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Can labour market institutions mitigate the China syndrome? Evidence from regional labour markets in Europe

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Abstract

This paper investigates how labour market regulations alter the adverse impact of rising import competition from China in European local labour markets between 1997 and 2006. The paper constructs measures of regional exposure to Chinese imports based on previous literature and on regional labour market frictions exploiting involuntary labour reallocations. Taking into account the endogeneity of import competition and its interaction with labour market regulations, the paper finds that regions more exposed to the rise of China have suffered from a reduction in manufacturing employment shares. This shock grows larger with regional labour market frictions; hence, it exacerbates the impact of trade shock on employment. Moreover, the paper finds that employment in public services, and not in construction or private services sector, absorbed the negative shock to the manufacturing sector. The unemployment rate, the labour force participation rate and wages in all sectors are unresponsive to import competition from China.

KEYWORDS

empirical trade, employment structure, labour reallocation, regional labour markets

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1 | INTRODUCTION

The academic and public debate on the impact of trade with low-wage countries on labour markets in advanced economies has received a boost in recent years. Much of the debate focuses on the adverse impact of trade with China on manufacturing workers after its accession to the WTO. Accession to the WTO mixed with internal reforms allowed China to become a crucial player in global commodity markets. Between 1997 and 2006, China raised its real exports to Europe and the United States by 452 and 366 percent, respectively.[1] Multiple single-country studies have provided mixed results with respect to the magnitude and the distributional impact of exposure to Chinese supply-driven exports. An important, but overlooked, feature is the relevance of labour market frictions induced by labour market institutions, and how they influence the response of local labour market outcomes.

This paper investigates how labour market frictions, induced by strong employment protection of permanent contracts, modify the response of local European labour markets to increased import competition from China. In particular, it seeks to answer the following research questions. First, do labour market frictions alter the impact of Chinese import competition on manufacturing employment? Second, which sector absorbs the adverse shock to the manufacturing sector and how does non-employment change? And third, how do hourly wages adjust in Europe?

To answer the research questions, the paper investigates changes in employment (and wages) of manufacturing, services, construction, public services, the unemployment rate and the labour force participation rate due to Chinese import exposure and labour market frictions. It exploits variation of both import competition and labour market frictions on the NUTS 2 level for eight European countries, that is Austria, Belgium, France, Germany, Italy, Spain, Sweden and the United Kingdom. The paper develops two measures of regional labour market frictions based on the idea that employment protection differs for temporary and permanent jobs. Specifically, it exploits the 'involuntary' flow between temporary employment and unemployment. Involuntary temporary employment is linked to stronger employment protection legislation of permanent contracts, therefore implying stronger labour market frictions. To identify the supply-driven component of imports from China, this paper follows Autor et al. (2013) by applying a Bartik shift-share instrumental variable approach. The identification strategy acknowledges that, as import competition is an endogenous regressor, its interaction with regional labour market frictions is also endogenous. To account for its endogeneity, the paper instruments for the interaction term of the endogenous regressor and the modifying variable (labour market frictions) using the interaction of the instrument and the modifying variable.

The results suggest that regional import competition per worker reduces manufacturing employment substantially in Europe. An increase of $ 1000 (in 2005 value) in import exposure per worker is related to a decline of 0.85 percentage points in the manufacturing employment share relative to the working-age population over a 5-year period in the average frictional labour market.[2] Irrespective of the measure, stronger regional labour market frictions tend to further decrease the manufacturing employment share. This finding shows that employment protection exacerbates the employment response in the manufacturing sector. Specifically, a one standard

[1]Europe comprises the EU15 countries, Norway and Switzerland. Numbers are based on author's calculation of OECD partner country trade statistics.

[2]The 0.85 percentage points is an average over the two point estimates in the benchmark analysis exploiting two different measures of regional labour frictions.

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deviation increase in regional labour market frictions reduces the manufacturing employment share by another .7 percentage points.

Extending the analysis to other sectors of activity and non-employment alternatives, the paper investigates which sector absorbs the adverse trade shock to manufacturing employment. Caliendo et al. (2019) argue that other sectors, such as construction and services, can expand due to access to cheaper intermediate inputs from China and therefore raise their labour demand. The empirical evidence is more mixed than for manufacturing itself. Charles et al. (2016) and Donoso et al. (2015) provide evidence that construction employment increases following trade shocks in the United States and Spain, respectively. Caliendo et al. (2019) show that other services and both the healthcare and education industries helped to absorb the adverse impact on manufacturing in the United States. For Europe, this paper finds that non-market services, which include healthcare and education occupations, absorb the shock from import competition on manufacturing the most.

Non-employment alternatives and wages do not react significantly to Chinese import competition. While the unemployment rate does not change in a meaningful way, the labour force participation rate declines with rising labour market frictions. This is indicative the fact that of older displaced manufacturing workers leave the labour force altogether when facing a job loss and lower opportunities to find permanent employment in the local labour market. For none of the sectors of activity under scrutiny, import competition has a profound impact on (hourly) wages. While changes in the sectoral workforce composition can bias the estimation results for hourly wages, these results need to be treated with caution.

There is an active literature on the labour market effects of import competition with low-wage countries. Most of the literature exploiting regional variation typically analyses individual advanced economies. Autor et al. (2013) sparked the literature around regional variation in Chinese import exposure analysing the labour market effect in commuting-zones in the United States. Examples of European single-country studies include Balsvik et al. (2015) for Norway, Donoso et al. (2015) for Spain and Dauth et al. (2017) for Germany. Based on these studies, import exposure has the strongest impact in Spain and a milder one in Norway and Germany, and for the latter export exposure offsets any adverse impact in the aggregate. Some authors hypothesise that the variation in magnitudes relates to labour market institutional settings. The main contribution of the paper to this literature is to include an interaction term of import exposure and regional labour market frictions to understand how frictions induced by labour market regulations alter the adverse effect on local labour markets.

This paper is closely related to Aghelmaleki et al. (2021), who investigate changes in worker flows for 14 European countries due to Chinese import competition and the mediating role of national employment protection legislation. They provide evidence that stronger employment protection of permanent contracts when a country faces an adverse trade shock reinforces the insider–outsider dilemma. The main similarities include the cross-country perspective, which allows to assess the potential costs and benefits of international trade exposure for a wide range of workers from different countries, and the investigation of a modifying impact of labour market settings. The key difference is that this manuscript examines the impact on workers in multiple sectors as the rise of China in global commodity markets has a direct effect on the manufacturing sector, but also indirect effects on other sectors as highlighted by Caliendo et al. (2019). In terms of labour market outcomes, this paper concentrates on both employment and wages in four sectors of activity and two non-employment outcomes instead of transition probabilities between manufacturing employment and unemployment. Other sectors of activity and labour force participation, besides unemployment the second non-employment alternative, tend to play

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an important role given the decline in the unemployment rate between China's entry into the WTO and the Great Financial Crisis.

The article is organised as follows. Section 2 introduces the measure for regional import competition from China and the two measures of regional labour market frictions. Section 3 discusses the benchmark identification strategy and alternative treatments of the interaction term. Section 4 presents the results for employment and wages of the major sectors of activity, the unemployment rate and the labour force participation rate. Section 5 concludes.

2 | REGIONAL INDICATORS

This section introduces the measures crucial for the analysis of the impact of Chinese import competition conditional on local labour market frictions on various labour market outcomes. It first presents the measure for import exposure per worker based on the previous literature. Specifically, this measure exploits the workforce composition within the manufacturing sector across regions in a given country. The paper then develops two new measures for regional labour market frictions. The underlying idea is to leverage the difference in employment protection between temporary and permanent contracts. Precisely, the measures take advantage of *involuntary* flows between unemployment and temporary employment. This section also describes the data used in the analysis and provides descriptive statistics.

2.1 | Import competition

The index for import exposure per worker follows Autor et al. (2013) who assign imports to the region according to its share of national manufacturing subsector employment. The argument is that regions with a proportionally large workforce in a subsector, in which Chinese supply-driven exports are strong, is hit stronger than a region with a smaller workforce:

$$\Delta IPW_{rct}^{EU} = \sum_{j} \frac{L_{rcjt}}{L_{cjt}} \frac{\Delta IMP_{cChinajt}}{L_{rct}}, \tag{1}$$

where ΔIPW_{rct}^{EU} is defined as the import exposure per worker in region r in country c in period t. The first fraction highlights the importance of beginning-of-period regional workforce composition. It computes the degree of specialisation of subsector j in a given region (L_{rcjt}) relative to the rest of the respective country (L_{cjt}). This weighting coefficient is then multiplied by the change in real imports of manufacturing goods of the individual European country c from China in subsector j over period t ($\Delta IMP_{cChinajt}$). This apportions the national imports from China to regions based on initial employment. To obtain import exposure *per worker*, this is normalised by the number of workers in region r in the initial year of period t (L_{rct}).

Imports from China are likely correlated with domestic demand, which bears the potential for endogeneity in the analysis. This endogeneity would lead to an underestimate of the true effect of supply-driven imports from China. Therefore, it is crucial to isolate the supply-driven component of Chinese exports. Due to increasing competitiveness during the time period under consideration and reduction in trade barriers, its exports to advanced economies share a common component. Hence,

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the paper instruments the growth of Chinese exports to the European countries with exports to the United States. This measure is constructed analogously:

$$\Delta IPW_{rct}^{US} = \sum_{j} \frac{L_{rcjt}}{L_{cjt}} \frac{\Delta IMP_{USChinajt}}{L_{rct}}, \tag{2}$$

where the only difference between equations (1) and (2) consists of the numerator of the second fraction, that is the destination country of exports from China differs. If the industry demand shocks are not correlated between the United States and European countries, then the paper successfully isolates the supply-driven component of Chinese exports.

In robustness analyses, the paper exploits Chinese exports to other (advanced) destination countries instead of the United States as a first alternative. These are countries are Australia, Canada, Korea, Japan and New Zealand. The second robustness analysis considers net exports (NPW), which are potentially more relevant for European countries compared to the United States because they have a less unbalanced trade deficit with China.

