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Hit by the Silk Road: how wage coordination in Europe mitigates the China shock*

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Abstract

Coordination in collective wage setting can constrain potential monopoly gains to unions in non-tradable industries. Countries with national wage coordination can thus stabilize overall employment against fluctuations and shocks in the world economy. We investigate this argument by exploring within-country variation in exposure to competition from China in 13 European countries. Our estimates demonstrate that in countries with uncoordinated wage setting, regions with higher import exposure experienced a marked fall in employment, while countries with wage coordination experienced no such employment effects. We show that our findings are robust to alternative measures of wage coordination, industry classifications, and trade exposure.

Keywords: China shock; employment; globalization; wage coordination

JEL classification: *F*16; *F*66; *J*51; *J*60

1. Introduction

Global shocks can hurt employment. China's entrance into the world economy has reduced employment in Europe, but more in some countries than in

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others.[1] The Great Recession also demonstrated a huge variation in how employment patterns changed in different countries (see, e.g., OECD, 2010). Such divergent labor market responses to shocks and more competition have renewed the interest in wage determination, bargaining institutions, and union coordination.

Comparing wage setting systems across countries, OECD (2018) finds that coordinated systems are associated with higher employment and lower unemployment than uncoordinated systems. This regularity is consistent with how the compressed wages of coordinated wage setting contribute to expand employment, suggesting that there is a prize rather than a price of wage equality in the form of higher employment levels (Barth and Moene, 2012). We add causal evidence to this literature by examining how wages and employment in local regions in Europe adjusted as import competition from China increased. How did the adjustments depend on the level of union wage coordination?

In our context, coordination means voluntary and self-administered mediation of union interests. The goal might be to raise the sum of welfare to the participating unions. Coordination thus entails the possibility that unions will exploit the buyers of the final product but also the possibility to internalize externalities. What matters is whose interests are coordinated. Does coordination take place between workers who are substitutes or between workers who are complements in production?[2]

It is well established that wage coordination between substitutes induces militancy and aggressive wage demands. The opposite case – how coordination between complements induces quiescence and wage moderation – is often less noticed.[3] Coordination among complements is especially relevant for economies exposed to international competition as long as producers in the non-tradable sector supply intermediates to the tradable sector. A higher wage to workers in non-tradable production would then imply higher costs and thus lower employment in tradable production.

Manufacturers of consumption goods typically depend on inputs from other industries, such as machinery, business services, utilities, travel services, and goods transportation. Investments in manufacturing firms depend on the price of capital goods and construction. Every private sector relies on infrastructure and government services, financed by taxes on employment, sales, and profits.

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[1]For example, Dauth et al. (2014) find small effects in Germany and Donoso et al. (2015) find large effects in Spain.

[2]Workers of type i are substitutes for workers of type j if a higher wage to i increases the demand for workers of type j. Workers of type i are complements to workers of type j if a wage increase of i reduces the demand for type j.

[3]The distinction between substitutes and complements in wage bargaining is explored in Moene et al. (1993) and Horn and Wolinsky (1988).

All this creates interdependence between unions in different industries, which strengthens the complementarity between their workers. There are also links on the demand side that work in the same direction. Workers in tradable and non-tradable sectors are therefore complements in production. Unions that care about their own employment can hence gain by coordinating their wage setting across industries to internalize such spillovers.

To set the stage, we incorporate the essence of these dependences in a simple model of wage coordination. Abstracting from the bargaining process, we do not incorporate the important direct employer interest of wage moderation. Theoretically, we are therefore erring on the safe side when exploring how collective wage setting might raise competitiveness in foreign markets. We explore how the wage aspirations of unions, even in the absence of the very likely support of employers, can raise the competitive strength of exposed producers.[4] We show how coordination of collective wage bargaining by self-interested unions can stabilize total employment against fluctuations in the world economy, enabling the majority of workers to achieve a greater share of the potential gains from globalization.

In what we call "simple coordination", the unions are supposed to do this with no constraints on relative wages. Such an approach, however, can represent a rather one-sided wage adjustment. If the wage of one union does not affect the welfare of other unions, in spite of other indirect effects between unions, then this union actually gets the same wage with coordination as it would have chosen without.

In what we call "reciprocal coordination", in contrast, the wage determination is based on mutual reciprocity in the form of a norm of parallel wage adjustments. Such pattern bargaining is described by the OECD as typical for European countries, referring to it as "the degree to which minor players deliberately follow what major players decide" (OECD, 2019, p. 61). In our interpretation, reciprocal coordination builds on a premise of equal treatment across unions, implying that if the sheltered union is supposed to accept wage moderation to improve the competitiveness of tradable industries, the exposed union must also moderate its own wage. We show that both types of coordination give similar theoretical results.

Our key mechanism is simple. A trade shock, such as cheaper Chinese products, implies a decline in the world price of tradable goods. When wages are set separately in each sector, the unions only organize workers who are substitutes and wages are then set as a mark-up over the fallback pay. Thus, the trade shock shows up in employment only, without any adjustment in wages.

[4]In small open economies, employers argue consistently that wage setting should follow a pattern where the conditions of the tradable sector should set the path of wage adjustments in the entire economy. Our formulation relies on the self-interests of unions to achieve such goals.

With wage coordination across tradable and non-tradable sectors, in contrast, the unions together organize complements and not only substitutes. The unions therefore internalize the effect that a high wage in the non-tradable sector can reduce employment in the tradable sector. Thus, the perceived cost of a wage increase in the non-tradable sector becomes higher and, hence, the wage aspiration becomes lower. In isolation, this is an effect that raises profits in the tradable sector as non-tradable inputs become cheaper. The corresponding rise in the net value-added price in turn leads to higher employment in the tradable sector, absorbing part of the initial trade shock. In other words, our claim is that wage coordination works as an insurance device against the risk of trade shocks that spread via domestic input–output linkages.

To investigate the hypothesis, we use data from 13 European countries during the period of China's entrance into the world market. We measure wage coordination using the coordination index provided by Visser (2016) in the Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) database.[5] This index measures the dimensions of bargaining systems that best capture our notion of wage coordination across sectors. The same measure was used, for instance, by OECD (2018, p. 79) to measure wage coordination that "helps negotiators internalize the macroeconomic effects of the terms set in collective agreements [. . .] keeping wage increases in the non-tradable sector in line with what can be afforded by the tradable sector".

