The arrival of cheap goods: measuring the impact of Chinese import competition on Nordic prices

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ABSTRACT. What is the impact of Chinese import competition on Nordic producer prices? This article examines whether labor-intensive exports from China have an impact on inflation in three Nordic countries. In a panel covering manufacturing sectors from 1995 to 2008, the results show that when Chinese exporters capture 1% of Nordic market share, producer prices decrease by about 2.0%. This Chinese price effect, which entails a drop of 14% in producer prices for the analyzed sample, re-confirms the view that prices in small, open economies are highly susceptible to the dampening effect of low-wage imports. The policy implications of these trade forces are discussed.

1. Introduction

It is well documented that China is relatively abundant in low-skilled labor and exports a significant volume of labor-intensive goods to large economies such as Europe, Japan, and the United States. Numerous studies have therefore attempted to determine whether imports from China have held down inflation in these large economies.[4] Despite the observation that smaller economies tend to be more open to trade than larger economies, these empirical studies have not been able to rigorously examine whether Chinese import penetration has also dampened price growth in small, open economies.

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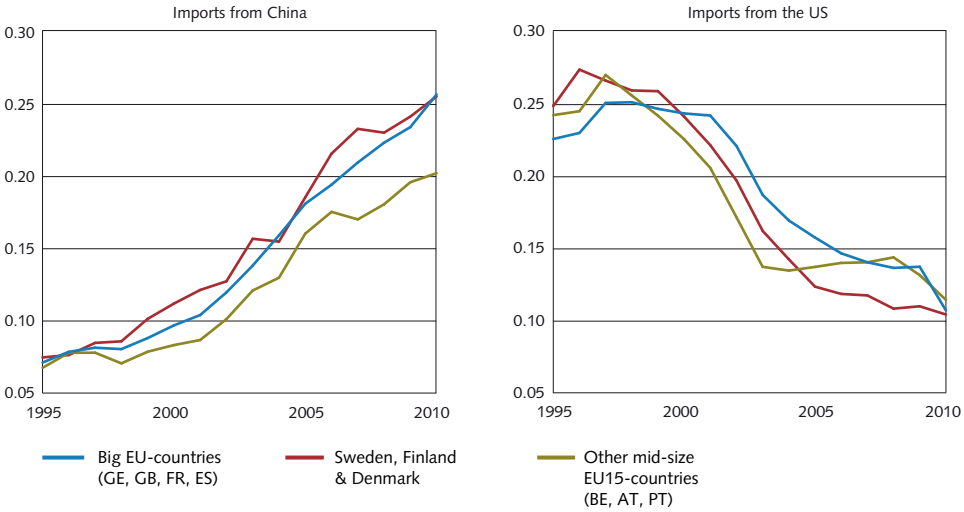
4 Micro studies using 2- and 4-digit price data include Bugamelli et al. (2010) for Italy, WEO (2006) for Europe, Broda and Weinstein (2010) for Japan, Wheeler for the United Kingdom, and Auer and Fischer (2010) and Kamin et al. (2008) for the United States. Borio and Filardo (2007), Gamber and Hung (2001), Ihrig et al. (2007), Pain et al. (2006), and Tootell (1998) use conventional specifications of Phillips curves to determine the role of foreign output gaps on (aggregate) domestic inflation.

The Nordic region represents an exceptional case of Chinese import penetration, which is evident when we look at Figure 1. The left-hand side of Figure 1 plots the Chinese import share with respect to manufacturing output for three European regions: Nordic (Denmark, Finland, and Sweden – due to lack of data, Norway and Iceland are not included), large European countries (France, Germany, Italy, Spain, and the United Kingdom), and small European countries (Austria, Belgium, and Portugal). It shows that Chinese exports captured only 5% of the Nordic market share of non-EU trade in 1995 and that this percentage climbed steadily to above 25% in 2010. This market share for the three Nordic countries lies above Europe's share for the five largest countries for most of the period. More importantly, this increase in Chinese market share has primarily come at the expense of U.S. exports. The right-hand side of Figure 1 shows a near homogenous fall in U.S. export market share for the three European regions. With this switch from high-wage to low-wage imports, we ask what the impact of Chinese import competition is on Nordic producer prices.

Figure 1. Share of US- & China-imports on all Outside-EU15-Imports



Source: Eurostat.

