[6] The import penetration index for sector k in country j is given by

$$\mathrm{IMP}_{jk} = \frac{\mathrm{IM}_{jk}}{\mathrm{OV}_{jk} + \mathrm{IM}_{jk} - \mathrm{EX}_{jk}}. \tag{3}$$

A higher share of imports in domestic demand would indicate stronger import competition in the sector. According to our data, the Netherlands has the largest variation in import penetration across sectors, whereas Japan has the smallest (Table 1e). Averaging across countries, the sector of textiles, textile products, leather and footwear (ISIC 17–19) is most open to import competition, whereas the sector of food products, beverages and tobacco (ISIC 15–16) is least open.

Besides the IMOPEN and IMP indexes, which are sector-specific trade-based measures, our analysis includes a broader measure of economic globalization at the economy-wide level. This globalization index is constructed by the KOF Swiss Economic Institute in Zurich (Dreher *et al*., 2008), and it is a weighted composite index not just for actual flows of trade and capital but also for restrictions on both trade and capital flows. Indeed, the trade openness component constitutes less than 20% of the KOF economic globalization index. The KOF index thus covers different facets of globalization that include financial openness in addition to trade openness. It follows that the globalization index can serve as a general control variable to capture any remaining effects of globalization not explained by the other openness variables.

2.3. *Additional control variables*

Other potential determinants of inflation are introduced as control variables. Product price inflation can be driven by changes in market demand and supply conditions. To control for such effects in our estimated model, the rate of real GDP growth is used as a proxy for general demand changes, and the rate of sectoral production growth is included to capture output supply changes. The empirical analysis further controls for changes in monetary conditions. The rate of M2 money supply growth serves as a proxy for the stance of monetary policy. To reflect possible lagged effects of monetary changes, one-period lagged M2 growth is used. [7]

3. STATIC PANEL DATA ANALYSIS

The empirical relationship between sectoral inflation and its potential determinants will be analysed on the basis of both static and dynamic panel data estimation methods. The static panel data analysis examines the following fixed effects model:

Table 1e. Import penetration index (sample averages and their inter-sector range values)

	Sector code (ISIC)											
Country	15–16	17–19	20	21–22	23–25	26	27–28	29–33	34–35	36–37	All	Range
Austria	0.17	0.71	0.20	0.32	0.54	0.22	0.38	0.70	0.83	0.39	0.45	0.66
Belgium	0.43	1.08	0.50	0.44	0.93	0.37	0.57	1.19	1.14	1.10	0.77	0.82
Canada	0.13	0.38	0.14	0.18	0.28	0.25	0.27	0.68	0.73	0.32	0.34	0.60
Denmark	0.28	0.97	0.47	0.27	0.66	0.24	0.52	0.74	0.85	0.39	0.54	0.73
Finland	0.11	0.51	0.07	0.07	0.41	0.16	0.28	0.49	0.74	0.27	0.31	0.67
Germany	0.16	0.59	0.18	0.16	0.31	0.15	0.23	0.33	0.35	0.27	0.27	0.45
Italy	0.17	0.16	0.16	0.13	0.24	0.08	0.19	0.30	0.40	0.10	0.19	0.32
Japan	0.09	0.18	0.15	0.03	0.08	0.03	0.05	0.09	0.04	0.10	0.08	0.15
Netherlands	0.31	1.10	0.52	0.29	0.71	0.36	0.55	1.15	0.77	0.39	0.61	0.86
Norway	0.12	0.74	0.19	0.19	0.58	0.24	0.59	0.65	0.62	0.43	0.43	0.62
UK	0.19	0.43	0.30	0.17	0.32	0.14	0.28	0.51	0.45	0.36	0.32	0.37
USA	0.06	0.26	0.12	0.04	0.10	0.09	0.11	0.25	0.20	0.17	0.14	0.22
All	0.19	0.60	0.25	0.19	0.43	0.19	0.34	0.59	0.60	0.36	0.37	0.41

DOI: 10.1002/ijfe

$$\pi_{jkt} = X'_{jkt}\beta + Y'_{jt}\theta + \eta_j + \mu_k + \varepsilon_{jkt} \tag{4}$$

where π is the inflation rate (with j denoting the county, k the sector and t the time period), X is a vector of sector-specific explanatory variables, Y is a vector of country-specific variables, η represents country fixed effects, μ represents sectoral fixed effects and ε is the random error. Both η and μ are included to account for any country-specific or sector-specific factors that are omitted in the model. The significance of fixed effects is confirmed by the F-test, and the use of a fixed effects model instead of a random effects model is further supported by the Hausman test.

Table 2 reports the baseline regression results for model specifications without the market structure and productivity variables. When running ordinary least-squares (LS) regressions, diagnostic tests cannot rule out the presence of serial correlation in the residuals. To account for autocorrelated errors, we also perform feasible generalized LS (FGLS) regressions based on the Prais-Winsten transformation, which allows the autocorrelation scheme to vary across panel groups.[8] Overall, the results show that greater trade openness (measured as the share of imports in either domestic production or domestic demand) tends to be associated with lower inflation. Even after accounting for the effects of trade openness, economic globalization shows a significant negative relationship with inflation. The results on other control variables are largely expected. Inflation tends to increase with faster real GDP growth (a proxy for the change in aggregate demand) and also with faster money supply growth but decrease with faster sectoral production growth (a proxy for the change in product supply).