2.2 | Regional labour market frictions

This paper proxies labour market frictions based on involuntary flows between unemployment and temporary employment. Typically, labour market frictions refer to higher restrictions firms face with respect to hiring and firing.[3] One example for hiring restrictions is strong employment protection legislation. The key consequence is a reduction of turnover in the labour markets. Various studies leverage voluntary flows between jobs, sectors or geographies, see, for example Caliendo et al. (2019), Dix-Carneiro (2014) and Artuç et al. (2010). However, Jolivet et al. (2006) present evidence that involuntary reallocations are forming a substantial part of total reallocations, in particular in high-turnover countries.

Involuntary flows between unemployment and temporary employment occur because of strong restrictions on hiring and firing workers under permanent contracts. Boeri and van Ours (2013, Fig. 10.3) and Kalleberg (2000) provide evidence that higher employment protection legislation for permanent contracts exhibits a strong positive relationship with the share of temporary workers. Hence, job seekers work under temporary contracts even though they prefer to work under permanent contracts. Economically, this means that the labour market cannot absorb job seekers into permanent contracts because of higher employment protection. In other words, the labour market is the more rigid the more employees work involuntarily under temporary contracts. And consequently, transitions between unemployment and temporary contracts also occur more frequently. On the other hand, voluntary flows in and out of temporary contracts, and the share of temporary contracts may be correlated to both observable demographic characteristics and unobservable factors such as workers' preferences.

Labour market institutions are typically enforced on the national level and do not vary by region. However, Boeri and Jimeno (2005) demonstrate that employment protection legislation is not uniformly enforced within an economy due to the various exemptions, for example for small companies below certain threshold of employees. Furthermore, Micco and Pages (2006) argue that employment protection regulations affect economic sectors exposed

[3]Other sources of frictions are also possible, such as geographic and skill mismatch.

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to higher volatility in demand or supply shocks more. As the composition of firms differs across space, this also implies regional differences for the degree of employment protection. Thus, this paper constructs both measures on the same level of regional variation as import competition induced by Chinese imports. The only attempt to set up a measure of subnational labour market frictions based on differences in employment protection is legislation is Hantzsche et al. (2018), but the authors take on a sectoral perspective.

The first measure of regional labour market frictions exploits the flows from unemployment into a temporary job from one year to another because the unemployed could not find a permanent job. This measure of involuntary flows into temporary jobs is normalised by the number of unemployed in the previous year to account for the size of local unemployment:

$$RLMF_{rct}^{UE \to TempJob} = \frac{Flow_{rct}^{UE \to TempJob}}{UE_{rct-1}}, \tag{3}$$

This indicator measures the chance of an unemployed to enter a temporary contract despite his initial objective to find work under a permanent contract. It is assumed that the firm considers the costs to hand out an infinite-horizon contract to the worker as too high because of high employment protection; hence, it only offers fixed-period employment opportunities. Economically, this measure can be interpreted as the prevalence of temporary contracts due to strict employment protection legislation.

The second measure reverses the direction of the flow, that is it looks at whether an individual entered unemployment because a temporary contract ended. Hence, it measures how many temporary contracts were used the year before and did not result in further employment, may it be a permanent or a renewed temporary contract.[4] This is normalised by total employment in the previous period:

$$RLMF_{rct}^{TempJob \to UE} = \frac{Flow_{rct}^{TempJob \to UE}}{Employment_{rct-1}}. \tag{4}$$

Economically, this index of regional labour market frictions proxies the difficulty of permanently entering a sector of activity. Therefore, it also rises with strong employment protection for permanent contracts.

This paper argues that both measures of labour market friction are exogenous to the trade shock from Chinese imports even though a common concern is that labour market institutions are endogenous to globalisation. A common argument is that trade openness erodes labour market standards. However, the empirical evidence is quite mixed on whether globalisation impacts institutional settings. Potrafke (2013) does not find any evidence that globalisation impacts labour market institutions. Furthermore, most studies focus on trade between advanced economies, which is due to the above-mentioned phenomenon that trade between advanced economies and developing countries did not occur until the rise of China in global commodity markets. Häberli et al. (2012) is the only study examining how trade agreements between countries with different stages of economic development affect labour market institutions. The authors show that trade between two advanced economies reduces institutional labour market standards, whereas trade between an advanced economy and developing countries does not impact the institutional setting of the importing country.

[4]This measure may not also include a certain degree of skill mismatch between employee and employer as temporary contracts also allow for the screening of the quality of the match.

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2.3 | Data

This paper focuses on eight European economies, which include Austria, Belgium, France, Germany, Italy, Spain, Sweden and the United Kingdom between 1997 and 2006. The selection of these countries follows two criteria. First, this paper concentrates on countries which are likely to suffer from a direct impact of Chinese import competition. Cabral et al. (2018) show that Portugal only loses manufacturing employment due to the indirect effect of Chinese exports crowding out Portuguese exports. Implicitly, this paper assumes that other low-wage countries in Europe are only implicitly affected by Chinese import competition. This includes all Eastern European countries, Greece and Portugal. Second, due to exploiting regional variation within countries, the countries subject to investigation need to exhibit sufficient spatial variation on the NUTS 2 regional level. This is not the case for Luxembourg and Ireland. Other high-income countries are omitted due to the lack data availability for at least one component.[5]

Starting in 1997, 5 years before China joined the WTO, is no issue for identification for two reasons. First, it is difficult to pin down a precise date when agents might have anticipated the (exact) timing of China's entry into the WTO. China gained the observer status in 1986, 15 years before the initial entry. Furthermore, a Working Party on China's status was established under GATT in 1987. With respect to, however, there is much variation in the starting dates. Second, most other studies start around the same time, for example Dauth et al. (2017) in 1994, Balsvik et al. (2015) in 1996, Aghelmaleki et al. (2021) in 1998 and Donoso et al. (2015) in 1999. Only Autor et al. (2013) start much earlier, namely in 1990. Analogous to previous studies, the time period ends in 2006 to capture periods of the same length around China's entry into the WTO in 2001 and to predate the Great Financial Crisis (2007–2009).

The eight European countries constitute a suitable sample to study whether labour market frictions modify the impact of Chinese import competition on local labour markets for two reasons. First, imports from China rose strongly for all countries in the sample, which are in line with a supply-driven shock. All countries in the sample experience a substantial increase between 1997 to 2006, but it only starts after China's accession to the WTO in 2001. Between 2001 and 2006, the value of real imports tripled on average. Among the countries in the sample, Spain experienced the largest increase with a factor of 3.48 and France the smallest with a factor of 2.76.

The second reason lies in the heterogeneity of labour market institutions. As both measures of regional labour market frictions are based on the idea that permanent contracts do not occur due to strong restrictions on hiring and firing workers under permanent contracts. The OECD provides measures the requirements with respect to notification, negotiation, and authorisation before an employment relationship is terminated by the employer, as well as severance pay, and the definition and costs of unfair dismissal. The crucial indicator in this setting applies to regular workers. Over the sample period, three countries do not experience changes in their employment protection legislation (EPL), namely Germany, Italy and Spain, whereas EPL increases in Belgium, France and the United Kingdom, and it falls in Austria and Sweden. Besides the heterogeneity in changes, there is also substantial variation in terms of the levels. Belgium and the United Kingdom have low levels of unemployment protection legislation, while Austria,

[5]The Netherlands and Denmark do not provide regional information in the EU LFS, which is the main data source to compute regional labour market frictions. The exclusion of Finland and Norway is based on the lack of employment data in the manufacturing subsectors previous to 2002.

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Germany, Italy and Sweden have high levels of EPL. Spain and France see medium levels of EPL. However, Spain had the second-highest employment protection for permanent contracts in the OECD until 1994 behind Portugal.

Outcome variables on sectoral employment shares and wages, as well as the unemployment rate and the labour force participation rate stem from the European Regional Database (ERD). The sectors of activity cover manufacturing, private services, construction and public services.[6] The sectoral employment shares are computed relative to working-age population, which is restricted to the age from 20 to 64 and stems from Eurostat Regional Database. One main issue with this feature could be that this study, in contrast to Autor et al. (2013), exploits variation in administrative units (NUTS 2 regions) instead of commuting zones. Administrative regions do not form closed labour markets in the same form, but comparing data on region of residence and region of work in the EU LFS exhibits that the share of workers crossing administrative borders is 4.47% for the NUTS 2 regions in this study; hence, any potential bias arising from non-closed labour markets are negligible.

For the measure of import exposure per worker, this paper exploits three different data sources. Trade statistics on the manufacturing subsector level are taken from World Integrated Trades Solutions (WITS) by the World Bank, which provides trade data on the level of manufacturing subsectors (NACE Rev.1) based on the UNComtrade database.[7] This feature of the WITS provides concordance of imported goods and exports to manufacturing subsectors. Employment on the manufacturing subsector level is taken from Eurostat Regional Database and the initial values of 1997 and 2002 are used to compute the regional weighting factor in equation (1).[8] Regional working-age population, the normalisation factor, comes from Eurostat.

Both measures of regional labour market friction originate from aggregating individual level data in the EU LFS to the regional level.[9] The survey contains information of employment status in the year the survey was conducted and the year before. It also asks whether the currently employed person has a permanent or a temporary contract, and in the case of the latter, also why this is the case. One possible answer to this question is that the worker could not find a job with a permanent contract. These information are exploited to construct the 'involuntary' inflow into temporary work out of unemployment for the first measure of labour market friction in equation (3).[10] The second measure reverses this movement as the EU LFS also asks currently unemployed why this is the case. One of the potential answers is that a temporary contract ended. Equation (4) restricts this flow out of temporary employment into unemployment to those who were employed the year before the survey was conducted.

[6]The private services sector encompasses 'wholesale, retail, transport, accommodation & food services, information and communication' and 'financial & business services'.

[7]See Table A1 in the Appendix S1 for an overview of manufacturing subsectors.

[8]For the United Kingdom, data in and before 1997 are not available; hence, 1998 is used to compute regional specialization.

[9]Regional information is not available for Germany prior to 2002; hence, the national average is used for all regions in Germany for the pre-entry period. The region of residence is available on the NUTS 1 level for Germany and the United Kingdom, so all NUTS 2 regions within the same NUTS 1 region are assigned the same value.