This article focuses on manufacturing imports and documents the fact that Chinese trade has had a profound impact on Nordic inflation. We use an empirical strategy that assumes that Chinese trade is endogenous to domestic demand. It is therefore important to find a variable that affects Chinese exports to the Nordic countries without having an impact on inflation in these countries except through changes in Chinese exports. The challenge is to find a valid instrumental variable (IV). Our IV strategy follows Auer and Fischer (2010) and is based on the observation that when Chinese manufacturing output grows, Chinese exports to the Nordic region increase in labor-intensive sectors relative to capital-intensive sectors. Nordic imports of Chinese manufacturing products are heavily

concentrated in labor-intensive industries. Regression analysis shows that this specialization also holds at the margin: for example, when China's manufacturing output rises, Chinese exports increase much more in labor-intensive sectors than in capital intensive sectors.

Using this empirical strategy in a panel covering 23 manufacturing sectors from 1995 to 2008 (2-digit sectors classified by the European industrial classification system, NACE), we show that producer prices decrease by about 2.0% when Chinese exporters increase their market share in the Nordic countries by 1%. Because China gained a market share of 7% in the manufacturing sector over the analyzed period, the price effect translates into a 14% reduction in Nordic producer prices. This result re-confirms the view that prices in small, open economies are highly susceptible to the dampening effect of low-wage imports.

This article proceeds as follows: section 2 discusses the empirical framework and the data in the context of Chinese exports. Section 3 presents IV estimates of China's impact on (aggregate) Nordic producer prices. Section 4 offers concluding remarks on the effect of labor-intensive goods and their implications for inflation in small, open markets.

2. Empirical framework and data

The discussion of the empirical framework is presented in two subsections. The regression model and the IV strategy are discussed in subsection 2.1. Data description and sources are offered in subsection 2.2.

2.1 IDENTIFYING THE EFFECT OF IMPORT COMPETITION

Identifying the effect of import competition on prices is difficult because of the problem of distinguishing between supply and demand shocks. For example, winter jackets in Sweden become cheaper when tariffs on imports from China are removed. Nevertheless, if demand was simultaneously increased by a cold winter, the equilibrium price would not necessarily decrease. Yet it is exactly the supply side that we must seek to identify if we want to know how much more expensive jackets would have been without cheap imports. Because current studies using ordinary least squares (OLS) cannot identify the supply and demand shocks that cause changes in trade flows, they cannot establish the true effect of import competition on prices.

At the heart of the Auer and Fischer (2010) strategy lies the simple observation that when labor-abundant nations grow, their exports tend to increase most in sectors that intensively use labor as a factor of production. Auer and Fischer (2010) and Auer et al. (2011) show that U.S. and European imports originating from low-income countries are highly concentrated in labor-intensive sectors. This relation is also shown to hold across time. In other words, if China's output capacity grows, its exports increase most in labor-intensive sectors.

This observation gives Auer and Fischer (2010) an empirical lever on supply side changes that does not depend upon the price. With this lever, the supply and demand effects can be separated. Building on the fact that the change in imports at the sector level is related to

the sector's labor intensity, the effect of import competition from China on Nordic producer prices is estimated controlling for both sector-specific trends and aggregate shocks. When China grows above trend, Nordic imports in labor-intensive sectors increase relative to Nordic imports in capital-intensive sectors. This difference in the reaction of sectoral import volume to Chinese growth is utilized to establish the effect of imports on Nordic producer prices.

More formally, we begin with the true relation between Nordic price changes and Chinese import changes. It is assumed to be specified as follows:

$$\Delta p_{j,t}^{NORD} = \alpha_j + \beta \Delta m_{j,t}^{CHN} + \varepsilon_t + \varepsilon_{j,t}, \qquad (1)$$

where $p_{j,t}^{NORD}$ denotes Nordic prices at time t for sector j and $m_{j,t}^{CHN}$ denotes Nordic imports in sector j from China. The industry-specific trend of Nordic prices in sector j is captured by α_j, the common shock to Nordic prices at time t by ε_t, and sector-specific price shocks by $\varepsilon_{j,t}$. The absolute change in a variable is denoted by Δ.