Table 3 gives the LS regression results for the full model. The PCM variable is found to be strongly significant with the correct positive sign, supporting that inflation tends to decrease with greater market competition (i.e., with a smaller PCM). Faster productivity growth, with the PCM variable included or not, also contributes significantly to lower inflation. These findings are robust cross model specifications. The significance of trade openness, on the other hand, appears sensitive to whether or not the PCM and productivity variables are added. We observe that trade openness, as measured by the level of either import openness or import penetration, is highly correlated with the PCM (although to a lesser extent with productivity growth). Once the contributions of PCM and productivity growth have both been accounted for, trade openness is left with an insignificant coefficient. Such sensitivity is instructive. It suggests that changes in market competitiveness and productivity growth together may have soaked up a very substantial portion of the effects of trade openness on inflation.

Interestingly, economic globalization still shows a significant negative relationship with inflation, even when both PCM and productivity variables are included in the estimated model. In contrast to trade openness, economic globalization is a more multidimensional composite index, measuring international integration not only through

Table 2. Baseline regressions without market structure and productivity variables

	LS regression:		FGLS Regression:	
Import openness	−1.240 (0.372)***		−0.849 (0.411)**	
Import penetration		−0.969 (0.503)*		−0.817 (0.579)
Economic globalization	−0.222 (0.010)***	−0.226 (0.011)***	−0.204 (0.013)***	−0.204 (0.014)***
Sectoral production growth	−0.402 (0.022)***	−0.401 (0.022)***	−0.397 (0.019)***	−0.397 (0.019)***
Real GDP growth	0.665 (0.075)***	0.665 (0.075)***	0.655 (0.068)***	0.656 (0.068)***
Lagged M2 growth	0.039 (0.011)***	0.039 (0.011)***	0.035 (0.010)***	0.035 (0.010)***
R^2	0.34	0.34	0.34	0.34

Notes: All regressions include both country and sector fixed effects. The FGLS regression employs the Prais-Winsten autocorrelation correction procedure. Heteroskedastic-robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.
LS, least squares; FGLS, feasible generalized LS.

DOI: 10.1002/ijfe

Table 3. Least-squares regressions with market structure and productivity factors included

	Alternative specifications			
	(a)	(b)	(c)	(d)
Price–cost margin		0.331		0.332
		(0.040)***		(0.040)***
Productivity growth	−0.442	−0.425	−0.443	−0.426
	(0.034)***	(0.032)***	(0.034)***	(0.032)***
Import openness	−0.646	−0.471		
	(0.357)*	(0.361)		
Import penetration			−0.457	−0.448
			(0.526)	(0.537)
Economic globalization	−0.220	−0.239	−0.222	−0.240
	(0.011)***	(0.011)***	(0.011)***	(0.011)***
Sectoral production growth	−0.050	−0.058	−0.049	−0.058
	(0.034)	(0.032)*	(0.034)	(0.032)*
Real GDP growth	0.470	0.389	0.469	0.388
	(0.074)***	(0.071)***	(0.074)***	(0.071)***
Lagged M2 growth	0.031	0.031	0.030	0.031
	(0.010)***	(0.010)***	(0.010)***	(0.010)***
R^2	0.40	0.41	0.40	0.41

Notes: All regressions include both country and sector fixed effects. Heteroskedastic-robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.

trade but also through foreign direct investment and capital flows (Dreher *et al.*, 2008). Without limiting itself to trade flows, this composite index can capture any residual effects of globalization not explained by trade openness. The literature is relatively thin on the inflation effects of financial openness. A few studies highlight the possible disciplinary effect of capital flows on policy making (Grilli and Milesi-Ferretti, 1995; Gruben and McLeod, 2002; Tytell and Wei, 2004). Capital flows can react negatively to bad economic policies. Countries with greater financial openness are induced to pursue more prudent policies that can maintain price stability, leading to a negative relationship between inflation and financial openness.

Table 4 contains the Prais-Winsten FGLS estimation results for the full model. These results with autocorrelation correction are largely similar to those reported in Table 3. The PCM and productivity growth are both strongly significant and have the correct sign as predicted in theory. Trade openness remains statistically insignificant when both PCM and productivity variables are included in the estimated model. We next consider an alternative method for dealing with autocorrelation in panel data regressions.

4. DYNAMIC PANEL DATA ANALYSIS

Inflation is generally known to be a rather persistent process. Such persistence can reflect the formation process of inflation expectations, structural rigidities and the conduct of monetary and fiscal policy. Hence, it is not surprising to find substantial serial correlation in the error term of the inflation equation. The Prais-Winsten approach treats the autocorrelation as a 'nuisance' in the residuals and applies a data transformation procedure to correct the problem in estimation. It does not model the temporal dependence of inflation. A more direct way to account for the inflation persistence is to introduce a lagged dependent variable. This leads us to a dynamic panel data model as follows:

$$\pi_{jkt} = \rho\pi_{jkt-1} + X'_{jkt}\beta + Y'_{jt}\theta + \eta_j + \mu_k + \varepsilon_{jkt} \tag{5}$$

Adopting this alternative modelling approach provides another check on the robustness of our empirical results. When estimating dynamic panel data models with fixed effects, the traditional LS estimator is commonly known to be biased and inconsistent (Nickell, 1981; Kiviet, 1995). To obtain consistent estimators, one approach is to use

DOI: 10.1002/ijfe

Table 4. Feasible generalized least-squares (FGLS) regressions with market structure and productivity factors included