In the main empirical analysis, we explore within-country variation in exposure to the China shock. We follow the now famous shift–share approach of Autor et al. (2013) and link initial employment composition with trade flows going from China to Europe. Regions initially specialized in the production of goods that China started to export were relatively more exposed to higher import competition. To give our estimates a causal interpretation, we instrument actual imports by trade flows from China to other rich economies outside Europe.

Our main interest is to explore whether the effect of the China shock was different in countries with wage coordination than in countries with uncoordinated wage systems.[6] To be clear, we are not estimating the total employment effect of wage coordination. Instead, we provide an estimator of the differential effects on regions within countries, and in this way we investigate the extent to which coordination across bargaining units at the national level provides insurance against global employment shocks.

[5]See http://www.uva-aias.net/en/ictwss for details.

[6]We approach this by adding an interaction term between import exposure and the measure of wage coordination. Beach and Lopresti (2019) use a similar approach to investigate whether the effects of the China shock on crime in the US depend on the generosity of unemployment insurance.

The analysis reveals an interesting pattern. We find no employment effects of higher import penetration in countries with wage coordination. In contrast, we find strong negative effects in countries with uncoordinated wage systems. The effects are mainly due to a reduction in manufacturing employment. The baseline estimate is that a rise of 1,000 euros in import exposure (per worker) leads to a reduction in manufacturing employment as a fraction of the population of 1.5 percentage points.

Is this a large effect? As mentioned, our estimates capture the relative effect of the China shock across regions. Still, to assess the magnitude of the effect, we can compare it to the total employment changes during our study period. Doing this, we find that the predicted trade-induced decline in employment amounts to around one-fifth of the actual decline in manufacturing employment during the period 2000–2008. We can also compare our estimates to those reported in previous research. The employment effect in countries with uncoordinated wages is, for example, stronger than what is found in the US by Autor et al. (2013) and others (see Autor et al., 2014; Acemoglu et al., 2016; Pierce and Schott, 2016; Asquith et al., 2019; Bloom et al., 2019), but in the same ballpark as studies of some European countries.

Overall, our findings might help resolve the puzzling variations in employment effects of the China shock found in different parts of Europe. For instance, Dauth et al. (2014) and Balsvik et al. (2015) find very small employment effects in Germany and Norway – both are countries with a coordinated wage bargaining – while Donoso et al. (2015) and Malgouyres (2017) find large negative employment effects in Spain and France, which are countries with uncoordinated wage setting.

Can the pattern we find be explained by differential growth in export to China? Clearly, trade goes both ways. Dauth et al. (2014) show that German regions specialized in export-oriented industries experienced employment gains and lower unemployment. To address this issue, we consider measures that take export into account and experiment with different measures of import exposure. The main findings are not sensitive to these changes in measurement.

The import of intermediates in production raises similar concerns. As discussed by Autor et al. (2016), offshoring might raise the productivity of workers (Grossman and Rossi-Hansberg, 2008) or lower the price of intermediates (Auer et al., 2013), and thus yield positive employment effects in the importing countries. While such effects were not detected in Auer et al. (2013), evidence from many countries might be more susceptible to variations in the share of intermediates, and thus we use imports in final goods in our main analysis. However, our main findings are not sensitive to using total imports in our measure of trade exposure.

Another key question is whether our results are driven by wage coordination in itself or by some other country-level variable correlated with coordination. We assess this by investigating several other country-level characteristics, such

as union density, employment protection legislation and average education attainments. We conduct two tests to explore whether these characteristics explain our findings. In the first, we weight our regressions in such a way that the group of countries with wage coordination matches those with uncoordinated wage systems. In the second test, we add an additional interaction term between import exposure and the additional country variables. Both tests suggest that the different employment effect is due to wage coordination, and not to any other (observed) country-level characteristic.

In line with the mechanism that we suggest, we also demonstrate that the industries not directly exposed to the import shock have lower wage growth when located in countries with wage coordination rather than in countries without, and that the absorbing effect of coordination is larger in import competing industries that rely more heavily on inputs from the sheltered sector.

Some recent papers have raised concerns with shift–share approaches such as the one we use (Borusyak et al., 2018; Jaeger et al., 2018; Adao et al., 2019; Goldsmith-Pinkham et al., 2020). We address all of the most relevant concerns. Among several other tests, we show that our estimates are robust to controlling for pre-trends in manufacturing employment, and to standard errors that account for residual correlation across regions with similar manufacturing structure.

Finally, our paper adds to the long string of literature exploring wage setting in small open economies. This literature focuses on the role of wage policies to retain full employment and prevent inflation. It started with the work of Odd Aukrust in the 1960s and with that of Edgren et al. (1969).[7] Nymoen (2017) surveys the comprehensive literature and provides informative long-run estimates of the suggested relationships.

Below, we articulate our main argument through a simple model, in Section 2. We describe our data, provide motivating empirical patterns and discuss our empirical strategy in Section 3. We present our empirical results and argue for their robustness in Section 4. We explore more detailed implications of our proposed mechanism in Section 5, before we conclude in Section 6.

2. The mechanism: a formal exposition

Any union can trade off higher wage aspirations against lower employment levels. Not all unions, however, face the real social terms of this trade-off between pay and jobs. First, there can be indirect effects from an implicit monopoly power of unions over producer prices. This power is implicit in the sense that unions influence wage determination and thus the level of production. The real cost of increasing the wage level for the union is lower

[7]Aukrust's work was first published in English in Aukrust (1977).

as long as the employers can increase the producer price and thus shift part of the costs to the buyers. Secondly, a further indirect effect can arise from interlinked production as the output of one industry is rarely made with the input of labor from a single union only. A wage rise in one trade can therefore affect employment also in other trades.