[10]France only provides the information on the 'involuntary' inflow in 2006, when 65% of all inflows are involuntary. Hence, for France the indicator exploits the overall inflow into temporary contracts.

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The control variables were largely constructed from the same data sources. This includes the initial shares of sectoral employment shares relative to working-age population and wages, the share of tertiary education and the percentage of women in employment in each region. As Xu et al. (2019) argue that Chinese import competition can be amplified through housing markets, the analysis accounts for geographic housing supply conditions based on Saiz (2010). First, the percentage of land covered by water and wetlands provided by Eurostat, and second the percentage of coarse fragments is taken from the LUCAS Topsoil data Panagos et al. (2012). Both variables are measured in the year 2009; however, due to the difficulty to change these variables in a significant manner, they are included to account for geographic constraints of the housing market.

Table A2 in the Appendix S1 shows summary statistics subdivided into pre- and post-entry period for changes in sectoral employment shares and (log) hourly wages, (net) import exposure per worker using bilateral trade between the EU countries and China and both measures of regional labour market frictions. The reduction in manufacturing employment is more than ninefold between 2002 and 2006 compared the previous five-year period, which suggests that Chinese imports affected manufacturing as import competition is significantly higher in the post-period. On the other hand, the services sector experiences stronger rise in the first period compared with the post-entry years. Possibly, this reflects that other factors such as technological progress influence—see, for example argumentation in Dauth et al. (2017)—are responsible for the rise in the service sector. The construction sector experiences a slightly higher inflow relative to working-age population in the second period, while the increase in public service employment is somewhat larger in the first period. The unemployment rate drops sharply during the first period and rises slightly during the second period, generating a huge gap between the pre- and post-entry periods. The labour force participation rate rises in both periods, although the increase is somewhat stronger in the first period.

Real (log) hourly wages are rising across all sectors of activity in both periods. However, the increase is much lower over the period between 2002 and 2006, that is after China entered the WTO. This finding holds for all sectors, but is particularly strong in the *non*-manufacturing sectors. Relative to the first period, wages in the construction sector rise by 84% less during the second period compared with growth over the first period. In private services and public services, the decline in growth equals around 71% and 67%, respectively. On the other hand, the reduction in wage increase in manufacturing is equal to 21%.

The measures of regional labour market frictions change only slightly, but move in opposite directions. On the one hand, flows from unemployment into involuntary temporary jobs are rising. Economically, this indicates a higher use of temporary contracts for workers entering employment. On the other hand, the flow from temporary contracts to unemployment falls slightly. This may be driven by firms handing out successive temporary contracts to employees. Murray (1999) highlights the high limits on the duration of successive temporary contracts. Berton et al. (2011) and Gash (2008) emphasise the high chance for successive temporary contracts. Economically, this makes it more difficult for these workers to permanently enter employment. This is in line with Berton et al. (2011) who find that the transition from a temporary position into a permanent contract can be long.

Figure 1 shows the geographic distribution of the import and net import shock per worker in Europe for the second time period from 2002 to 2006. The resemblance with the geographic dispersion with Colantone and Stannnig (2017, fig, 4) is striking and provides evidence for the correct measurement of the exposure to Chinese import competition. The left panel shows that regions most exposed to Chinese exports are located in South and Central Germany, Southern

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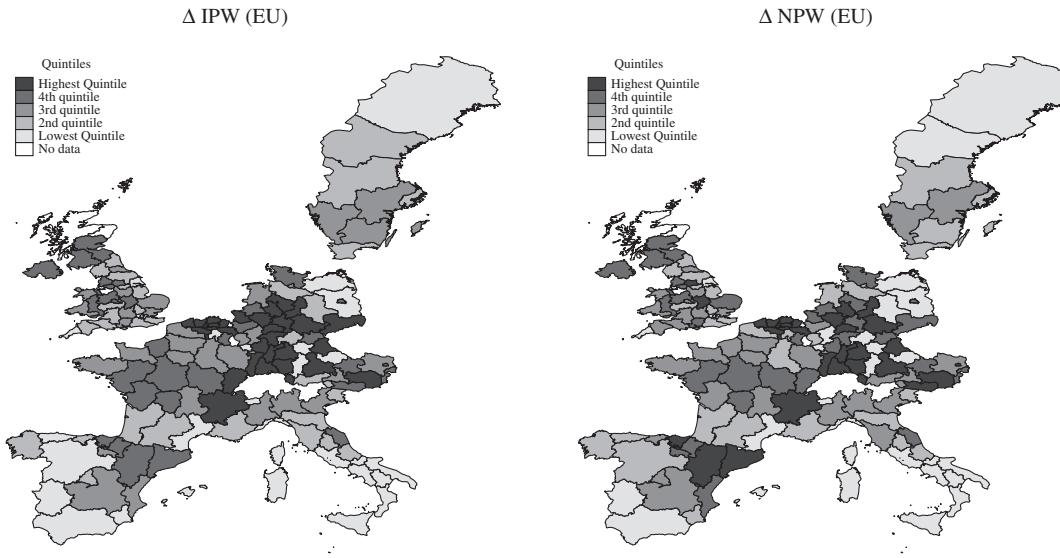

FIGURE 1 Quintile distribution of regional indicators for (net) import exposure in 2002. These maps shows the spatial variation of (net) import exposure (Δ IPW and Δ NPW) for the eight European economies in the year 2002. Each NUTS 2 region is sorted into one out of five quintiles, with darker colors indicating a higher degree of import competition from China

Austria, North East Spain and the North of Italy. The North West of England is also quite strongly exposed to Chinese goods' penetration. The right panel shows that the geographic distribution of the net import shock is very similar. However, some German regions are less exposed when accounting for exports. Given that Germany is the only European economy that could substantially increase its exports to China, this change is not surprising.

Figure 2 presents the variation of both regional labour market friction measures 2002 across space, where darker colors indicate stronger frictions. The left panel shows the flow from unemployment into involuntary employment under a temporary contract, which indicates the use of temporary contracts. France and Spain are the most rigid with both measures, and all their regions are in one of the highest two quintiles. This is not surprising giving that Bentolila and Dolado (1994) find that temporary contracts already spread in both countries already in the 1980s. Generally, these two countries are also considered to have more rigid labour markets within continental Europe. Germany and Italy exhibit within-country variation. East Germany and Southern Italy display stronger labour market frictions than their Western and Northern counterparts, respectively. These findings are in line with previous findings. Southern Italy historically suffered from higher unemployment rates, which is often interpreted indicative of labour market frictions, compared with Northern Italy. For Germany, Burda (2006) finds that labour markets in the east do not adjust because they are more rigid than those in the west.

The right panel shows the geographic distribution of the second measure of local labour market frictions, which uses the involuntary flow from temporary employment into unemployment. A higher level of this indicator implies that the chances to enter employment permanently are lower. Most of the geographic variation is similar, for example Spain has frictional labour markets, the variation within Germany and Italy holds as well. One key difference to the left panel is the lower level of frictions in France and the higher level of frictions in Sweden. This highlights the importance of distinguishing between the two types of frictions.

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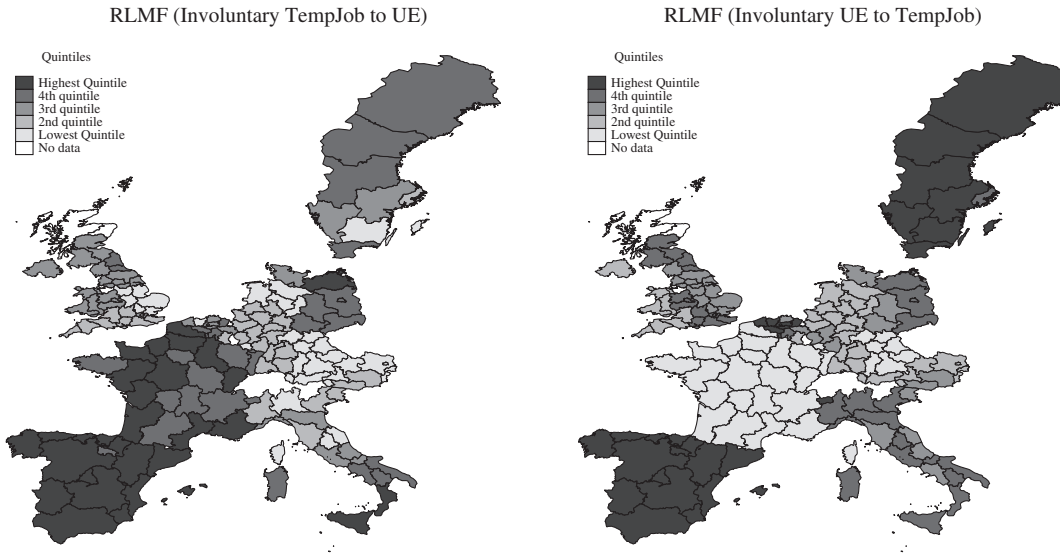

FIGURE 2 Quintile distribution of regional labour market friction measures 2002. These maps shows the spatial variation of regional labour market friction (RLMF) for the eight European economies in the year 2002. The right panel shows the involuntary flow from unemployment (UE) into a temporary job, whereas the right panel shows the flow in the opposite direction. Each NUTS 2 region is sorted into one out of five quintiles, with darker colors indicating a higher degree of import competition from China

3 | IDENTIFICATION STRATEGY

Previous work on the labour market effects of the China shock primarily apply a Bartik shift-share instrumental variable design. This holds in particular for work exploiting within-country regional variation, such as Autor et al. (2013) for the United States, Balsvik et al.(2015) for Norway, and Donoso et al. (2015) for Spain. The true effect cannot be estimated with OLS because trade with China is not exogenous. Instead, due to demand for Chinese products, point estimates not accounting for demand factors is biased. Typically, the idea of the shift-share instrument is to exploit trade between China and other advanced economies not subject to scrutiny in the study. That is why, to isolate the supply-driven component of Chinese exports, the first stage explains domestic imports from China with imports of other advanced economies from China.