	Alternative specifications			
	(a)	(b)	(c)	(d)
Price–cost margin		0.436		0.437
		(0.046)***		(0.046)***
Productivity growth	−0.409	−0.392	−0.410	−0.392
	(0.030)***	(0.029)***	(0.030)***	(0.029)***
Import openness	−0.706	−0.275		
	(0.387)*	(0.395)		
Import penetration			−0.625	−0.122
			(0.574)	−0.61
Economic globalization	−0.202	−0.235	−0.202	−0.236
	(0.014)***	(0.014)***	(0.014)***	(0.015)***
Sectoral production growth	−0.071	−0.078	−0.070	−0.078
	(0.029)**	(0.027)***	(0.029)**	(0.027)***
Real GDP growth	0.524	0.440	0.524	0.439
	(0.065)***	(0.061)***	(0.065)***	(0.061)***
Lagged M2 growth	0.027	0.025	0.027	0.025
	(0.010)***	(0.010)**	(0.010)***	(0.010)**
R^2	0.40	0.42	0.40	0.42

Notes: All regressions include both country and sector fixed effects. The FGLS regression employs the Prais-Winsten autocorrelation correction procedure. Heteroskedastic-robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.

instrumental variables (IV) and generalized method of moments (GMM) procedures (Anderson and Hsiao, 1982; Arellano and Bond, 1991; Blundell and Bond, 1998). Although these GMM/IV estimators have good asymptotic properties, they can still yield severely biased estimates in finite-sample applications, especially when the number of cross-sectional observations is not large, as in most panels of macroeconomic data. In addition, GMM/IV estimators are shown in simulation studies to have a larger variance than LS estimators (Kiviet, 1995; Judson and Owen, 1999).

Table 5. Dynamic model regressions with bias correction

	Alternative specifications			
	(a)	(b)	(c)	(d)
Price–cost margin		0.320		0.321
		(0.036)***		(0.035)***
Productivity growth	−0.439	−0.423	−0.439	−0.423
	(0.026)**	(0.026)***	(0.026)**	(0.026)***
Import openness	−0.538	−0.397		
	(0.581)	(0.570)		
Import penetration			−0.447	−0.492
			(0.824)	(0.807)
Economic globalization	−0.216	−0.238	−0.217	−0.238
	(0.012)**	(0.012)***	(0.012)**	(0.013)***
Sectoral production growth	−0.052	−0.060	−0.051	−0.059
	(0.028)	(0.028)**	(0.028)	(0.028)**
Real GDP growth	0.495	0.412	0.494	0.411
	(0.066)**	(0.066)***	(0.066)**	(0.066)***
Lagged M2 growth	0.029	0.032	0.029	0.032
	(0.011)**	(0.011)***	(0.011)**	(0.011)***
Lagged inflation	0.091	0.075	0.092	0.075
	(0.014)**	(0.014)***	(0.014)**	(0.014)***
R^2	0.42	0.43	0.42	0.43

Notes: All regressions include both country and sector fixed effects. Heteroskedastic-robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.

DOI: 10.1002/ijfe

Our analysis here uses the bias-corrected LS estimator proposed recently by Bruno (2005, 2005). This approach to bias correction has gained increasing popularity in research. Using asymptotic expansion techniques, Kiviet (1995, 1999) derives explicit approximation formulas for correcting the finite-sample bias of the LS estimator. Bun and Kiviet (2003) reformulate Kiviet's (1999) bias approximation using a simpler formula (see also Bun and Carree, 2005). To broaden the applicability of the bias-corrected procedure, Bruno (2005) generalizes the bias approximation formula of Bun and Kiviet (2003) and extends the analysis to cover unbalanced panels. The bias-correction procedure needs some first-round consistent estimates, for which the Blundell and Bond (1998) system GMM estimator is used in our study.[9] As recommended by Kiviet and Bun (2001), the variance–covariance matrix of coefficient estimates is obtained from bootstrap simulation, given its relative accuracy and easy applicability to unbalanced panels.

Table 5 presents the bias-corrected estimation results for the dynamic panel data model. There is substantial evidence confirming the persistence in inflation dynamics. Lagged inflation is uniformly found to have a significant positive coefficient, rendering support for the use of the dynamic panel data model. Overall, the change in the econometric model does not alter our main findings reported earlier. Inflation is still found to decrease with greater market competition (i.e., with a lower PCM) and with faster productivity growth as well. Economic globalization keeps showing a significant dampening effect on inflation. On the other hand, trade openness (as measured in terms of either import openness or import penetration) remains insignificant in explaining inflation when market competitiveness and productivity variables are included in the regression.