Below, we combine the two reasons within a stylized partial equilibrium approach of tradable and non-tradable production, showing how wage coordination in the form of a seemingly monopoly collusion among unions can be associated with higher competitiveness in international markets. We abstract from the bargaining process and focus on the wage aspirations of the unions. Hence, unions set wages with and without union coordination. We also abstract from other, less important, input–output links than the one that stems from non-tradable outputs being used as inputs in tradable production. Incorporating similar links both ways would actually strengthen our mechanism (as we briefly comment on in the end of this section).

In each of the two sectors, there is one union with leaders who care about the numbers of jobs L_i and the level of union rents $R_i = w_i - z_i$, where w_i is the pay beyond the fallback wage z_i. The trade-off between jobs and union rents is captured by the union preferences[8] given by

$$V_i = L_i^{\beta} R_i^{1-\beta}, \tag{1}$$

with $\beta \in (0, 1)$.

2.1. Prices in tradable and non-tradable sectors

In our model, the price of tradable goods is given on the world market. It is denoted by P_e, where subscript e stands for exposed. To find the relevant value-added price p_e, we subtract the unit cost of variable inputs (raw materials and intermediates), which vary in fixed proportion to the production in the tradable sector. The unit costs capture the cost-minimizing mixture of domestic and foreign supply, expressed as $C = c\,p_s^{\alpha} q^{1-\alpha}$, where p_s is the price of non-tradable goods (s for sheltered) and q is the given price of imported inputs.[9] Accordingly, the relevant value-added price within the

[8] See Farber (1986) for an overview of the early literature of union preferences.

[9] Raw materials and intermediates are combined into material, which is used in a fixed proportion to total output as its use is determined by the characteristics of the final output. By a suitable choice of units, each unit of the final output requires one unit of material. There is no substitution possibilities between material and labor. Material is a combination of imports m_q and supplies from the s-sector m_s, where $1 = m_s^{\alpha} m_q^{1-\alpha}$ with $\alpha \in [0, 1]$. Minimizing unit costs $p_s m_s + q m_q$ s.t. $1 = m_s^{\alpha} m_q^{1-\alpha}$ yields $C = c\,p_s^{\alpha} q^{1-\alpha}$ with $c = [\alpha/(1-\alpha)]^{1-\alpha} + [(1-\alpha)/\alpha]^{\alpha}$.

tradable sector becomes

$$p_e = P_e - c p_s^{\alpha} q^{1-\alpha}, \tag{2}$$

with $\alpha \in (0, 1)$.

Production in the tradable sector as well as in the non-tradable sector takes place with Cobb–Douglas technologies, $b_i L_i^{\xi_i}$, with $\xi_i < 1$ for $i = s, e$. After wages are set, employers have the right to manage employment levels by maximizing profits, $p_i b_i L_i^{\xi_i} - w_i L_i$, for given w_i with $i = s, e$. Finally, in our partial equilibrium approach, the domestic demand for the non-tradable output x_s is $p_s = a x_s^{-\epsilon}$, with $\epsilon < 1$, where p_s is the value-added price.

We are interested in how the non-tradable price p_s is linked to the wage w_s, which can be derived by combining the domestic demand with how production is determined in the non-tradable sector. It follows that with constant elasticities the derived relationship is similar in cases where the producers of non-tradable goods are price-takers in the output market, or price-setting monopolistic competitors. In both cases, the link can be written as

$$p_s = A w_s^{\theta}, \tag{3}$$

where, as we show in the supplementary material (Online Appendix A), the elasticity $\theta = \epsilon \xi_s / [1 - \xi_s (1 - \epsilon)] < 1$ is the same in the two cases, but the value of the parameter A is higher under monopolistic competition than in the case with price-taking behavior.

2.2. Union power and employment

Given the employers' right to manage employment, the unions take the relationship between wages and employment as given. The relationship can be derived from employers' profit maximization. Whether there is price-taking behavior or monopolistic competition in the non-tradable sector, the relationships take the form:

$$L_i = B_i [w_i / p_i]^{-\eta_i}. \tag{4}$$

Here, $\eta_i = 1/(1 - \xi_i) > 1$ and the level of B_s is lower in the case with monopolistic competition than in the case with price-taking behavior, while B_e does not change with the form of market competition in the non-tradable sector (see Online Appendix A). Combining equations (1) and (4), we obtain

$$V_i = R_i^{1-\beta} B_i^{\beta} (w_i / p_i)^{-\beta \eta_i} \tag{5}$$

To derive an interior solution in wage setting, where unions balance the gain of a higher wage against the cost of job loss, unions must care enough, but not

too much, about employment. The restrictions on β that this implies are made precise in Online Appendix A.

Sheltered unions have implicit market power as long as the output price is determined by the production of non-tradable goods, and thus by the labor costs, as in equation (3). As we have just seen, the elasticity θ in equation (3) depends on the supply-side parameters ξ_s and the demand-side parameters ϵ. The higher θ is from an increase[10] in ϵ, the stronger the implicit market power of the sheltered union. This is because a high θ means that the union can shift part of the wage increases to a higher producer price, implying that the reduction in employment becomes less dramatic. Accordingly, a 1 percent increase in the non-tradable wage increases the producer real wage by only $(1-\theta) < 1$ percent. In this way, the implicit monopoly power of the union makes own employment less sensitive to own wage increases, just as if the "real" elasticity of wages on employment is not η_s but rather reduced to $\eta_s(1-\theta)$. The union can thus charge a higher wage without a severe loss of own jobs. The social cost of the implicit market power is lower profits and employment in the tradable sector.

The union in the tradable sector, in contrast, cannot shift wage increases over to a rise in the output price. The value of $p_e = P_e - c\,p_s^{\alpha} q^{1-\alpha}$ goes down when the wage in the non-tradable industry goes up, implying a higher price on non-tradable inputs. The reliance of the tradable sector on inputs from the non-tradable sector, as captured by the unit cost elasticity α, plays a crucial role in our argument.

2.3. Coordinated and uncoordinated wage setting

Coordination as a voluntary self-administered mediation is captured by the wages that maximize the common union welfare:

$$W = V_s + V_e. \tag{6}$$

We distinguish between (i) simple coordination and (ii) reciprocal coordination.