This paper follows the previous literature in exploiting spatial variation and therefore also applies a shift-share instrumental variable approach. Specifically, it accounts for the endogeneity of Chinese product demand of the eight European countries under investigation by using Chinese imports of the United States. As in the previous literature, the similarity between domestic and US imports from China helps to identify the supply-driven component of trade with China. Typically, the single-country studies mentioned previously use an array of other advanced countries' imports from China. Given the multi-country setting, this proves more difficult here, and the paper follows Colantone and Stanig (2017) by using Chinese exports to the United States to isolate the supply-driven component. In a robustness analysis, the paper uses Chinese exports to advanced economies outside Europe, specifically Australia, Canada, Korea, Japan and New Zealand.

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The key difference in the estimation strategy compared with previous work relates to the introduction of the interaction term between Chinese imports and local labour market frictions. Economically, this interaction term indicates whether labour market frictions modifies the impact of Chinese import competition on local labour market outcomes. Econometrically, it is important to acknowledge that this interaction term, like the main effect of Chinese import competition, is endogenous as well. This is because this is an interaction of an endogenous regressor (import competition) and an exogenous regressor (labour market frictions). Therefore, the identification strategy needs to take into account the endogeneity of the interaction term. This paper performs three different treatments of the interaction term, which are explained below in detail.

To estimate the effect of Chinese import competition conditional on local labour market frictions, the second-stage estimation equation takes the following form:

$$\Delta Y_{rct}^{k} = \gamma_t + \gamma_c + \beta_1 \Delta IPW_{rct}^{EU} + \beta_2 RLMF_{rct} + \beta_3 \left(\Delta IPW_{rct}^{EU} \times RLMF_{rct} \right) + \mathbf{X}'_{rct} \Theta + \varepsilon_{rct}, \tag{5}$$

where ΔY_{rct}^{k} is the quinquennial change of either employment outcomes or log hourly wages of sector k in region r in country c in period t. The dependent variable is explained by regional differences in both import exposure per worker (ΔIPW_{rct}^{EU}), labour market frictions ($RLMF_{rct}$) and their interaction.[11] Level variables, such as the measurement of regional labour market friction and the control variables ($\mathbf{X}'_{rct}$), constitute beginning-of-period values. The identification strategy treats the modifying variable, that is regional labour market frictions, as exogenous. To avoid any potential reverse causality caused by labour market developments due to trade between China and European countries, the estimation strategy exploits initial values for labour market friction. Beginning-of-period values help to circumvent this potential bias as labour market institutions are typically sluggish to adjust to market forces such as trade.

The vector of control variables $\mathbf{X}'_{rct}$ encompasses start-of-period employment share or log hourly wage of the respective sector k to account for regional convergence. To control for regional demographic and labour market characteristics, the vector of controls includes both the share of the population with tertiary education, the percentage of women in employment and the share of workers employed in firms with ten or less workers. Finally, Xu et al. (2019) show that Chinese import competition operated partially through housing markets and show that the impact is reduced by 20%–30% accounting for the amplification impact. Due to data constraints on regional house price developments in European regions, the vector of controls includes geographic housing supply restrictions based on Saiz (2010), namely the share of coarse fragments as a proxy for the steepness and the share of water surface. The estimation equation contains a period-fixed effect (γ_t) for the period prior and after China's inclusion in the WTO, that is 1997–2001 and 2002–2006, and a country-fixed effect (γ_c). Hence, identification relies on within-period and within-country variation. Observations are weighted by their relative size of the working-age population, and standard errors are clustered on the regional level.

[11]Each estimation includes only one of the two measures of regional labour market frictions because the two measures are correlated with one another and it would require three first stages when including both interaction terms in the same estimation equation. To keep it as general as possible, $RLMF_{rct}$ stands for one of the measures in equations (3) and (4).

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3.1 | Accounting for the endogeneity of the interaction term

Equation (5) estimates the impact of Chinese import competition conditional on regional labour market frictions. This effect is given by the sum of β_1 and the multiplication of β_3 with the level of labour market frictions, that is $(\beta_1 + \beta_3 \times RLMF_{rct})$. For coherence of the scale of the two measures of labour market frictions, the paper standardises each measure. For a better interpretation of the conditional impact including correct standard errors, this paper shows graphical evidence in the form of marginal effects plots based on Brambor et al. (2005). Specifically, marginal effects plots are helpful because they present the impact of Chinese import competition estimated in equation (5), and indicate how this marginal effect changes over the distribution of the modifying variable, that is regional labour market frictions, including the correct standard errors at each point. One crucial point is that the point estimate of β_1 cannot be interpreted as the unconditional marginal effect like in previous studies without interaction terms. Instead, the coefficient indicates the impact of the Chinese import shock for a local labour market with average labour market frictions because of the standardisation of the modifying variable.

This paper expects that Chinese import competition has an adverse impact on manufacturing employment based on basic trade theory and previous findings by Autor et al. (2013), Balsvik et al. (2015) and Donoso et al. (2015). However, the impact conditional on labour market frictions, that is the sign of the coefficient for the interaction term, is ambiguous as Aghelmaleki et al. (2021) suggest. On the one hand, labour market frictions due to high employment protection can safeguard current employees from losing their work. This would imply that higher labour market friction reduce the impact of Chinese import competition on manufacturing employment. On the other hand, labour market frictions due to high employment protection can have the opposite sign for two reasons. First, high employment protection of permanent contracts implies a higher use of temporary contracts, that is the high share of temporary employees does not profit from heightened protection. Second, unemployed and new entrants face a stronger obstacle to enter the manufacturing sector.

To identify the causal impact of Chinese import competition conditional on regional labour market frictions, this paper accounts for the endogeneity of both the main effect and the interaction term. This set-up implies two first-stage regressions, one for the former and one for the latter. As described above, it accounts for Chinese import competition (main effect) using a Bartik shift-share instrumental design. With respect to the interaction term, it follows Aghion et al. (2005), that is it instruments for the interaction term of the endogenous regressor and the modifying variable with the interaction term of the instrument and the modifying variable. The two first-stage regressions take the following form:

$$\Delta IPW_{rct}^{EU} = \lambda_1 \Delta IPW_{rct}^{US} + \lambda_2 RLMF_{rct} + \lambda_3 \left(\Delta IPW_{rct}^{US} \times RLMF_{rct}\right) + \mathbf{X}'_{rct}\Pi + \omega_{rct}, \tag{6}$$

$$\Delta IPW_{rct}^{EU} \times RLMF_{rct} = \alpha_1 \Delta IPW_{rct}^{US} + \alpha_2 RLMF_{rct} + \alpha_3 \left(\Delta IPW_{rct}^{US} \times RLMF_{rct}\right) + \mathbf{X}'_{rct}\Upsilon + \rho_{rct}, \tag{7}$$

where equation (6) accounts for the main effect, that is Chinese import competition for a labour market with average regional labour market frictions. Equation (7) explains the endogenous interaction term.[12] The point estimates δ_1 in equation (6) and α_3 in equation (7) play crucial roles as they

[12]For a better view, the regression equations do not show the time and country-fixed effects. However, they are included in the estimations.

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help to identify the supply-driven component of Chinese exports. For credible results, both coefficients need to be positive and statistically significant.

3.2 | Alternative treatments of the interaction term

As it is not common to introduce interaction terms of an exogenous variable with an endogenous regressor, there is no consensus in the literature on how to treat the interaction term. Therefore, this paper considers two alternative treatments of the endogenous interaction term. The first robustness treatment follows Nizalova and Murtazashvili (2016) and Bun and Harrison (2018), who argue that the interaction term can be interpreted as exogenous once the main effect of the endogenous variable has been taken account of, and the OLS estimator of the interaction term is unbiased and consistent. The second robustness treatment of the endogenous regressor is based on the second suggestion in Bun and Harrison (2018) and exploits the non-linearity of the interaction term. Subsequently, the paper refers to the former as 'OLS' and to the latter as the 'functional' approach.

3.2.1 | The OLS approach of the interaction term

The first robustness treatment of the interaction term ($\Delta IPW_{rct}^{EU} \times RLMF_{rct}$) follows Nizalova and Murtazashvili (2016) and Bun and Harrison (2018). They argue that if the estimation strategy applies the 2SLS approach for the constitutive term of the endogenous regressor, then its interaction with the modifying variable can be interpreted as any other OLS coefficient. In other words, once the endogeneity of the import competition is accounted for, the interaction term is exogenous. The constitutive term in equation 5 is equivalent to the main effect, that is Chinese import competition. Therefore, this estimation approach has just one first-stage, namely for the main effect. And this first-stage estimation corresponds to equation (6). As argued for the benchmark estimation strategy, the point estimate of δ_1 needs to be positive and statistically significant to identify the supply-driven component of Chinese exports to the European countries under investigation.

3.2.2 | Exploiting the non-linearity of the interaction term

The second robustness treatment of the interaction term exploits the non-linearity of the interaction term. It adopts another approach suggested by Bun and Harrison (2018) inspired by Kelejian (1971). Precisely, this approach uses a second-order polynomial of the control variables and the modifying variable, that is regional labour market frictions, as instrumental variables. The second-order polynomial consists of the squares and the cross-products of the control variables including the modifying variable. Econometrically, any non-zero correlation between the dependent variable (ΔY_{rct}^{k}) and the exogenous regressor of the interaction term ($RLMF_{rct}$) and the control variables (X'_{rct}) will already cause the second-order polynomial of the exogenous regressors to be relevant instruments for the interaction term. However, economically, the second-order polynomial serving as a vector of instrumental variables has no meaning.