5. FURTHER ANALYSIS AND DISCUSSION

Previous studies often use the logarithm of GDP per capita to control for the potential impact of a country's economic development on inflation. As recommended by Romer (1993), this general proxy measure of economic development can be useful for capturing a variety of factors influencing inflation, including a country's aversion to

Table 6. Dynamic model regressions with a control variable for economic development added

	Alternative specifications			
	(a)	(b)	(c)	(d)
Price–cost margin		0.354		0.351
		(0.034)***		(0.034)***
Productivity growth	−0.443	−0.427	−0.443	−0.426
	(0.026)***	(0.026)***	(0.026)***	(0.026)***
Import openness	0.445	0.753		
	(0.573)	(0.573)		
Import penetration			0.835	0.976
			(0.813)	(0.811)
Economic globalization	−0.097	−0.106	−0.098	−0.108
	(0.023)***	(0.024)***	(0.023)***	(0.024)***
Sectoral production growth	−0.047	−0.055	−0.047	−0.055
	(0.027)*	(0.028)**	(0.027)*	(0.027)**
Real GDP growth	0.448	0.349	0.448	0.351
	(0.066)***	(0.067)***	(0.066)***	(0.066)***
Lagged M2 growth	0.027	0.029	0.026	0.029
	(0.011)**	(0.011)***	(0.011)**	(0.011)***
Lagged inflation	0.077	0.058	0.077	0.058
	(0.013)***	(0.014)***	(0.013)***	(0.013)***
GDP per capita	−7.097	−8.046	−7.146	−7.991
	(1.039)***	(1.029)***	(1.038)***	(1.030)***
R^2	0.43	0.44	0.43	0.44

Notes: All regressions include both country and sector fixed effects. The GDP per capita variable is included as a control variable for the level of economic development of a country. Robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.

inflation and possible inflation tax considerations (Campillo and Miron, 1997; Lane, 1997; Neiss, 2001). In previous studies, higher GDP per capita is often found to be associated with lower inflation.

We observe that the globalization index is positively correlated with GDP per capita (giving a sample correlation of 0.19) and that two-way feedback effects may likely exist. Although trade and financial openness may help promote economic development, the level of economic development can shape policies and institutions that support trade and financial openness. In any case, given their positive correlation, omitting GDP per capita in the regression equation can bias the coefficient estimate for globalization upward.

We re-estimate the dynamic panel data model with nominal GDP per capita added as a control variable. The results from dynamic panel regressions are reported in Table 6. In accord with those results reported in previous studies, GDP per capita shows up with a significant negative coefficient, confirming that countries with a higher level of economic development tend to have lower inflation. Although including GDP per capita among the regressors reduces the estimated coefficient on globalization, globalization continues to be an important determinant of inflation. Introducing the additional control variable also does not affect the significance of PCM, which is still highly significant and has the correct positive sign. Neither does it change the significant negative relationship between productivity growth and inflation. In sum, our main findings remain unchanged even after taking the level of economic development into account.

5.1. *De jure* versus *de facto* measure of globalization

In measuring the extent of economic globalization, a distinction is sometimes drawn between *de jure* measures (based on the level of restrictions governing trade and financial flows) and *de facto* measures (based on the size of actual flows). These two types of globalization measures are not perfectly correlated, and they do not always agree

Table 7. Dynamic model regressions using a *de jure* versus a *de facto* measure of globalization

	Regressions using a *de jure* globalization measure				Regressions using a *de facto* globalization measure			
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
Price–cost margin		0.354 (0.034)***		0.352 (0.034)***		0.348 (0.035)***		0.345 (0.035)***
Productivity growth	−0.431 (0.026)**	−0.414 (0.026)***	−0.431 (0.026)**	−0.413 (0.026)***	−0.442 (0.026)***	−0.426 (0.026)***	−0.441 (0.026)***	−0.425 (0.026)***
Import openness	0.189 (0.577)	0.485 (0.576)			0.466 (0.578)	0.777 (0.578)		
Import penetration			0.187 (0.810)	0.282 (0.808)			0.675 (0.813)	0.835 (0.812)
Globalization (*de jure*)	−0.148 (0.022)**	−0.154 (0.022)***	−0.148 (0.022)**	−0.155 (0.022)***				
Globalization (*de facto*)					−0.020 (0.017)	−0.027 (0.017)	−0.021 (0.016)	−0.029 (0.017)*
Sectoral production growth	−0.065 (0.028)*	−0.075 (0.028)***	−0.066 (0.027)*	−0.076 (0.027)**	−0.048 (0.027)*	−0.055 (0.028)**	−0.048 (0.027)*	−0.056 (0.027)**
Real GDP growth	0.449 (0.066)**	0.350 (0.067)***	0.450 (0.066)**	0.352 (0.066)***	0.442 (0.067)***	0.345 (0.067)***	0.442 (0.066)***	0.347 (0.067)***
Lagged M2 growth	0.016 (0.011)	0.018 (0.011)	0.016 (0.011)	0.019 (0.011)*	0.033 (0.010)***	0.036 (0.010)***	0.033 (0.010)***	0.036 (0.010)***
Lagged inflation	0.076 (0.013)**	0.057 (0.013)***	0.076 (0.013)**	0.057 (0.013)***	0.083 (0.013)***	0.063 (0.013)***	0.082 (0.013)***	0.063 (0.013)***
GDP per capita	−7.274 (0.718)**	−8.447 (0.712)***	−7.257 (0.698)**	−8.313 (0.696)***	−9.957 (0.987)***	−10.857 (0.981)***	−9.942 (1.004)***	−10.75 (1.000)***
R^2	0.43	0.45	0.43	0.45	0.42	0.44	0.42	0.44

Notes: All regressions include both country and sector fixed effects. The GDP per capita variable is included as a control variable for the level of economic development of a country. Robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.

DOI: 10.1002/ijfe

with one another. For instance, *de jure* measures could indicate a relatively low degree of trade or financial openness, whereas *de facto* measures could indicate the opposite.