(i) Simple coordination is just the the solution to $\max_{w_s, w_e} W$. This approach would internalize indirect effects in the wage setting. Yet, this internalization can represent a rather one-sided wage adjustment. Because the wage of the exposed union has no direct effects on wages

[10] A higher ϵ raises θ without affecting the elasticity of labor demand.

and employment of the sheltered union, the wage level w_e that maximizes W is equal to the level of w_e that maximizes V_e in our formulation. To think about wage coordination as such a one-sided wage moderation is perhaps naïve.

(ii) Reciprocal coordination is a more realistic form of coordination. As mentioned in the Introduction, such coordination captures what the OECD describes as typical for European countries (OECD, 2019, p. 61). In our interpretation, the pattern of coordination reflects a premise of equal treatment across unions, implying that if the sheltered union is supposed to accept wage moderation to improve the competitiveness of tradable industries, the exposed union must also moderate its own wage. Reciprocal coordination is pattern bargaining with a reciprocity norm about relative wages between the two sectors, say $(w_e/w_s) = k$, and we let coordination mean the outcome of $\max_{w_e} W$ subject to $w_s = kw_e$. In the case of homogeneous labor, we have $k = 1$.

We call this pattern bargaining because it is contingent on the wage pattern set by one major player (the exposed union) in the collective interests of all players. Internalizing the indirect effects via the price of non-tradable inputs to exposed industries requires, in this case, a parallel wage moderation by both unions.

We derive five implications from our set-up, which are all proved in Online Appendix A.

1. **Uncoordinated wage setting provides no wage flexibility.**

   When wages are set separately in each sector, the wage setting union only organizes workers who are substitutes, implying aggressive wage aspirations. Wages are set as a mark-up over the fallback pay z_i in each sector. In the non-tradable sector, the mark-up is increasing in the market power of the union θ. With uncoordinated union bargaining, wages can differ for equal work; homogeneous workers can obtain unequal wages in the two sectors (see Online Appendix A). Most importantly, wages in both sectors are unaffected by price shocks for tradable goods. Changes in international markets show up in variation in employment only.

2. **Wage coordination lowers the wage aspiration of the sheltered union.**

   The intuition is simple. With wage coordination, the union internalizes the effect that a higher sheltered wage also reduces employment in the tradable sector. Thus, the perceived cost of a wage increase in the non-tradable sector becomes higher and, hence, the wage growth becomes lower. The sheltered union's wage moderation holds when the coordination

is reciprocal as well as when it is naïve. With reciprocal coordination, the effects are strongest as wages in both sectors are reduced in tandem.

3. **Wage coordination expands overall employment.**

   Overall employment goes up because wage moderation in the sheltered sector reduces the producer's real wage in both sectors, but for different reasons. It declines in the non-tradable sector as a direct effect of a lower nominal wage. It declines in the tradable sector because it raises the value-added price as the unit cost of intermediates declines. Lower real wages for producers in the two sectors expand employment in both. With reciprocal pattern bargaining, there is an additional effect of wage moderation in the tradable sector with its own contribution to the rise in employment.

4. **Wage coordination provides insurance against the risk of trade shocks.**

   The implicit insurance means that the decline in the value-added price of the tradable sector is less than the fall in the corresponding international price. The insurance is provided by wage moderation in the non-tradable sector, absorbing part of the trade shock. Exposed producers obtain cheaper non-tradable intermediates as sheltered unions take their share of the economic decline in the world market. This implicit insurance mechanism that protects exposed workers somewhat against negative trade shocks also works in the opposite direction when the economy is hit by a positive trade shock. When the world market prospers, wage coordination and solidarity provide a rise in wages to all unions. Hence, exposed workers now share the benefits of international improvements with the rest of the union movement. Both types of wage coordination entail an insurance effect. The impact of exposed employment is strongest in the case of reciprocal coordination in pattern bargaining.

5. **Wage coordination offers more shock absorption the more non-tradable inputs the tradable sector uses.**

   A higher share of non-tradable intermediates in the tradable production means that the impact of wage moderation by the sheltered union is more effective. Thus, the wage moderation in the non-tradable sector becomes stronger and the impact of negative trade shocks on the exposed workers weaker. Again, this effect is strongest in the case of reciprocal coordination.

We show these results while incorporating an input–output link from non-tradable to tradable production only. If, in addition, we accounted for possible links, capturing inputs going from tradable to non-tradable production, our mechanism would be strengthened. A decline in the world market price

would then, in isolation, gain the sheltered unions, as their value-added output price would go up. As wage coordination based on maximizing the joint union utility, $V_s + V_e$, works as a sharing of possible marginal gains across the two unions, a lower P_e would then lead to more wage moderation in non-tradable production compared with the case with no links from tradable to non-tradable production.

In the above discussion, we have focused exclusively on the comparison between union wage aspirations with and without coordination. An alternative benchmark could be the competitive labor market with no unions (which is a hypothetical case given the organizational structure of European labor markets). In a competitive labor market, a negative trade shock would reduce the employment in the tradable sector. If labor were homogeneous across sectors, then the trade shock would also be met by a lower common wage across sectors, $z_e = z_s = z$, modifying the initial effect.

In this connection, it is interesting to note that the response to the trade shock in the union case without coordination is far from the response that would result in a competitive labor market. The response with full coordination, however, comes closer to the competitive case, in line with the non-monotone relationship between real wages and wage coordination (the so-called "hump"), derived by Calmfors and Driffill (1988). One difference between full union coordination and a competitive labor market in our case is the explicit attention to the tradable sector. In the coordinated union case, this competitive sector remains larger in the coordinated union equilibrium than in a hypothetical competitive labor-market setting.

The basic feature of the model, however, is how wage coordination across unions mitigates the employment decline of the China shock – both by limiting job loss in the tradable sector and by increasing employment in the non-tradable sector. Without coordination, a decline in foreign prices would reduce employment in tradable production. Wages would remain fixed. With coordination, however, wages become more flexible, as unions would reduce the wage in particular in non-tradable production and with reciprocal coordination in both sectors. This wage decline would increase production of non-tradable goods and lower the costs of intermediate inputs in tradable production. In isolation, this adjustment leads to a rise in the value-added price in tradable production, counteracting the initial decline in international prices and also in the employment in tradable production. These are the implications that we explore empirically.