Similar to the benchmark estimation approach, this treatment approach of the interaction term also implies two first-stage regression equations, which take on the following form:

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$$\Delta IPW_{rct}^{EU} = \pi_1 \Delta IPW_{rct}^{US} + \pi_2 RLMF_{rct} + \mathbf{X}'_{rct}\Phi + \mathbf{Z}'_{rct}\Psi + \kappa_{rct}, \tag{8}$$

and

$$\Delta IPW_{rct}^{EU} \times RLMF_{rct} = \delta_1 \Delta IPW_{rct}^{US} + \delta_2 RLMF_{rct} + \mathbf{X}'_{rct}\Omega + \mathbf{Z}'_{rct}\Lambda + \xi_{rct}, \tag{9}$$

where

$$\mathbf{Z}_{rct} = \left[\begin{array}{ccc} RLMF_{rct}^2 & \mathbf{X}'^2_{rct} & RLMF_{rct} \times \mathbf{X}'_{rct} \end{array} \right]. \tag{10}$$

Equation (8) is nearly equivalent to the first-stage of the main effect in the benchmark identification strategy, see equation (6). The key difference is the inclusion of the second-order polynomial consisting of the squares and cross-products of the control variables. Simultaneously, the interaction term between Chinese import competition and regional labour market frictions is excluded in this estimation approach. Given that the aim of introducing this polynomial is the approximation of the interaction term for the second first-stage regression, its introduction should have no impact on the point estimate of the main effect. In other words, the point estimate π_1 should also be positive and statistically significant to isolate the supply-driven component of Chinese import competition. In equation (9), this second-order polynomial fulfils its main purpose, that is it is approximating the non-linearity of the interaction term.[13]

4 | LABOUR MARKET EFFECTS OF IMPORT COMPETITION

This section reports how Chinese import competition affects local labour markets conditional on regional labour market frictions. To understand the impact on local labour markets, the paper analyses employment shares and hourly wages for multiple sectors of activity, such as manufacturing, private services, construction and private services. Besides the employment shares for these sectors, the first part also investigates the unemployment rate and the labour force participation rate.

The empirical findings provide answers for the research questions laid out in the beginning. First, whether regional labour market frictions change the magnitude of the adverse shock to employment in the manufacturing sector. Depending on which type of frictions is dominant, the protection of insiders or the disadvantage to outsiders, it is either mitigating or amplifying. To answer the second question, namely whether any sector of activity absorbs the adverse shock to manufacturing, the paper conducts the same analysis for services, construction, private services, the unemployment rate and labour force participation rate. And third, to understand what happens to employee's compensation face to increased import competition, the paper repeats the same exercise for (log) hourly wages across all sectors.

Marginal effects plots based on Brambor et al. (2005) present the results of the estimations explained in the previous section.[14] This allows for a better visibility of the estimation results. For

[13]Similar to the benchmark estimations of the first-stage, the equations do not show the time and country-fixed effects for formatting reasons.

[14]Exact estimation results are reported in the Appendix S1.

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the graphical presentation and to allow for a better comparison across both measures of regional frictions, both are standardised for the empirical analysis. Due to the standardisation, a value of zero of each measure indicates the region with average regional labour market frictions. The underlying reason is the stark difference in the scale of the two measures of labour market frictions (see Table A2 in the Appendix S1).

4.1 | Employment

4.1.1 | The decline of the manufacturing sector

Since the turn of the century, China's sharply exports to advanced economies grew tremendously, in particular in handful of consumer goods industries. Hanson and Robertson (2008) show that between 2000 and 2005, the share of manufacturing accounted for 89% of China's merchandise exports. This stellar rise in global commodity markets for these goods most likely affects the manufacturing sector directly, especially in terms of employment. The economic argument is straightforward. China's rising productivity and lowering trade costs by joining the WTO affects a region in an advanced economy because Chinese products supplants the products this region produces. A second channel relates to rising demand in the same region for Chinese products. Because the emphasis lies on the supply-driven component, the paper uses an instrumental variable approach based on the previous literature.

Previous work, pioneered by Autor et al. (2013) for the United States, shows an economically significant negative impact of rising import competition on manufacturing employment. Compared with the United States, Donoso et al. (2015) find a significantly larger impact on Spanish regional labour markets, and Balsvik et al. (2015) find a smaller impact in Norway. Although not directly in terms of magnitude, both Malgouyres (2017) for France and Federico (2014) for Italy identify strong reductions in manufacturing employment growth due to rising import competition from low-wage countries, especially China.

Balsvik et al. (2015) and Donoso et al. (2015) argue that key differences in the magnitudes across countries may be due to labour market institutions. Especially, the latter argue that adjustment in employment is stronger in Spanish regions due to rigid labour markets. They emphasise that demand shock mainly affect quantities, that is employment, instead of wages. The authors put forward a second argument for a larger impact in Spain, namely the skill composition of the workforce compared with the United States. Specifically, the Spanish workforce is unskilled, and therefore, the demand for labour in Spanish manufacturing may experience a stronger adverse impact than in the United States.

Figure 3 supports the hypothesis that labour markets frictions have an economically meaningful impact on the size of the import competition shock. Less frictional labour markets, indicated by low values of the standardised RLMF along the horizontal axis, exhibit a smaller decline in manufacturing employment face to Chinese supply-driven exports. The solid line indicates the magnitude of the trade shock on manufacturing employment, and the dashed lines indicate the 95% confidence interval. At low levels of regional labour market frictions, the estimated impact is statistically insignificant. On the other hand, the effect is statistically and economically much larger in frictional labour markets. While the magnitudes and steepness of the interaction term differ across the two measures of regional labour market frictions, the qualitative pattern is the same. The results underlying the marginal effects plots are presented in Table B1 in the Appendix S1. They exhibit that, across both measures of regional

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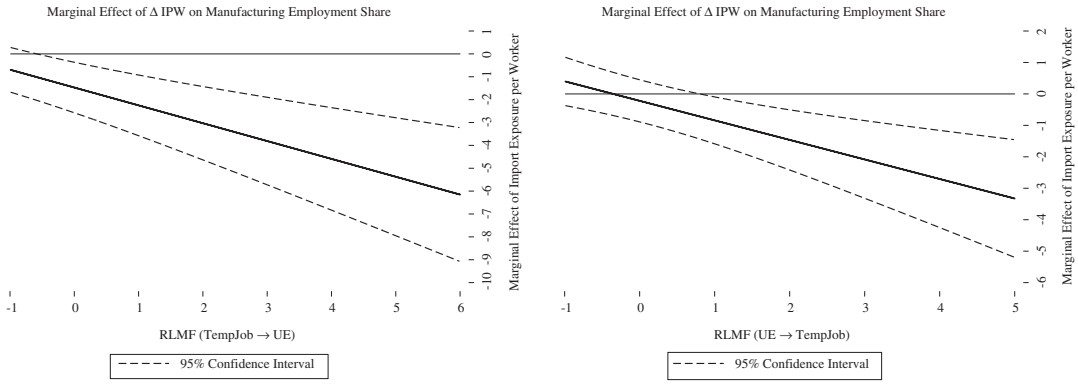

FIGURE 3 Marginal Effect of Import Exposure on Manufacturing Employment. The marginal effects plots show the response of manufacturing employment per working age population to Chinese import competition. The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (1) and (2) of Table A2 in the Appendix S1

labour market frictions, that an increase of $1000, with 2005 as the base year, in import exposure per worker over a five-year period reduces the manufacturing employment share relative to the working-age population in a labour market with average frictions by .85 percentage points.[15] Of key interest, however, is the coefficient of the interaction term. For both measures of regional labour market frictions, it is negative and statistically significant at conventional levels. They indicate that the same trade shock in a region with stronger labour market frictions by one standard deviation raises the decline in manufacturing employment by .7 percentage points.

Columns (1) and (2) in Panels II and III in Table B1 in the Appendix S1 provide evidence on the reliability of the key results presented above. They show the first-stage results of both the main effect and the interaction term similar to Aghion et al. (2005). With respect to the main effect, following Autor et al. (2013), the imports of European countries from China is instrumented using US imports of Chinese goods. Panel II shows the point estimates of import exposure using the United States for explaining import competition with European imports. In both specifications, the point estimates are positive (0.01) and both of them are statistically significant at the 1% level and the F-Statistic is either above 10 or close to it. The coefficients are smaller than in other studies focusing on European countries, such as Colantone and Stanig (2017) or Donoso et al. (2015). One key reason is the inclusion of the interaction term of the endogenous regressor and regional labour market frictions.

The first-stage results of the interaction term lend strong credibility to the importance of regional labour market frictions face to trade shocks. Panel III shows the results of the second first-stage regression for the endogenous interaction term. The point estimates of λ_3 for both measures of regional labour market frictions are positive and statistically significant on all conventional levels. In magnitude, they are larger than the point estimate of the main effect. The F-Statistics in both specifications are well above 100.

[15]It is to note that the point estimates differ substantially in size, and one is insignificant at conventional levels.

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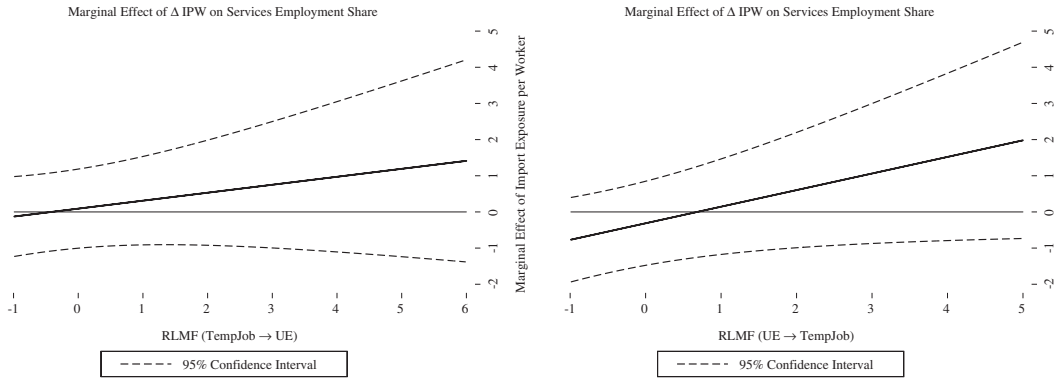

FIGURE 4 Marginal Effect of Import Exposure on Services Employment. The marginal effects plots show the response of service employment per working age population to Chinese import competition (Δ IPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (1) and (2) of Table A3 in the Appendix S1

4.1.2 | Noisy response of the services sector

Chinese supply-driven exports affect non-manufacturing sectors indirectly and can therefore also impact the demand for labour for these sectors. The model in Autor et al. (2013) also explicitly examines the change the change in employment in non-traded goods in response to trade shocks. Furthermore, Caliendo et al. (2019) argue that other sectors such as services and construction profit from the trade shock due to cheaper intermediate inputs from China, which should lead to a rise in employment in these sectors. However, the empirical evidence is mixed. Autor et al. (2013) find no change in non-manufacturing employment, instead unemployment rises due to higher import competition from China. Balsvik et al. (2015) find that employment in 'other' sectors rises slightly, but find that the largest increase occurs in unemployment. Donoso et al. (2015) find an increase in employment related to construction and services related to it. For Denmark, Keller and Utar (2016) find that mid-skilled workers in manufacturing reallocate to either high-skilled or low-skilled service jobs after a trade shock, contributing to the polarisation of labour markets.