In equation (1), the coefficient of interest, β, measures the true impact of an increase in Chinese trade on Nordic sectoral prices. A prior finding shared by most researchers is that Chinese imports lead to lower domestic prices, i.e., $\beta < 0$, the so-called Chinese price effect.

It is important to be clear what the price effect, stemming from an increase in China's market share, captures in equation (1). The price effect stems from low-wage competition or, in other words, China's comparative advantage in low-skilled, labor-intensive production. This price effect does not capture potential efficiency gains from tariff changes, China's industrial policy, or exchange rate policy.[5] The price effect also does not capture indirect effects arising from China's competition with exporters in other countries or domestic producers. Further, equation (1) does not capture improvements in retail chain management that are linked with Chinese goods.

It is evident that imports are endogenous to local demand conditions in equation (1). To solve this endogeneity problem, Auer and Fischer (2010) instrument for $\Delta m_{j,t}^{CHN}$ by taking the interaction between Chinese (annual) growth of manufacturing output, g_t^{CHN}, and the European sector's (average) labor intensity, $\overline{ls}_j$, yielding $g_t^{CHN}\overline{ls}_j$.[6]

As in Auer and Fischer (2010), the preferred specification is a reduced form relation between labor intensity differentials and price differentials. This difference-in-difference

5 This is not to say that these factors are unimportant, but simply that the empirical strategy cannot identify them. For example, the empirical literature on international trade utilizes one-time tariff reductions to identify the causal effect of trade; see for example Trefler (2004) on the effect of NAFTA on Canadian industry. Unfortunately, large tariff reductions are rare and the literature has yet to find a suitable event that led to a substantial increase of imports from low-cost producers. China's accession to the WTO in 2001 reduced average tariffs by less than two percentage points and did not result in a significant effect on the U.S. economy.

6 A similar strategy has been used in empirical finance. For example, Rajan and Zingales (1998) construct an instrumental variable by interacting between the average external financing needs of U.S. firms across industrial sectors and the size of financial markets for a large sample of countries to examine whether financial development facilitates economic growth.

specification relates Chinese growth changes times labor intensity to relative changes in prices

$$\Delta p_{j,t}^{NORD} - \Delta p_{k,t}^{NORD} = \lambda_{1,j} + \lambda_{2,t} + \gamma \left(\overline{ls}_j - \overline{ls}_k \right) g_t^{CHN} \qquad (2)$$

$$+ \varrho(\Delta X_{j,t} - \Delta X_{k,t}) + \varepsilon_{k,j,t},$$

where $\Delta p_{j,t}^{NORD} - \Delta p_{k,t}^{NORD}$ denotes the differential price change between sector j and k, λ_1 and λ_2 are fixed and time effects, $\left(\overline{ls}_j - \overline{ls}_k \right) g_t^{CHN}$ measures the differential in import competition between two sectors, $\Delta X_{j,t}$ are control variables, and $\varepsilon_{k,j,t}$ is the error term. Fixed effects are introduced to filter out sector specific trends in prices. The variation that is exploited relates the difference in how imports change in sectors with different labor intensities to differences in sectoral price changes.

2.2 DATA DESCRIPTION

For the empirical analysis, we merge Nordic sector specific trade, domestic production, and producer price index data classified in the NACE rev 1.1 system. To guarantee a reasonable number of observations the analysis considers only the aggregate of Denmark, Finland, and Sweden. The selection of these countries is based on data availability.[7] While the domestic production data as well as the PPI data are available in NACE rev. 1.1 classification on Eurostat, the trade data has to be converted to NACE rev. 1.1 from CN8 using a correspondence table. To guarantee the largest available panel, the sample begins in 1995. To exclude the world trade collapse in 2009, we conduct our analysis for the years 1995–2008.[8] The quality of PPI data limits the analysis at the 2-digit NACE level, leaving us with 23 manufacturing sectors for most years.

The measure of import penetration is constructed in the following manner. We divide the value of Chinese imports by the value of domestic production in the Nordic countries plus total imports. To make sure that the results are not driven by the endogenous response of Nordic sales to Nordic price developments, the value of domestic production plus total imports is averaged over the full sample. Our measure of import penetration takes the value of 0.01 in a sector where Chinese imports amount to 1% of average Nordic sales in the respective sector.