3. Data and identification

To test the mechanism, we need detailed information about changes in employment and about which sectors are hit by the China shock and which are not. In this section, we describe our data sources and provide motivating

empirical patterns, dependent on how wage bargaining is organized. We also describe our empirical approach.

3.1. Data sources and measurement

Our analysis focuses on the period 2000–2008, and we use data from the following 13 European countries: Austria, Belgium, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom.

Most of our data are extracted from the Eurostat regional database, in which the Structural Business Statistics (SBS) provide annual employment data for manufacturing.[11] The published data, however, are incomplete for some countries, and in these cases we supplement with national sources (see Online Appendix B for details). In total, we have the disaggregated employment data for 187 labor market regions, so-called NUTS 2, by 14 manufacturing industries at the two-digit NACE level. The Eurostat database also provides information on population size, total employment, and average education attainment at the same level of aggregation. In addition, we extract some data on wages from the Eurostat and the OECD, which we supplement with micro data from the Structure of Earnings Survey. The geographical identifiers in all of these datasets are at a higher level than NUTS 2. Therefore, we do not use these data in our main empirical analysis.

We obtain information on international trade from the United Nations Commodity Trade Statistics (Comtrade). This data source provides annual trade flows for over 170 countries, by commodity and trade partner. We use the four-digit SITC product codes, which gives us about 1,100 commodity groups. We convert the trade flows into 2007 euros. We then match trade flows with disaggregated manufacturing employment data using harmonized industry and product classifications. The World Bank provides the correspondence between SITC product codes and NACE industry codes. Using this correspondence list, we are able to unambiguously match 93 percent of all commodity groups to two-digit NACE industries. The rest of the commodities are linked to more than one NACE code. For these ambiguous cases, we make use of the five-digit SITC trade data and compute the share of trade by NACE codes within each four-digit commodity group. We then choose the NACE code with the highest share, separately for import and export.[12] Finally, we allocate commodities into final consumption goods, intermediates, and capital goods using the

[11] See https://ec.europa.eu/eurostat/web/structural-business-statistics.

[12] The reason why we do not use the five-digit data only is that these have a lot of missing commodities (the sum of trade in five-digit commodities is much lower than the sum of trade in four-digit commodities).

United Nations Broad Economic Categories. As discussed in the Introduction, we use imports of final consumption goods in our main specifications below, but we also provide robustness analyses with intermediates and capital goods included.

We extract country-level labor market characteristics from the databank compiled by Visser (2016). This dataset includes information on, for example, union density, employment protection legislations, wage-setting coordination, and much more. The coordination index takes five values:

1. fragmented wage bargaining, confined largely to individual firms or plants;
2. mixed industry and firm-level bargaining, and weak government coordination through minimum wage setting or wage indexation;
3. negotiation guidelines based on centralized bargaining;
4. wage norms based on centralized bargaining by peak associations with or without government involvement;
5. maximum or minimum wage rates/increases based on centralized bargaining.

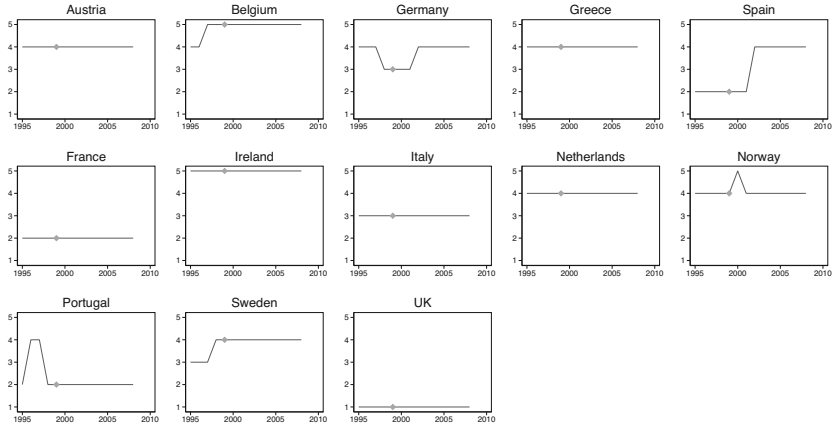
In most of our analysis, we make use of a simple binary variable to capture wage coordination. We set this binary variable equal to unity if the country has a coordination index of three or more, which implies negotiation guidelines, wage norms, or bounds on wage rates/increases based on centralized bargaining by peak organizations. To validate that our cut-off is empirically meaningful, we also provide evidence from flexible specifications using all five values of the index. Figure 1 displays the raw coordination index by country and year. The dots in the figure mark the baseline period, which we use for our binary classification. We thus classify the wage bargaining to be coordinated in the following nine countries: Austria, Belgium, Germany, Greece, Ireland, Italy, the Netherlands, Norway, and Sweden.

3.2. Descriptive statistics and stylized patterns

Before we proceed, we present two descriptive patterns that motivate our empirical investigation.

3.2.1. Countries with wage coordination have been equally exposed to China as countries with uncoordinated wage systems. In the top panel of Figure 2, we present per capita trade flows of final consumption goods. The flow of imports from China to the European countries in our sample increased substantially, especially during the period 2004–2008. Exports to China also