The globalization measure employed in our analysis is a composite index constructed as a weighted average of *de jure* and *de facto* measures. As a robustness check, we redo our dynamic model regressions using the *de jure* and the *de facto* component of the index alternately.[10] The results from using the *de jure* index are displayed along side with those from using the *de facto* index in Table 7. Regardless of whether the *de jure* or the *de facto* index is used, similar results are obtained in terms of the significance of both market competition and productivity effects. On the other hand, whereas the *de jure* measure is statistically significant, the same does not apply to the *de facto* measure. Hence, for our empirical exercise here, the *de jure* measure seems more able to capture the effects of globalization on inflation than the *de facto* measure does. In any case, the distinction made between the *de jure* and the *de facto* globalization measure has little impact on the key results of our analysis.

5.2. *Subsample analysis*

To further evaluate the robustness of our main results, we conduct additional subsample analysis. Most of the countries entering the panel are European Union (EU) countries. In our subsample analysis, two separate smaller panels are examined: one for EU countries and another for non-EU countries. Their results are displayed in Table 8. Both market competition and productivity effects are still found to be strongly significant and have a correct sign for both EU and non-EU panels. On the other hand, whereas the globalization effect remains significant for the EU panel, it turns insignificant for the non-EU panel. The change in finding may suggest that market competition and productivity growth play an even more important role in explaining inflation among non-EU countries than among EU countries. Nevertheless, extra caution needs to taken when interpreting the subsample results here. The

Table 8. Dynamic model regressions for different subsample country groups (EU versus non-EU countries)

	Regressions using data from EU countries				Regressions using data from non-EU countries			
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
Price–cost margin		0.393 (0.044)***		0.390 (0.044)***		0.313 (0.057)***		0.313 (0.056)***
Productivity growth	−0.408 (0.026)***	−0.393 (0.026)***	−0.408 (0.027)***	−0.393 (0.026)***	−0.573 (0.054)***	−0.550 (0.054)***	−0.574 (0.054)***	−0.550 (0.054)***
Import openness	0.504 (0.560)	0.701 (0.555)			−0.828 (1.777)	0.017 (1.787)		
Import penetration			0.901 (0.718)	0.861 (0.712)			−0.671 (3.040)	0.277 (3.031)
Economic globalization	−0.112 (0.017)***	−0.128 (0.017)***	−0.113 (0.017)***	−0.129 (0.017)***	0.065 (0.094)	0.025 (0.094)	0.065 (0.096)	0.025 (0.096)
Sectoral production growth	−0.036 (0.024)	−0.044 (0.024)*	−0.036 (0.024)	−0.045 (0.024)*	−0.086 (0.042)**	−0.096 (0.042)**	−0.085 (0.042)**	−0.096 (0.042)**
Real GDP growth	0.403 (0.057)***	0.304 (0.052)***	0.403 (0.057)***	0.305 (0.052)***	0.564 (0.120)***	0.445 (0.123)***	0.562 (0.120)***	0.444 (0.123)***
Lagged M2 growth	0.033 (0.013)**	0.037 (0.013)***	0.033 (0.013)**	0.037 (0.013)***	0.006 (0.020)	0.001 (0.020)	0.006 (0.020)	0.001 (0.020)
Lagged inflation	0.066 (0.017)***	0.045 (0.016)***	0.065 (0.017)***	0.045 (0.016)***	0.09 (0.027)***	0.07 (0.027)**	0.09 (0.027)***	0.07 (0.027)**
GDP per capita	−6.192 (0.979)***	−6.474 (0.971)***	−6.250 (0.967)***	−6.415 (0.958)***	−13.116 (3.200)***	−14.575 (3.224)***	−13.237 (3.190)***	−14.614 (3.211)***
R^2	0.42	0.44	0.42	0.44	0.47	0.48	0.47	0.48

Notes: All regressions include both country and sector fixed effects. The GDP per capita variable is included as a control variable for the level of economic development of a country. Robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.

DOI: 10.1002/ijfe

non-EU panel consists of three countries only and may fail to have sufficient cross-sectional variation in the data to unveil the systematic relationship that we seek.

In addition to the analysis by country group, we also carry out subsample analysis by time period. As a robustness check, we split the sample period into two halves. The subsample analysis can help offer some insight into whether our findings reflect just a relatively recent phenomenon or apply to a more long-term trend. Interestingly, the first half of the data sample covers a period of relatively high inflation, whereas the second half covers a period of relatively low inflation for all the countries under study.[11] In fact, the average difference in the inflation rate exceeds 3.5 percentage points between the two subsample periods. It is interesting to see how our core results fare with a high inflation as opposed to a low-inflation environment.

The results from the two subsample periods are shown in Table 9. Again, our core results hold independent of the subsample period. The subsample results, in general, confirm that both market competition and productivity factors play an important role in determining inflation and that once the effects of market competitiveness and productivity changes have been taken into account, trade openness makes no significant additional contribution to explaining inflation. The overall evidence consistently supports that the effects of trade openness on inflation operate primarily through changes in market competitiveness and productivity.