When examining changes of import penetration, the absolute change in the level of China's import share is evaluated, i.e. Chinese import share at time t minus Chinese import share at $t-1$. This strategy is expedient, because the response of Nordic prices should be related to the increase of imports in proportion to Nordic demand but not in proportion to the percentage growth of Chinese imports. Further, normalizing by sector size in the Nordic

7 All data are from Eurostat.
8 Figure 1 shows that China's takeoff occurred only after 1995.

region does not drop any zero-trade observations. The size of a sector is defined as the value of domestic shipments plus the values of imports from all countries.

To define a representative European measure of sectoral labor share that is free of large variations in time and country characteristics peculiar to the Nordic region, we measure an industry's labor intensity by using the average of the European labor expenditure share for each of the 23 sectors during 1995–2008. In this calculation, labor intensity is defined as the ratio of average labor expenditure divided by the average capital expenditure. Average labor expenditure is measured based on data from France, Germany, Italy, Sweden, and the United Kingdom.[9]

3. Chinese imports and Nordic prices

We begin the discussion of the IV results with the first-stage regressions. These regressions are displayed in Panel A of Table 1. In each specification, the instrument passes several tests of weak identification.[10] The same panel also shows that the instrumental variable, labor intensity multiplied by the change in Chinese industrial output, is significant at the 1% level.

The second-stage IV regressions show that the relative price effect is stable across a number of different specifications. These are presented in Panel B. Column 1 shows that the relative price effect is –2.0 and is highly significant in the baseline regression with time dummies. This point estimate means that a 1% increase in Chinese import share is associated with a 2.0% fall in Nordic producer prices. Next, column 2 adds annual Chinese manufacturing output to the regression with fixed effects. This control variable is significant but it does not change the point estimate for import share. Column 3 introduces sectoral productivity and sectoral wages into the specification defined in column 2. Although productivity is found to be significant, again it has no bearing on the baseline estimate of –2.0 shown in column 1. The last two specifications in columns 4 and 5 control for dynamics and do not alter the baseline estimate.

When we observe that the market share of Chinese imports grows, this could stem from either more goods being imported at constant prices (the channel we want to isolate), or alternatively, the same quantity being imported at higher prices.[11] To capture the first effect, physical import volumes (measured in kilos) in the first-stage regressions are used instead of import values (measured in euros).[12] Also the measure of physical import

9 This measure was used in Auer et al. (2011). The countries were selected because of their wide data availability across sectors.

10 The Cragg-Donald statistics, the associated Stock-Yogo statistic, as well as the F-statistics from the first-stage regressions reveal that the criticism of weak instruments is not an issue.

11 To understand that perverse effects may arise in our use of log differences of market share, consider the following extreme example. Suppose that quantities of goods produced in the Nordic countries and imported from the world and China are constant, however prices vary over time. In such an example, where $\Delta ln \frac{P_j Q_j^{CHN}}{PQ} = \left(P_{j,t} - P_{j,t-1}\right) \frac{Q_j^{CHN}}{PQ}$, even though the true market share is fixed, the estimated market share is time varying as prices vary.

12 Although exchange rate fluctuations are absent in the measure of import volumes, import values remain the preferred measure to make statements about the effect of Chinese import competition on Nordic producer prices.

Table 1 – China Import Value (in €) and Nordic Prices: IV Results (Fixed Effects Panel Estimations)

SPECIFICATION	(1) WITH YEAR DUMMIES	(2) INCL. CHINA IND. GROWTH	(3) INCL. CHINA IND. GROWTH/ PRODUCTIVITY & WAGES	(4) LAGGED PRICES	(5) LAGGED CH. IMPORTS LWC
Panel B: IV Second Stage Estimation – Dep. Var. is the y/y Ln-change in Producer Prices					
Ch. Imports China	-1.978**	-2.016**	-2.043*	-1.970**	-2.040**
(in % of European Industry Size)	[0.871]	[0.988]	[1.049]	[0.918]	[0.856]
Ch. % China Manufacturing		0.329***	0.319***		
Output		[0.076]	[0.076]		
Productivity			0.000***		
			[0.000]		
Wages			0.000		
			[0.000]		
Lag of Producer Prices				0.030	
				[0.055]	
Lag of Ch. Imports China					-0.410**
					[0.178]
Panel A: IV First Stage Estimation – Dep. Var. is the y/y change in (China Import Value in € / European[1] industry Size)					
Labor Intensity * Ch. % China	0.024***	0.024***	0.022***	0.024***	0.024***
Manfct. Output	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
Ch. % China Manufacturing		-0.061**	-0.058*		
Output		[0.029]	[0.030]		
Productivity			-0.000		
			[0.000]		
Wages			0.000		
			[0.000]		
Lag of Producer Prices				0.003	
				[0.008]	
Lag of Ch. Imports China					-0.196***
					[0.036]
Cragg-Donald Statistic	10.78	10.32	9.483	9.686	12.05
Max Reject Stock-Yogo Crit Value Level	15%	15%	15%	15%	15%
1st stage F-statistic	5.150	12.30	12.25	2.498	2.874
Year dummies (both stages)	y	n	n	y	y
Observations	713	713	629	671	671
Groups (Destination – NACE)	63	63	63	63	63
R-Square (first stage within)	0.0825	0.0422	0.0510	0.0800	0.196