This paper first examines whether the private service sector absorbs the adverse impact on manufacturing employment. Figure 4 documents that the private service sector does not seem to absorb the adverse shock to manufacturing employment. The two marginal effects plots show that the share of service employment does not change in the average frictional labour market, but the slopes are positive. Hence, for both measures of regional labour market frictions, the share of service employment rises with stronger frictions. However, the confidence bands is large and the point estimates across the whole distribution of regional labour market frictions stays statistically insignificant.

When measuring labour market frictions with the involuntary flow from unemployment into temporary employment, then the service sector in frictional labour markets absorbs the adverse trade shock stronger in magnitude. In other words, the slope of the right panel is steeper than in the left panel. TableB2 in the Appendix S1 shows that the interaction term in Column (2) is statistically significant at the 5% confidence level. Economically, this result indicates that a higher use of temporary contracts leads to a better shock absorption in terms of employment.

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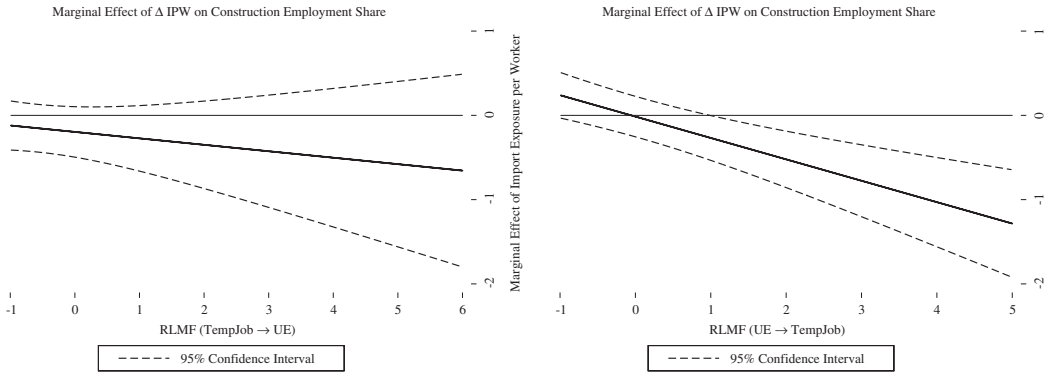

FIGURE 5 Marginal Effect of Import Exposure on Construction Employment. The marginal effects plots show the response of construction employment per working age population to Chinese import competition (Δ IPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (1) and (2) of Table A4 in the Appendix S1

There are multiple reasons why the private service sector, despite its rise since the 1980s, does not absorb the trade shock to manufacturing employment. Keeping in mind that the service sector grew strongly before China's WTO entry documented in Table A2 in the Appendix S1, indicates that other factors are crucial for its rise. Autor and Dorn (2013) highlight the ongoing polarisation of labour markets in the United States, especially in the service sector, but they argue that both consumer preferences favoring variety and cheaper automation technology are the main drivers. These determinants hold particularly for low-skilled jobs, while Buera and Kaboski (2012) emphasise the role of education and the returns to skill for high-paid jobs in services, which were crucial to the rise of private services. Furthermore, the rise in female labour market participation lead to an increase in the share of service employment in advanced economies.

4.1.3 | No absorption by the construction sector

The construction sector could absorb the adverse trade shock to the manufacturing sector primarily because of occupational similarity between the two sectors. Curuk and Vannoorenberghe (2017) point out that occupational similarity and regional proximity matter for labour reallocation. Regional proximity is typically given for both the services and the construction sector as they constitute non-tradable sectors and hence locate close to their customers due to high transportation costs. However, using job flows in Sweden Neffke and Henning (2013, Fig. 1) show that occupational similarity between manufacturing and construction is higher than between the former and services. Empirically, Charles et al. (2016) argue that the rise in construction masked the decline of manufacturing employment in the United States, especially for low-skilled workers, and Donoso et al. (2015) show that the construction sector experience a large expansion during the decline of manufacturing in Spain.

Despite occupational similarity between manufacturing and construction, Figure 5 does not provide evidence that construction employment increased face to the trade shock. The average frictional labour market even exhibits a small, albeit statistically insignificant, decline in construction employment per working-age population. If anything, this decline becomes even

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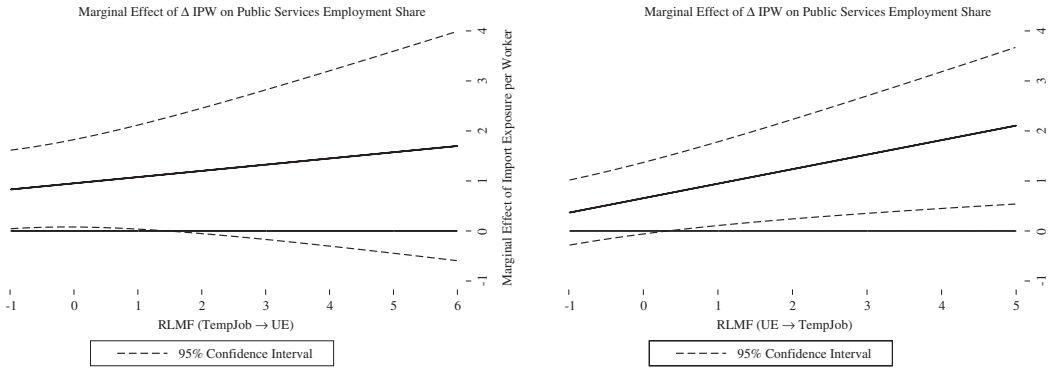

FIGURE 6 Marginal Effect of Import Exposure on Public Services Employment. The marginal effects plots show the response of construction employment per working age population to Chinese import competition (Δ IPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (1) and (2) of TableA4 in the Appendix S1

stronger with rising labour market frictions. The point estimates in the left panel are all statistically noisy, but the right panel indicates a significant drop in the constructions sector in regional labour markets with strong labour market frictions.

Controlling for housing supply factors could be an explanation for the discrepancy between this papers findings and previous work. Specifically, Donoso et al. (2015) and Minondo for Spain and Charles et al. (2016) for the United States highlight the role of construction employment and its mitigating impact on regional labour markets. As Xu et al. (2019) argue, the Chinese import competition shock partially operated through the housing market. Controlling here for housing supply factors, such as steepness of the terrain and water share, could therefore reduce the alleviating nature of the construction sector found in previous work.

4.1.4 | Shock absorption by public service sector

The final sector under consideration for absorbing the adverse trade shock to manufacturing employment is the public service sector. For the United States, Caliendo et al. (2019) show that, apart from 'Other Services', education and health are contributing most to employment gains in non-manufacturing, which typically belong to the category of public services in most European countries. The authors provide evidence that displaced workers found employment in these sectors, even more likely than in construction and transport services. Besides displaced workers, new entrants to the labour market may choose to start employment in these sectors because new labour market participants consider these sectors more resilient to shocks.

The marginal effects plots in Figure 6 illustrate that the public service sector largely absorbs the adverse trade shock on the manufacturing sector. Along the distribution of each measure of regional labour market frictions, the point estimate is positive. However, depending on the measure of frictions, the point estimates at one tail of the distribution are statistically noisy. In the left panel, it is the right tail of the distribution, whereas it is the left tail in the right panel.

In both figures, it is evident that public service employment is rising with rising labour market frictions. Keeping in mind that the manufacturing employment declines most in labour markets

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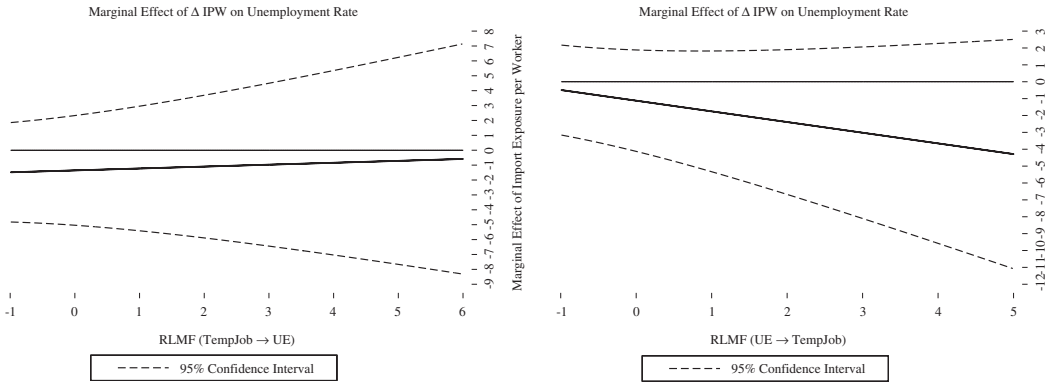

FIGURE 7 Marginal Effect of Import Exposure on Unemployment Rate. The marginal effects plots show the response of the unemployment rate to Chinese import competition (Δ IPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (1) and (2) of Table A6 in the Appendix S1

with frictional labour markets, this finding reinforces the notion that public services absorbs the adverse shock from rising import competition to the manufacturing sector. Table B4 in the Appendix S1 presents the estimation results for the public service sector. Columns (1) and (2) indicate that the point estimates of the main effect, that is for the local labour market with average frictions, are consistently positive for the public service sector. Compared with other sectors, the main effects are either null or negative.

4.1.5 | Non-employment alternatives

Displaced manufacturing workers and new labour market entrants to the labour market also face two non-employment alternatives, namely being unemployed and dropping out of the labour force. New entrants and young displaced manufacturing workers could face unemployment given the adverse trade shock to the manufacturing sector. Overall, the empirical evidence is mixed. Unemployment may only be temporary as Dauth et al. (2017) show for Germany that the rise in service employment comes from re-entrants, that is former employees in the manufacturing sector first enter unemployment and then re-enter the service sector. For the United States, the trade shock increases unemployment in local labour markets, whereas Balsvik et al. (2015) find higher unemployment rates for less-skilled displaced manufacturing workers.