Figure 1. Degree of wage coordination



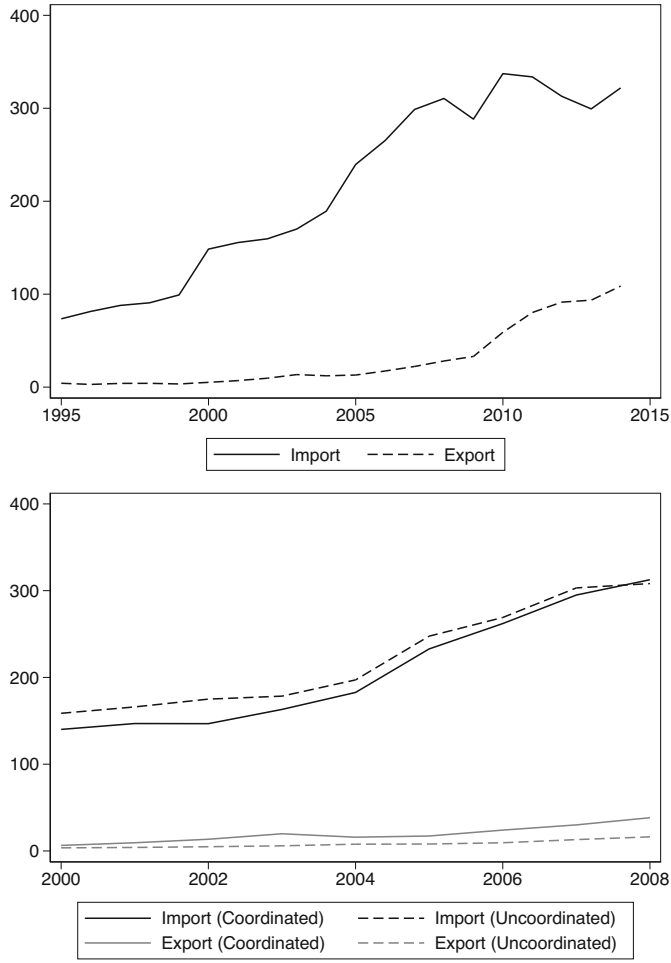
Notes: The figure is based on the ICTWSS database (see Visser, 2016).

increased, but much less, leading to an increasing trade deficit in Europe. In the bottom panel of Figure 2, we zoom in on our main study period and group countries based on wage coordination. The rise in imports is very similar across the two groups of countries, although slightly steeper for countries with wage coordination.

In Table 1 we show how the rise in imports is split between manufacturing industries. Manufacturing of textiles and manufacturing n.e.c. are the two dominant industries. The latter industry produces furniture, and importantly for this application, sports goods and toys. Textiles make up a slightly higher share of the increase in imports for countries with uncoordinated wage systems than for those with wage coordination, while the share of manufacturing n.e.c. is somewhat lower. Still, the overall composition is very similar. The top five manufacturing industries make up the majority of the increased imports: 87.2 percent for countries with wage coordination and 88.8 percent for those with uncoordinated systems. The employment shares for the same industries are also very similar in the two groups of countries. The descriptive statistics thus suggest that exposure to China was about the same.

3.2.2. Decline in manufacturing employment was more modest in countries with wage coordination. The entrance of China into the world economy coincides with a significant decline of European manufacturing employment. In Figure 3, we plot manufacturing employment relative to the working-age population (aged 15–74) for the years 1996–2008. As can be seen, the employment ratio fell somewhat for countries with wage coordination, but much more so for those without. From 2000 to 2008,

Figure 2. Trade in final consumption goods with China (per capita)



Notes: The figure is based on data from Comtrade and presents trade flows of final consumption goods, in constant 2007 euros and in per capita terms. The top panel is based on the EUR/USD exchange rate from 1999 for years before the introduction of the euro. Countries are weighted by population.

the employment rate fell by more than 2 percentage points for these countries, while it fell by less than 1 percentage point in countries with wage coordination.

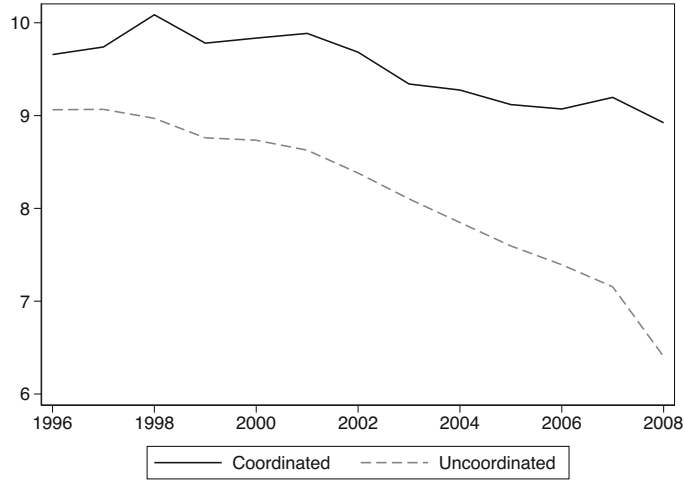
Of course, countries could have been hit by shocks other than the inflow of inexpensive Chinese imports. In the next section, we describe our empirical approach of how we isolate the effects from the China shock.

Table 1. Manufacturing industries: share of total increase in imports of final goods and employment

	Wage coordination		Uncoordinated wage system	
	% of Δ import	% of empl.	% of Δ import	% of empl.
	(1)	(2)	(3)	(4)
Textiles and textile products	38.3	1.4	45.3	1.5
Manufacturing n.e.c.	26.9	0.9	22.8	1.0
Leather and leather products	10.7	0.3	10.2	0.3
Machinery and equipment n.e.c.	6.8	2.2	7.5	1.3
Electrical and optical equipment	4.5	2.0	3.0	1.7
Food products, beverages and tobacco	2.9	1.9	2.2	2.3
Transport equipment	2.5	1.8	2.2	1.3
Rubber and plastic products	2.6	0.8	1.5	0.9
Basic metals and fabricated metal	1.6	2.7	1.5	2.3
Other non-metallic mineral products	1.4	0.8	1.4	0.8
Pulp, paper and paper products	1.0	1.3	1.3	1.4
Chemicals, chemical products and manmade	0.7	1.1	1.0	1.0
Wood and wood products	0.2	0.6	0.3	0.5
Coke, refined petroleum products	0.0	0.1	0.0	0.1

Notes: Columns 1 and 3 display percentage of changes in imports from 2000 to 2008. Columns 2 and 4 present the percentage of employment in 1999.

Figure 3. Manufacturing employment as a fraction of working-age population, by wage coordination



Notes: The figure is based on employment figures from the SBS. Countries are weighted by population.

3.3. Empirical set-up

Like Autor et al. (2013), we first define changes in import exposure, as

$$\Delta Import\ exposure_{it} = \sum_j \frac{L_{ijt}}{L_{jt}} \frac{\Delta Import_{jt}}{L_{it}}, \tag{7}$$

where $\Delta Import_{jt}$ is the total change in import from China to Europe in industry j during time period t to $t+1$. The term L_{ijt}/L_{jt} denotes region i's share of the total employment in industry j at time t, while L_{it} represents the total employment in region i. The measure in equation (7) thus apportions imports of different commodities to regions based on their share of total employment.