5.3. Common component of price–cost margin and trade openness

The sample correlation of market competiveness with trade openness is relatively high compared with that with the other variables.[12] Including such correlated series into the same regression as explanatory variables can cloud the interpretations of results. To explore this issue more, we conduct principal component analysis, which enables us to generate a set of uncorrelated variables (referred to as components) from correlated variables while preserving the data information carried by the variables. These components are then used in place of the original variables in

Table 9. Dynamic model regressions for different subsample periods (first half versus second half)

	Regressions using data from the first-half period				Regressions using data from the second-half period			
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
Price–cost margin		0.656		0.648		0.383		0.384
		(0.083)***		(0.085)***		(0.041)***		(0.041)***
Productivity growth	−0.502	−0.455	−0.503	−0.457	−0.422	−0.400	−0.424	−0.401
	(0.039)***	(0.038)***	(0.039)***	(0.038)***	(0.028)***	(0.028)***	(0.028)***	(0.028)***
Import openness	2.161	3.105			−0.905	−0.222		
	(1.995)	(1.928)			(0.642)	(0.635)		
Import penetration			0.255	0.287			−0.869	−0.23
			(3.368)	(3.323)			(0.706)	(0.687)
Economic globalization	−0.082	−0.227	−0.075	−0.215	−0.095	−0.105	−0.094	−0.105
	(0.074)	(0.080)***	(0.079)	(0.084)**	(0.024)***	(0.024)***	(0.024)***	(0.024)***
Sectoral production growth	−0.043	−0.056	−0.042	−0.055	−0.038	−0.061	−0.036	−0.060
	(0.036)	(0.035)	(0.036)	(0.035)	(0.029)	(0.029)**	(0.029)	(0.029)**
Real GDP growth	0.220	−0.016	0.220	−0.013	0.560	0.497	0.556	0.496
	(0.076)***	(0.086)	(0.076)***	(0.087)	(0.061)***	(0.060)***	(0.060)***	(0.059)***
Lagged M2 growth	0.019	0.030	0.019	0.030	−0.024	−0.024	−0.025	−0.024
	(0.018)	(0.017)*	(0.018)	(0.017)*	(0.012)**	(0.012)**	(0.012)**	(0.012)**
Lagged inflation	0.065	0.030	0.065	0.031	0.040	0.013	0.040	0.013
	(0.023)***	(0.022)	(0.023)***	(0.022)	(0.020)*	(0.020)	(0.020)**	(0.020)
GDP per capita	−16.846	−13.739	−16.478	−13.235	0.123	−1.045	−0.022	−1.075
	(2.956)***	(3.055)***	(2.857)***	(2.961)***	(1.126)	(1.121)	(1.108)	(1.098)
R^2	0.37	0.40	0.37	0.40	0.37	0.39	0.37	0.39

Notes: All regressions include both country and sector fixed effects. The GDP per capita variable is included as a control variable for the level of economic development of a country. The average inflation rate over the first-half sample period is 6.14%, and the average inflation rate over the second-half sample period is 1.43%. Robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.

the regression model. For our analysis here, we estimate the principal component of PCM and trade openness and compute their corresponding idiosyncratic components after taking out their common principal component. We evaluate the significance of PCM and trade openness in explaining inflation with or without their common component included in the regression.

Table 10 contains the results from dynamic panel regressions with or without the common principal component of PCM and trade openness (measured by the import penetration index) included. As expected, the common component is confirmed to be strongly significant when it is included in the regression. With the common component separated out, trade openness continues to show little additional effect on inflation, whereas market competitiveness remains a significant determinant of inflation. A similar finding can be obtained, regardless of whether or not the common component of PCM and trade openness is added back to the regression. In general, the evidence underscores the importance of market competitiveness in explaining inflation and bears out the robustness of this finding.

6. CONCLUDING REMARKS

This study examines whether market competition and productivity changes are the main channels through which trade openness affects sectoral inflation in OECD countries. Both static and dynamic panel data models are applied. The use of sectoral data rather than national aggregate data recognizes that trade openness, market competitiveness and productivity changes can all vary substantially across sectors even within the same country. In theory, trade openness can affect inflation through changes in market competitiveness and productivity. Nevertheless, previous empirical studies generally fail to account for productivity effects, and their results may overstate the role of market competition. This study shows that inflation decreases with greater market competition

Table 10. Dynamic model regressions with or without the common component of price–cost margin (PCM) and trade openness included

	Alternative specifications	
	(a)	(b)
Common component of PCM and trade openness		1.159
		(0.190)**
PCM (common component removed)	0.323	0.364
	(0.116)**	(0.116)**
Trade openness (common component removed)	1.985	0.808
	(1.100)	(1.143)
Productivity growth	−0.439	−0.427
	(0.026)**	(0.026)**
Economic globalization	−0.108	−0.107
	(0.024)**	(0.024)**
Sectoral production growth	−0.045	−0.055
	(0.027)	(0.028)*
Real GDP growth	0.381	0.348
	(0.068)**	(0.067)**
Lagged M2 growth	0.026	0.029
	(0.011)*	(0.011)**
Lagged inflation	0.065	0.058
	(0.014)**	(0.014)**
GDP per capita	−8.725	−8.08
	(1.016)**	(1.036)**
R^2	0.44	0.44

Notes: All regressions include both country and sector fixed effects. The common component of PCM and trade openness (measured as import penetration) is computed using principal component analysis. The GDP per capita variable is included as a control variable for the level of economic development of a country. Robust standard errors are given in parentheses. Statistical significance is indicated by a single asterisk (*) for the 10% level, by double asterisks (**) for the 5% level and by triple asterisks (***) for the 1% level.

DOI: 10.1002/ijfe

(proxied by the PCM) even after accounting for productivity effects. Furthermore, our results support that market competitiveness and productivity changes are the main channels through which trade openness affects inflation. Once the effects of market competition and productivity changes have both been taken into account, the remaining effect of trade openness on inflation becomes statistically insignificant. The use of different modelling strategies, alternate explanatory variables, and subsample analysis generally confirms the robustness of our findings.