Figure 7 shows that rising Chinese import competition does not have any impact on unemployment rates on European regional labour markets. Both marginal effects plots show that the point estimates of how unemployment changes are negative along the whole distribution of each measure of regional labour market frictions, but they are estimated with large statistical noise. The direction of the slope across labour market frictions go in opposite directions. In other words, the coefficients for the interaction term have opposite signs depending on which measure is used. The right panel, using the involuntary flow from unemployment to temporary employment, which is indicative of the use of temporary contracts, exhibits a negative sign of the interaction term. Economically, this implies that the unemployment rate tends to fall stronger with a higher use of temporary contracts in case of an adverse trade shock.

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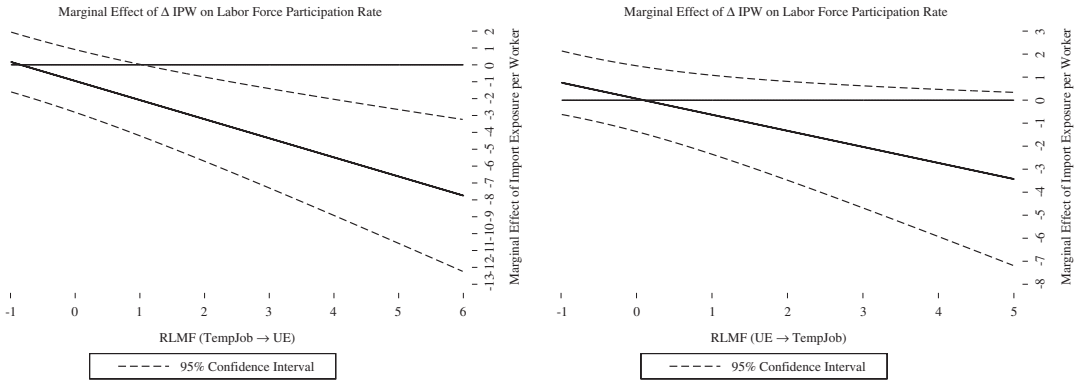

FIGURE 8 Marginal Effect of Import Exposure on Labour Force Participation Rate. The marginal effects plots show the response of the unemployment rate to Chinese import competition (Δ IPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (3) and (4) of Table A6 in the Appendix S1

Dropping out of the labour force is the second non-employment alternative, which is more probable for older workers from manufacturing who lost their employment due to rise in Chinese import competition. Older workers are close to retirement and simply advance it and therefore exit the labour force. Especially in the case of strong labour market frictions, that is small opportunities to find another permanent contract, older workers close to retirement may drop out of the labour force. Similar to unemployment, previous work provides mixed evidence. Autor et al. (2013) find that the trade shock has an adverse impact on labour force participation in the United States, and Balsvik et al. (2015) provide evidence that primarily less-skilled workers exit the labour force in Norway. Donoso et al. (2015), on the other hand, does not find a negative impact of the trade shock on the labour force participation rate in Spain.

Figure 8 indicates that displaced workers tend to drop out of the labour force when a frictional labour market faces Chinese import competition. Independent of the measure of labour market frictions, the slopes are strongly negative. Columns (3) and (4) in Table B5 in the Appendix S1 show that both coefficients are statistically significant at least at the 5% confidence level. The left panel, using involuntary flows from temporary employment to unemployment, shows that the labour force participation rate falls statistically significantly for frictional labour markets. However, while qualitatively providing the same message, the right panel does not indicate that the result is statistically significant at the right tail of the distribution of the modifying variable due to increasing confidence bands.

4.2 | Wages

Regional labour market adjustments given rising Chinese import competition can also include worker's wages. Wages in all sectors are the last labour market outcome of interest in the model of Autor et al. (2013) after employment in both traded and non-traded industries. However, wage estimations, in particular for the manufacturing sector, can be strongly biased because of workforce composition changes after the trade shock. Specifically, if low-skill employees bear the burden of the adverse trade shock, then wages in manufacturing will be upward biased.

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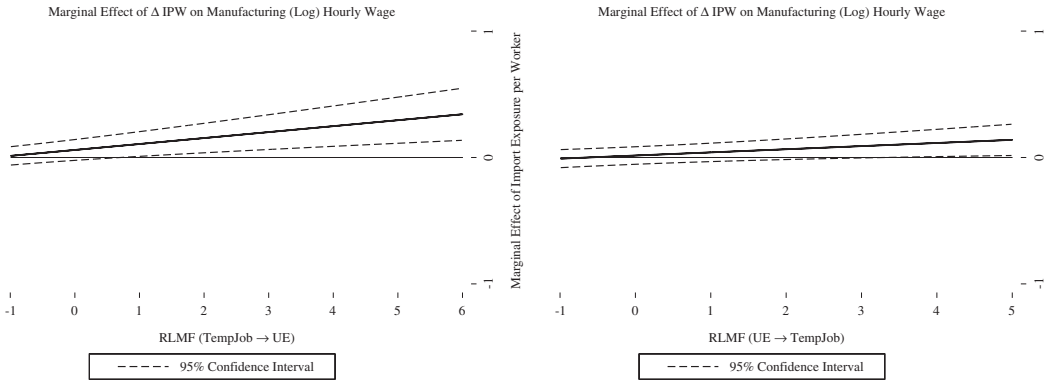

FIGURE 9 Marginal Effect of Import Exposure on Manufacturing Wages. The marginal effects plots show the response of manufacturing hourly wages to Chinese import competition (Δ IPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (3) and (4) of Table A2 in the Appendix S1

Analogously, if the low-skill displaced workers enter other sectors of activity, this might introduce a downward bias into the estimation results. Therefore, the results of this section need to be interpreted cautiously.

Figure 9 does not show an adverse impact of import exposure to Chinese exports on manufacturing wages. If anything, the effect is positive. Independent of the measure, this holds particularly for the right tail of the distribution of local labour market frictions. This stands in contrast to previous findings for the United States by Autor et al. (2013), but confirms the findings by Balsvik et al. (2015) for Norway and Donoso et al. (2015) for Spain. One explanation for the non-negative effect on wages is through the lens of wage bargaining centralisation. In European countries, especially outside of the United Kingdom, wages are determined much more centrally and individuals bargain much less often for their wages than in the United States. The second explanation is that hourly wages stay unaffected, but the number of hours worked falls due to import competition.

The third explanation for the non-negative impact of the trade shock is a stronger upward bias due to changing labour force compositions. Both panels of Figure 9 indicate that this explanation plays a role. Labour markets located in the right tail of each distribution of regional labour market frictions tend to experience wage gains. These labour markets are also the same ones which see the strongest decline in manufacturing employment. Therefore, the potential for changes in the workforce composition, that is low-skill workers are hit the hardest by Chinese import competition, then the upward bias is the strongest at this tail of the distribution. Given that the left tail of the distribution hardly experiences employment losses, the potential upward bias is very small. If upward bias is close to zero, then this speaks to the importance of both explanations for the non-negative impact of trade exposure on manufacturing wages.

The wage estimations for other sectors are also likely to suffer from estimation bias due to workforce composition changes. However, the direction of the bias is less clear. One the one hand, the wage estimations for private services, construction and non-market services can be downward biased. This is particularly the case if displaced workers from the manufacturing sector re-enter a different sector of activity without further training. On the other hand, the wage estimations could also be upward biased for two reasons. First, displaced worker from

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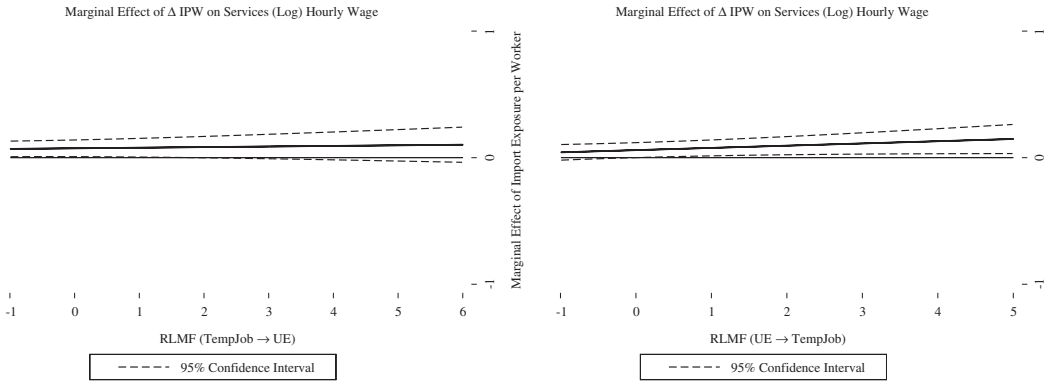

FIGURE 10 Marginal Effect of Import Exposure on Services Wages. The marginal effects plots show the response of service hourly wages to Chinese import competition (ΔIPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (3) and (4) of Table A3 in the Appendix S1

FIGURE 11 Marginal Effect of Import Exposure on Construction Wages. The marginal effects plots show the response of construction hourly wages to Chinese import competition (Δ IPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (3) and (4) of Table A4 in the Appendix S1

manufacturing due to the trade shock can enter formal education and obtain specific education for the new sector of employment.[16] Second, new labour market entrants can choose higher educational attainment and enter non-manufacturing employment to insure themselves against future adverse shocks. Ferriere et al. (2020) provide evidence for higher educational attainment of young labour market entrants in adversely affected labour markets in the United States.

Keeping the strong potential for bias due to workforce composition changes, Figures 10 to 12 do not provide evidence that rising import competition affects wages strongly in Europe. This

[16]The rising importance of active labour market policies and (re-)training of unemployed workers could affect this.