Notes: [1] Nordic is Sweden, Finland, and Denmark. Panel B displays two-stage least squares estimations. The dependent variable is the annual change in the logarithm of the producer price at the 2-digit NACE (Rev. 1.1) level (only manufacturing industries). "Ch. Imports China" is defined as the y/y absolute change in (China import value in €/European industry size). The industry size is defined as the 1995–2008 average value of European domestic production plus world imports. In columns 2 and 3, "Ch. % China Manufacturing Output" is the growth rate of manufacturing output in China. Productivity is the wage-adjusted labor productivity and wages capture wages and salaries. Column 4 includes lagged producer price changes and column 5 incorporates lagged changes of Chinese import values. In Panel A the first-stage relation is displayed. The instrument is the sector's labor intensity times "Ch. % China Manufacturing Output". All estimations include fixed effects by sector. Clustered standard errors (by country) reported in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2 – China Import Volume (in kilograms) and Nordic Prices: IV Results (Fixed Effects Panel Estimations)

SPECIFICATION	(1) WITH YEAR DUMMIES	(2) INCL. CHINA IND. GROWTH	(3) INCL. CHINA IND. GROWTH/ PRODUCTIVITY & WAGES	(4) LAGGED PRICES	(5) LAGGED CH. IMPORTS LWC
Panel B: IV Second Stage Estimation – Dep. Var. is the y/y Ln-change in Producer Prices					
Ch. Imports China	-0.815**	-0.802**	-0.714**	-0.793***	-0.741**
(in % of European Industry Size)	[0.290]	[0.340]	[0.350]	[0.291]	[0.292]
Ch. % China Manufacturing		0.395***	0.333***		
Output		[0.091]	[0.089]		
Productivity			0.000***		
			[0.000]		
Wages			0.000**		
			[0.000]		
Lag of Producer Prices				0.021	
				[0.058]	
Lag of Ch. Imports China					-0.141
					[0.120]
Panel A: IV First Stage Estimation – Dep. Var. is the y/y change in (China Import Volume in kilograms / European[1] industry Size)					
Labor Intensity * Ch. % China	0.062***	0.062***	0.058***	0.063***	0.065***
Manfct. Output	[0.022]	[0.021]	[0.020]	[0.022]	[0.024]
Ch. % China Manufacturing		-0.100	-0.127		
Output		[0.090]	[0.102]		
Productivity			-0.000		
			[0.000]		
Wages			0.000*		
			[0.000]		
Lag of Producer Prices				-0.029	
				[0.020]	
Lag of Ch. Imports China					-0.056
					[0.161]
Cragg-Donald Statistic	14.11	12.99	13.58	13.47	14.78
Max Reject Stock-Yogo Crit Value Level	15%	15%	15%	15%	15%
1st stage F-statistic	7.861	13.44	14.63	3.962	4.819
Year dummies (both stages)	y	n	n	y	y
Observations	613	613	538	575	577
Groups (Destination – NACE)	55	55	55	55	55
R-Square (first stage within)	0.157	0.0867	0.136	0.156	0.158