In contrast to trade openness, we observe that economic globalization (measured by a more comprehensive composite index of trade flows, capital flows and their restrictions) is still found to have a significant negative relationship with inflation, even after accounting for the contributions of market competition and productivity changes. These results suggest that different aspects of globalization other than trade openness may play a significant role in influencing inflation. Further research is warranted to identify these other contributing factors.

APPENDIX

Data series	Data source
Production or gross output (current prices)	OECD's STAN database
Value added (current prices)	OECD's STAN database
Value added (volume indices)	OECD's STAN database
Labour compensation of employees	OECD's STAN database
Total employment	OECD's STAN database
Exports of goods (current prices)	OECD's STAN database
Imports of goods (current prices)	OECD's STAN database
Economic globalization index	KOF Swiss Economic Institute
Real GDP (constant prices)	World Bank's WDI database
Nominal GDP (current prices)	World Bank's WDI Database
GDP per capita (current prices)	World Bank's WDI Database
M2	IMF's IFS database

NOTES

1. Along a related line of investigation, some studies look at the role of structural factors in inflation dynamics. Romer (1993) and Lane (1997) point out that more open economies benefit less from creating surprise inflation due either to its adverse term-of-trade effects or to the lower share of monopolistically produced non-traded goods in consumption. Also, see Seldadyo and de Haan (2011) and Teo and Yang (2011).
2. The analytical argument is that stronger market competition can alleviate the distortions in monopolistic sectors and make prices more flexible, thereby lessening the central bank's incentive to inflate (see, for example, Rogoff, 2003).
3. Individual data series used are described in the data appendix.
4. In preliminary analysis, we also considered another market structure indicator that showed the extent of intra industry trade (IIT). The IIT index, proposed by Grubel and Lloyd (1975), would gauge the degree of firms' market power arising from product differentiation in a given industry. However, the IIT variable was found to be generally insignificant and sometimes even produce an incorrect sign. We thus took out this variable in our final analysis.
5. Trade openness has sometimes been broadly measured in terms of total trade (exports plus imports). Given that our present study focuses on the possible effects of trade on domestic market competition, we use a more targeted measure that gauges the extent of openness to imports.
6. See Greenaway *et al*. (2008) for a recent empirical study using the import penetration measure.
7. In our previous analysis (Binici *et al*., 2008), a measure of central bank (CB) independence was also included to control for the potential role of monetary commitment and independence. This measure, suggested by Ghosh *et al*. (2003), was constructed on the basis of the notion that a higher turnover of central bank governors would signify a lower level of CB independence. Because the CB independence variable was found to be generally insignificant and because more recently updated data were not available, this variable was later dropped from our analysis.
8. A recent study by Baltagi *et al*. (2007) underscores that generalized least squares estimators have better statistical properties than ordinary least squares estimators and some other fixed-effects estimators. Also see Oh and Evans (2011).
9. Compared with the Arellano and Bond (1991) generalized method of moments estimator, the Blundell and Bond (1998) estimator can be more efficient by using stronger IVs. Nonetheless, we checked the statistical results and found these two estimators to produce very similar results in our analysis.
10. In our data, the *de jure* and *de facto* variables have a sample correlation coefficient of 0.70.
11. The authors are indebted to an anonymous referee for this point.
12. The correlation between price–cost margin and trade openness is about −0.33, whereas the correlation between price–cost margin and trade penetration is about −0.36 in our data.

DOI: 10.1002/ijfe

REFERENCES

Alesina A, Summers LH. 1993. Central bank independence and macroeconomic performance: some comparative evidence. *Journal of Money, Credit, and Banking* **25**: 151–162.

Anderson TW, Hsiao C. 1982. Formulation and estimation of dynamic models using panel data. *Journal of Econometrics* **18**: 47–82.

Arellano M, Bond S. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* **58**: 277–297.

Ball LM. 2006. Has globalization changed inflation? NBER Working Paper, No. 12687.

Baltagi BH, Kao C, Liu L. 2007. Asymptotic properties of estimators for the linear panel regression model with individual effects and serially correlated errors: the case of stationary and non-stationary regressors and residuals. Center for Policy Research Working Paper No. 93.

Barro R, Gordon D. 1983. A positive theory of monetary policy in a natural rate model, *Journal of Political Economy* **91**: 589–610.

Binici M, Cheung Y-W, Lai KS. 2008. Trade openness, market competition, and inflation: some sectoral evidence from OECD countries. Discussion Paper, University of California, Santa Cruz.

Blundell R, Bond S. 1998. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics* **87**: 115–143.

Borio C, Filardo A. 2007. Globalization and inflation: new cross-country evidence on the global determinants of domestic inflation. BIS Working Papers, No 227.

Brumm HJ. 2000. Inflation and central bank independence: conventional wisdom redux. *Journal of Money, Credit, and Banking* **32**: 807–819.

Bruno GSF. 2005a. Approximating the bias of the LSDV estimator for dynamic unbalanced panel data models. *Economics Letters* **87**: 361–366.

Bruno GSF. 2005b, Estimation and inference in dynamic unbalanced panel data models with a small number of individuals. CESPRI Working Paper No. 165.

Bun MJG, Carree MA. 2005. Bias-corrected estimation in dynamic panel data models. *Journal of Business and Economic Statistics* **23**: 200–210.