In our baseline specification, we regress the change in regional employment, Y_{it}, between period t and $t+1$, on the change in import exposure over the same period, controlling for start-of-study-period regional characteristics, X_i', and country × period fixed effects, θ_{ct}:

$$\Delta Y_{it} = \beta_1 \Delta Import\ exposure_{it} + X_i'\gamma + \theta_{ct} + \epsilon_{it}. \tag{8}$$

The variation in import exposure stems from two sources: the size of the overall manufacturing sector and the composition of the manufacturing sector in each region. The empirical strategy seeks to exploit the latter source of variation. Therefore, we always include the initial share of employment in manufacturing in the regional controls, X_i'.

The main challenge of the specification is the potential endogeneity of regional trade exposure. To tackle this, we use an instrumental variable (IV) strategy similar to Autor et al. (2013). We construct the following instrument for every region i:

$$\Delta Import\ exposure_{IV,it} = \sum_j \frac{L_{ij,t=1999}}{L_{j,t=1999}} \frac{\Delta Import_{jt}^{Other}}{L_{i,t=1999}}. \tag{9}$$

This expression differs from equation (7) in two ways.

First, it replaces changes in actual trade flows from China to Europe with changes in trade flows from China to other high-income countries ($\Delta Import_{jt}^{Other}$). In our baseline specification, we use the following high-income countries: Australia, Canada, New Zealand, and the US. The intuition is that we see the increased trade flow from China largely as an exogenous supply shock, induced by the improved competitiveness of Chinese manufacturing. The supply shock hits the whole world economy, not just Europe. Using import flows to high-income countries outside Europe as an instrument can therefore identify the exogenous component of Chinese import penetration.

Second, equation (9) differs from equation (7) in that it replaces the start-of-period employment structure in each region with the employment structure from the year prior to our estimation period (i.e., 1999).[13] We do this to tackle potential measurement errors and reverse causality, if firms anticipate future trade exposure and adjust their employment accordingly.

We include an interaction term between import exposure and the degree of wage coordination to identify potential differences in the response to the China shock. Because wage coordination can be endogenous, we use a measure from the year prior to our estimation period. In our main specification, we use a simple binary variable, $Coord_{c,t=1999}$, to denote countries with coordinated wage bargaining. The specification can thus be written as

$$\Delta Y_{it} = \beta_1 \Delta Import\ exposure_{it} + \beta_2 (\Delta Import\ exposure_{it} \times Coord_{c,t=1999}) + X_i' \gamma + \theta_{ct} + \epsilon_{it}. \quad (10)$$

The direct effect of coordination is absorbed in the country fixed effects. Analogous to equation (9), we construct an instrument for the interaction term as

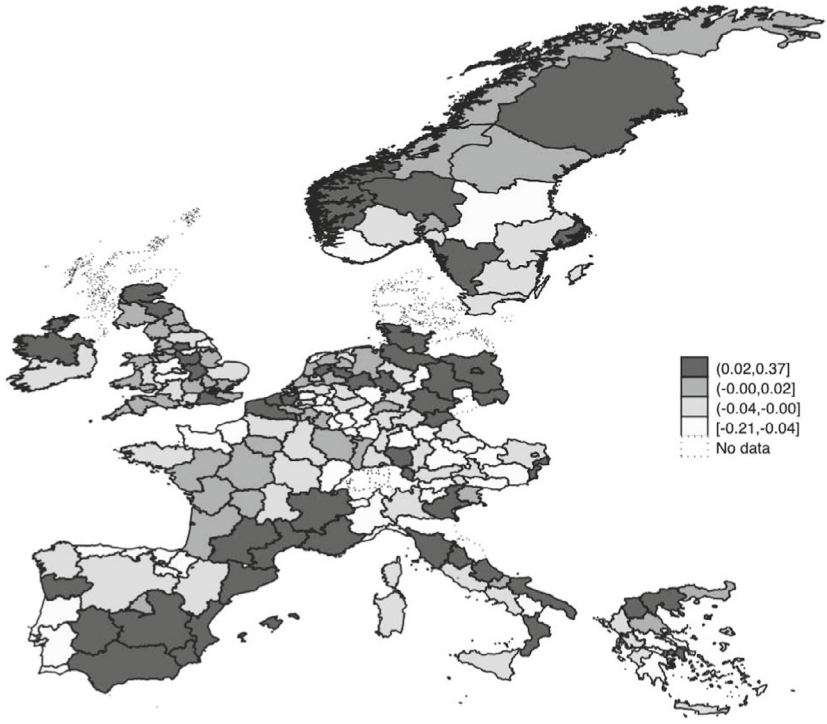
$$\Delta Import\ exposure_{IV,it} \times Coord_{c,t=1999} = \sum_j \frac{L_{ij,t=1999}}{L_{j,t=1999}} \frac{\Delta Import_{jt}^{Other}}{L_{i,t=1999}} \times Coord_{c,t=1999}. \quad (11)$$

As we include country × period fixed effects in our model, we identify the effect of import exposure from differences between regions within countries. These differences arise because the import shock hits regions deferentially according to their industry structure. The heat map in Figure 4 illustrates this variation. Consider, for instance, national macro policy responses, or country-wide adaptations by the national confederations of unions or employers, that are identical across industries and regions. Such potential spillovers between regions at the national level are effectively swept out of the estimation, together with any other shock at the country level that potentially could be correlated with the import shock. Thus, we are not estimating the total impact of the trade shock, or the total effect of wage coordination. Instead, we provide a clean estimator of the differential effects on regions, and in this way investigate the extent to which coordination across bargaining units at the national level provides insurance against global employment shocks.

Because our model predicts that coordination induces wage moderation in the non-tradable sector, potential employment effects are spread out

[13] We are not able to go further back in time due to data constraints.