Notes: [1] Nordic is Sweden, Finland, and Denmark. Panel B displays two-stage least squares estimations. The dependent variable is the annual change in the logarithm of the producer price at the 2-digit NACE (Rev. 1.1) level (only manufacturing industries). "Ch. Imports China" is defined as the y/y absolute change in (China import volume in k g/European industry size). The industry size is defined as the 1995–2008 average value of European domestic production plus world imports. In columns 2 and 3, "Ch. % China Manufacturing Output" is the growth rate of manufacturing output in China. Productivity is the wage-adjusted labor productivity and wages capture wages and salaries. Column 4 includes lagged producer price changes and column 5 incorporates lagged changes of Chinese import volumes. In Panel A the first-stage relation is displayed. The instrument is the sector's labor intensity times "Ch. % China Manufacturing Output". All estimations include fixed effects by sector. Clustered standard errors (by country) reported in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

volumes is normalized by market size, which is measured in the same physical quantity as is the import volume. Estimates for Nordic prices and their corresponding specifications as in Table 1 are shown in Table 2. In terms of the instrument's strength, the first-stage regressions show higher F-tests than the regressions with import values. The relative price effect remains highly significant but is now estimated to be around –0.8%.

The lower coefficient estimate for import volume is not surprising. Volume measures defined in kilos or in other units are extremely crude because they do not capture quality aspects which are best reflected by price. Despite this shortcoming in the volume measure, we are still able to identify a price effect for Nordic producer prices.

4. Conclusions and policy implications

The results of our analysis show that labor-intensive imports from China restrain Nordic producer prices. While it is difficult to say how much of the Chinese price effect flows into consumer prices, the fact that China has steadily gained market share in the Nordic region suggests that Chinese import competition will weigh more heavily in future monetary policy decisions. The Nordic exposure to China gives rise to several considerations for domestic inflation.

The first issue concerns interpreting the nature of the price shock. The relative price effect stemming from Chinese imports acts as a positive supply shock. If the supply shock is temporary, this leads to lower transitory inflation and the optimal monetary policy response would be to do nothing. The recent Nordic experience, however, suggests that the pressures associated with China's increasing import share resemble a permanent series of shocks. The danger is that if these shocks are interpreted as simply being temporary, monetary conditions will become contractionary when the nominal policy rate is left unchanged.

A further issue concerns rapid changes in exchange rates and import volumes. Let us first consider the exchange rate issues. China's exchange rate policy towards the U.S. dollar is currently the subject of one of the most prominent debates in international monetary economics. Exchange rate flexibility is repeatedly mentioned as a resolve for global imbalances. Numerous economists and policymakers are calling on China to revalue its currency in the order of 20% to 40%. If such a rapid yuan appreciation occurs, the disinflation effect of Chinese imports could be quickly reversed. Auer (2012) notes that nearly a sixth of all U.S. consumption of manufactured goods is produced in China. Thus, a real appreciation in the yuan would lead to a substantial pass-through effect because of the increasing weight of Chinese goods in U.S. inflation indexes. Auer (2012) examines the 2005 to 2008 period when the yuan appreciated by 17% against the U.S. dollar to estimate the exchange rate pass-through of U.S. producer prices. His pass-through estimates show that a 1% appreciation of the yuan causes U.S. producer prices to increase by about 0.14%. These new pass-through estimates suggest that the timing sequence of an

eventual yuan appreciation may also be crucial. From the perspective of international policy coordination, it would be more desirable to experience a yuan appreciation when global inflationary pressures are receding as opposed to when they are rising.

Supply disruptions represent a similar source of uncertainty. Natural disasters, such as the 2011 Tohoku earthquake, trigger supply disruptions that are difficult to interpret in terms of the fallout's depth and duration. If such events affect Chinese trade flows, this would again reverse the Chinese price effect.

A more important concern is the policy response. In our analysis for the three Nordic countries, only Sweden pursues an independent monetary policy. The Danish and Finnish monetary authorities are unable to respond to regional price pressures stemming from Chinese import competition. This issue becomes redundant if the level of Chinese import penetration is uniform across the euro area. However, Auer et al. (2011) show that this is precisely not the case for individual euro area countries. Their results show that the price effect of Chinese import competition is stronger in Germany than in France. This difference in the price effect is explained by differences in Chinese import exposure for the respective euro area countries. For example, in 2009, China exported more goods to Germany than to France, Greece, Italy, Portugal, and Spain combined. Such diverging trade dynamics imply that the price effects from Chinese import competition are not uniform across Europe and that the optimal monetary policy response is country specific.

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