Bun MJG, Kiviet JF. 2003. On the diminishing returns of higher order terms in asymptotic expansions of bias. *Economics Letters* **79**: 145–152.

Campa J, Goldberg LS. 1995. Investment in manufacturing, exchange rates and external exposure. *Journal of International Economics* **38**: 297–320.

Campillo M, Miron JA. 1997. Why does inflation differ across countries? In Reducing Inflation: Motivation and Strategy, Romer CD, Romer DH (eds). University of Chicago Press: Chicago; 335–357.

Chen NA, Imbs JM, Scott A. 2009. The dynamics of trade and competition. *Journal of International Economics* **77**: 50–62.

Cox WM. 2007. Globalization, aggregate productivity, and inflation. Federal Reserve Bank of Dallas Staff Papers, No. 1; 1–24.

Cukierman A. 1992. Central Bank Strategy, Credibility and Independence: Theory and Evidence. MIT Press: Cambridge, MA.

Dreher A, Gaston N, Martens P. 2008. Measuring Globalization: Gauging Its Consequences. Springer: New York.

Fuhrer JC. 1997. Central bank independence and inflation targeting: monetary policy paradigms for the next millennium? *New England Economic Review*, 19–36.

Ghosh AR, Gulde A-M, Wolf HC. 2003. Exchange Rate Regimes: Choices and Consequences. the MIT press: Cambridge, MA.

Greenaway D, Gullstrand J, Kneller R. 2008. Surviving globalization. *Journal of International Economics* **74**: 264–277.

Grilli V, Milesi-Ferretti GM. 1995. Economic effects and structural determinants of capital controls. *IMF Staff Papers* **42**: 517–551.

Grubel HG, Lloyd PJ. 1975. Intra-industry Trade: The Theory and Measurement of International Trade in Differentiated Products. Wiley: New York.

Gruben WC, McLeod D. 2002. Capital account liberalization and inflation. *Economics Letters* **77**: 221–225.

Helbling T, Jaumotte F, Sommer M. 2006. How has globalization affected inflation? World Economic Outlook, IMF; 97–134. Washington DC.

Judson RA, Owen AL. 1999. Estimating dynamic panel data models: a guide for macroeconomists. *Economics Letters* **65**: 9–15.

Keller W. 2004. International technology diffusion. *Journal of Economic Literature* **42**: 752–782.

Kiviet JF. 1995. On bias, inconsistency, and efficiency of various estimators in dynamic panel data models. *Journal of Econometrics* **68**: 53–78.

Kiviet JF. 1999. Expectation of expansions for estimators in a dynamic panel data model; some results for weakly exogenous regressors. In Analysis of Panel Data and Limited Dependent Variables, Hsiao C, Lahiri K, Lee L-F, Pesaran MH (eds). Cambridge University Press: Cambridge.

Kiviet JF, Bun MJG. 2001. The accuracy of inference in small samples of dynamic panel data models. Tinbergen Institute Discussion Paper TI 2001-006/4.

Kydland F, Prescott E. 1977. Rules rather than discretion: the inconsistency of optimal plans. *Journal of Political Economy* **85**: 473–492.

Lane PR. 1997. Inflation in open economies. *Journal of International Economics* **42**: 327–347.

Loungani P, Razin A. 2005. Globalization and disinflation: the efficiency channel. CEPR Discussion Papers, No. 4895.

Melitz MJ, Ottaviano GIP. 2008. Market size, trade, and productivity. *Review of Economic Studies* **75**: 295–316.

Neiss KS. 2001. The markup and inflation: evidence in OECD countries. *Canadian Journal of Economics* **34**: 570–587.

Nickell S. 1981. Biases in dynamic models with fixed effects. *Econometrica* **49**: 1417–1426.

Oh K-Y, Evans P. 2011. Test of the convergence hypothesis allowing for cross-sectional dependence. *Pacific Economic Review* **16**: 302–312.

DOI: 10.1002/ijfe

Pain N, Koske I, Sollie M. 2006. Globalization and inflation in the OECD economies. OECD Economics Department Working Papers No. 524.

Przybyla M, Roma M. 2005. Does product market competition reduce inflation? Evidence from EU countries and sectors. ECB Working Paper Series, No.453.

Rogoff K. 1985. The optimal degree of commitment to an intermediate monetary target. *Quarterly Journal of Economics* **100**: 1169–1189.

Rogoff K. 2003. Globalization and global disinflation. Federal Reserve Bank of Kansas City Economic Review, No. 4; 45–78.

Romer D. 1993. Openness and inflation: theory and evidence. *Quarterly Journal of Economics* **108**: 869–903.

Sachsida A, Galrão Carneiro F, Loureiro PRA. 2003. Does greater trade openness reduce inflation? Further evidence using panel data techniques. *Economics Letters* **81**: 315–319.

Sbordone AM. 2008. Globalization and inflation dynamics: the impact of increased competition. Federal Reserve Bank of New York Staff Reports No. 324.

Seldadyo H, De Haan J. 2011. Is corruption really persistent? *Pacific Economic Review* **16**: 192–206.

Teo, WL, Yang PC. 2011. Welfare cost of inflation in a New Keynesian Model, *Pacific Economic Review* **16**: 313–338

Tytell I, Wei S-J. 2004. Does financial globalization induce better macroeconomic policies?, IMF Working Paper, No. 84.

DOI: 10.1002/ijfe