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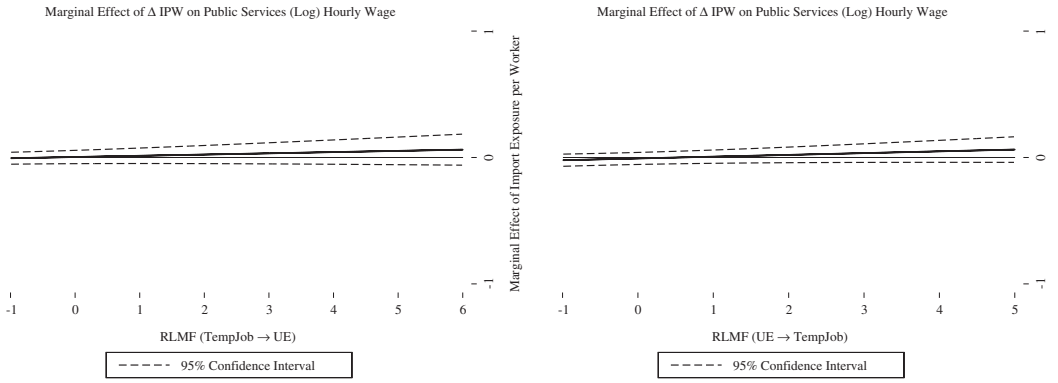

FIGURE 12 Marginal Effect of Import Exposure on Public Services Wages. The marginal effects plots show the response of construction hourly wages to Chinese import competition (Δ IPW). The left panel uses the involuntary outflow from temporary employment to unemployment (RLMF TempJob → UE), while the right panel uses the involuntary inflow from unemployment into temporary employment as a measure of regional labour market friction (RLMF UE → TempJob). Results are based on the IV treatment of the interaction, that is columns (3) and (4) of Table A5 in the Appendix S1

holds for all sectors of activity under consideration, with the exception of left panel for the construction sector in 11. However, all six graphs share one feature. Specifically, wages tend to increase stronger in frictional labour markets. In other words, the point estimates of all interaction terms of the wage regressions for every single sector of activity is positive. Columns (3) and (4) of Tables B1–B4 in the Appendix S1 show that some of the interaction terms are also statistically significant at various conventional levels of confidence. This finding speaks in favour of an upward bias in the wage estimations for other sectors, driven either by higher educational attainment of new entrants or re-training of displaced workers from manufacturing.

4.3 | Robustness analyses

The paper conducts two types sensitivity analyses, one with respect to the treatment of the endogenous action term, and one with respect to alternative measurements of import exposure. As European regional labour markets primarily adjust on the employment margin compared with the wage margin, the robustness analysis focuses on the employment results.

4.3.1 | Treatment of the interaction term

Interactions between endogenous and exogenous regressors, resulting in the endogeneity of the interaction term, are still rare in applied work. Hence, there is no 'dominant' way how to treat the endogeneity of the interaction term. Section 3 discusses various approaches. In the benchmark results, this paper follows Aghion et al. (2005) by instrumenting for the interaction term of the endogenous regressor and the modifying variable with the interaction term of the instrument and the modifying variable. The other two approaches encompass either assuming that the endogeneity of the interaction term is accounted for by considering the main effect (the OLS approach) or exploiting the non-linear nature of the interaction term and using a second-order polynomial of the control variables (the functional approach).

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The results for the different treatment of the interaction term are shown in Tables C1–C6 in the Appendix S1. Columns (1) and (2) show the results for the OLS treatment of the interaction term, and columns (3) and (4) present the estimation results for the functional treatment. As explained above, the former only includes one first-stage estimation, namely for the main effect, whereas the latter approach has a second first-stage as in the benchmark estimations. However, one crucial difference exists between the second first-stage estimation in the benchmark treatment and the functional approach. As the benchmark treatment following Aghion et al. (2005) has an economic meaning with expected sign of the first-stage for the interaction term, this is not the case in the robustness analysis. The functional approach exploits the second-order polynomial of control variables, implying that the F-Statistic and the signs of the coefficients play no econometric role.[17]

Overall, the robustness results with respect to the treatment of the interaction term do not change the results qualitatively. Specifically, frictional labour markets experience a stronger decline in manufacturing employment face rising import competition from China. Slight quantitative differences between the estimation strategies exist, for example the main effect of import competition is stronger in the robustness analysis, but the interaction terms of the functional approach are somewhat smaller and estimated with noise. Furthermore, the notion that the public services sector tends to absorb the adverse trade shock to manufacturing the most is unchanged.

4.3.2 | Alternative measurements

Measurement of import competition per worker is a key concern. Specifically, it relates to the focus on imports from China and the instrumental variable exploiting bilateral trade between China and the United States. The baseline measure of import competition (per worker) only accounts for imports, but not for exports from European countries to China. As exports raise employment opportunities in Europe, the concern is that the benchmark estimations just point to the drawbacks of trade, but is silent on the positive effects on the labour market. For example, for the United States Feenstra and Sasahara (2018) highlight the role of exports and labour demand changes.[18] The second concern, which relates to using trade between the United States and China for the construction of the instrumental variable, constitutes a correlation between industry demand shocks in the United States and European countries. This is a crucial assumption in the identification, therefore a second set of robustness analyses exploits Chinese exports to other advanced economies.

Tables C1–C6 in the Appendix S1 present the estimation results for the second set-up robustness results relating to measurement. Columns (1) and (2) provide the findings when accounting for exports to China. However, the results are largely unchanged for all sectors of

[17]For completeness, the paper reports the F-Statistics for the first-stage estimation of the interaction term in the functional approach. However, they are greatly reduced due to the large number of instruments. Given that every regression includes five control variables, the number of instrumental variables for the interaction term is equal to 15 (squared products and cross-products).

[18]Another key advantage of trade not discussed here nor in previous work with a reduced-form approach is the decline of input prices. Galle et al. (2017) provide evidence that the net welfare impact of Chinese trade is positive, albeit some groups experience welfare losses.

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activity and the non-employment alternatives. While the estimated impact of trade exposure for manufacturing employment is smaller, the point estimates change only marginally. One key reason for this small decline in the coefficients is that, apart from Germany, no other European country significantly increased exports to China. Overall, the sensitivity analyses in relation to accounting for exports to China corroborate the findings from the benchmark analysis.

The last robustness analysis exploits Chinese exports to other advanced economies. The advanced economies are Australia, Canada, Korea, Japan and New Zealand. The idea is to set up a different pool of countries to isolate the supply-driven component of Chinese exports to Europe. Similar to all other alternative estimation strategies, the results are equivalent qualitatively. Further, the magnitudes of the point estimates only differ marginally.

4.3.3 | Accounting for Germany as beneficiary from trade with China

Dauth et al. (2017) argue that Germany is an outlier as it benefited from trading with China, primarily due to rising export opportunities. The authors argue that trade with China (and Eastern Europe) pulled German workers into export-oriented manufacturing subsectors, and therefore, import exposure helped to retain jobs in Germany, in contrast to findings for the United States. However, the authors highlight that the transitions from import- to export-oriented manufacturings subsectors or services did not occur smoothly. Instead, these observations are driven by young labour market entrants and re-entrants.

Germany's special role with strong export opportunities to China poses the question whether the results are driven by Germany. To test this, I repeat the benchmark analysis for the sample without Germany. Tables E1 and E2 in the Appendix S1 present the estimation results for changes in sectoral employment, unemployment, labour force participation and wage changes. Table E1 in the Appendix S1 uses the involuntary flow from temporary employment to unemployment to measure local labour market frictions, whereas Table E2 in the Appendix S1 uses the involuntary flow from unemployment to temporary employment. As Germany comprises the second-highest number of NUTS 2 regions, the sample size drops from 292 to 220.

The results for manufacturing employment are qualitatively unchanged, if at all the impact seems to be stronger (as expected) than in the benchmark results. The results are also qualitatively similar for other employment outcomes. The only deviation from the previous results is in Table E1 in the Appendix S1, where the interaction term of labour market frictions and import competition for non-market services (PS) in column (4) turns negative, although it is very small and still statistically insignificant. Instead, the interaction term for private services in the same table grows somewhat larger, but remains statistically insignificant. One possible explanation for the deviation from the benchmark analysis is the smaller number of observations, especially given that I exploit within-country variation due to the inclusion of country-fixed effects. Furthermore, the findings are non-employment and wage outcomes are also qualitatively unchanged.

5 | CONCLUSION

Between 1997 and 2006, China's exports grew significantly stronger for European countries compared with the United States, in particular after China entered the WTO in 2001. Previous work

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on the United States and individual European countries suggest that the magnitude of the impact of Chinese import competition on labour market varies significantly. Institutional settings of the labour market constitute a potential driver of these differences, and the paper aims to understand how labour market frictions modify the effect of imports from China. The analysis of European regional labour market allows the paper to determine whether local labour market frictions amplify or mitigate the adverse trade shock on manufacturing employment. To measure regional labour market frictions, the paper sets up two measures relating to involuntary flows between unemployment and temporary employment. To circumvent the endogeneity of imports from China, and subsequently its interaction with regional labour market frictions, the paper applies a Bartik shift-share instrument common in the literature for both the main effect and the interaction term.

The results provide evidence that local labour market frictions amplify the adverse effect of import competition on manufacturing employment in European regional labour markets. In frictional labour markets, the decline in manufacturing employment is much stronger than in less frictional labour markets, independent of the measure of local labour market frictions. To understand how the trade shocks affect the structure of local labour markets, for example due to changes in local labour demand and cheaper inputs for other sectors of activity, the paper repeats the same empirical analysis for other sectors of activity, non-employment responses and hourly wages. The findings suggest that public services absorbs the adverse shock to manufacturing, whereas private services and construction do not play a crucial role for absorption. Local labour markets in the aggregate do not experience strong wage changes, although the wage results need to be treated cautiously due to various biases.

The paper highlights the importance of taking features of local labour markets into account when investigating the impact of trade shocks. In this paper, European regions differ by their degree of local labour market frictions, implying a strong difference in the response to trade shock from a low-wage country expanding in global commodity markets. Regions can also differ in other characteristics such as the industries' phase in the product cycle and local education levels as Eriksson et al. (2021) suggest. These local differences, their non-random distribution and the modifying impact they have on the extent of trade shocks highlight the importance of targeted policies to cushion the impact on more adversely affected local labour markets.

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