Figure 4. Heat map of the regional variation in import exposure



Notes: The map shows the residual variation in predicted changes in import exposure, after all regional covariates, as well as the country × period fixed effects, are partialed out.

across all regions. In terms of equation (10), this could be translated into a prediction of $\beta_1 < 0$ and $\beta_2 > 0$. If the level of wage moderation is sufficiently high in the non-tradable sector, then the overall employment effects would be the same regardless of the industry composition of the regions, and $\beta_1 = -\beta_2$.[14]

4. Results

In this section, we present our empirical findings. Our main outcome variable is the four-year change in manufacturing employment as a share of the working-age population.

[14] We interpret the manufacturing and the non-manufacturing sectors as proxies for the classification of the tradable and non-tradable sectors used in our conceptual framework.

4.1. Baseline estimates

We start by presenting our baseline 2SLS estimates. The first stage in these regressions is always strong and coefficients have the expected sign. For brevity, we show the first-stage estimates in Online Appendix D. The second-stage estimates are presented in Table 2. In the first column, we do not include any controls, except the initial manufacturing share. The interpretation of the import exposure coefficient is that a rise of 1,000 euros in import exposure reduces the manufacturing employment share by 1.482 percentage points in countries with uncoordinated wage systems.

The positive interaction coefficient shows that the decline is much less pronounced in countries with wage coordination. In fact, the sum of the interaction coefficient and the main coefficient is not significantly differently from zero. Our point estimates thus suggest that the negative employment effects vanish completely in the coordinated case. In the second column of Table 2, we add controls for the population share of high- and medium-skilled workers, as well as the share of female workers. We define medium-skilled workers as those with secondary education (ISCED 3/4)

Table 2. Baseline specification

	Manufacturing		Non-manufacturing	
	(1)	(2)	(3)	(4)
Δ*Import Exposure*	−1.482***	−1.408***	−0.960	−0.927
	(0.494)	(0.488)	(0.926)	(0.914)
Δ*Import Exposure* × *Coordination*	1.532***	1.659***	0.743	0.781
	(0.541)	(0.544)	(1.287)	(1.231)
Manufacturing employment share	−0.035***	−0.037***	0.061***	0.063**
	(0.008)	(0.008)	(0.024)	(0.025)
Population share, medium-skilled		0.024***		−0.009
		(0.009)		(0.040)
Population share, high-skilled		0.003		0.003
		(0.009)		(0.027)
Female employment share		−0.031**		−0.039
		(0.013)		(0.044)
Observations	366	366	366	366
R^2	0.598	0.612	0.472	0.474
F-stat excluded instruments				
Δ*Import Exposure Other*	127.3	131.6	127.3	131.6
Δ*Import Exposure Other* × *Coordination*	141.5	143.6	141.5	143.6

Notes: The dependent variable is the four-year change in employment/working-age population (in percentage points), 2000–2008. Robust standard errors clustered on NUTS 2 are shown in the parentheses. All regressions include country times period fixed effects. 182 observations for the 2000–2004 period, and 184 observations for the 2004–2008 period. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

and high-skilled workers as those with tertiary education (ISCED 5A/5B/6 or higher). Adding these controls leaves our main coefficients largely unchanged, although the import exposure coefficient decreases somewhat while the interaction term becomes slightly larger.[15]

What is the economic significance of these estimates? One way of illustrating this is to assume, for a moment, that the estimates capture absolute changes and not just relative changes across European regions. We can then compare the predicted trade-induced employment decline with the observed changes during our study period. The average fall in the manufacturing share was 2.3 percentage points between 2000 and 2008 in the four countries with uncoordinated wage systems. Combining the increase in import exposure with the coefficients from Column 2, we can calculate that the rise of Chinese imports contributed to a reduction of 0.4 percentage points in the manufacturing share. This is equal to around one-fifth of the total decline in these countries.

Another test of our results is to compare them with studies for other countries. Autor et al. (2013) estimated a coefficient of −0.6 for the effect of Chinese import penetration on US manufacturing employment. Adjusting for the fact that their analysis is conducted in 2007 US dollars, and not 2007 euros, this coefficient can be converted to −0.8.[16] Thus, their estimates imply a smaller impact in the US than the one we find for European countries with uncoordinated wage systems. Our results are in line with previous studies of European countries. Dauth et al. (2014) and Balsvik et al. (2015) find very small employment effects in Germany and Norway, respectively, which is consistent with our result for countries with wage coordination. Citino and Linarello (2022) find modest effects in Italy. In contrast, Donoso et al. (2015) estimate large negative employment effects in Spain, a country classified as "uncoordinated" in our analysis. Converted to euros, their baseline estimate is about −2.8, which is twice the effect we estimate for the group of countries with uncoordinated wage bargaining. Finally, Malgouyres (2017) documents large negative effects on employment growth in France, another country with uncoordinated wage bargaining. He further finds wage decline across the wage distribution in the manufacturing sector, but wage polarization in the non-tradable sector. Interestingly, he finds that the total effect on local wage inequality depends on how strongly the local labor market is affected by minimum wage legislation, which points to the important role of institutions in mitigating shocks.

[15] Without the interaction term, we obtain an Δ*Import Exposure* coefficient of −0.5131, with a p-value of 0.065, as a measure of the average impact of the China shock in our sample.

[16] Here we use the average USD/EUR exchange rate for 2007 of 1.3705. Note also that Autor et al. (2013) study ten-year changes in manufacturing employment.

In Columns 3 and 4 of Table 2, we use changes in non-manufacturing employment as an outcome variable. The point estimate for the main import exposure coefficient is about two-thirds of that for manufacturing employment, and the interaction term again suggests a more modest effect for countries with wage coordination. The standard errors are, however, large and the estimates are far from being statistically significant. Yet, and as a minimum, the estimates clearly reject the idea that the non-manufacturing sector compensated for the job losses in the manufacturing sector.

Overall, the baseline estimates suggest that employment declined significantly as a result of the rise in Chinese imports, but that wage coordination mitigated the negative effect of higher import penetration. Wage coordination varies at the level of countries, and we only have 13 countries in our sample. Does this mean that we rely on 13 observations in making the above claim? No, the key is that our dependent and independent variables display variation within coordination level, and this is the variation we use in our estimation procedure. We have 366 observations of regions × years (219 observations with wage coordination and 147 without) that we use to estimate the relationship between import exposure and employment. Our claim is based on comparing the employment effect for each group of coordination, but our inference is based on estimates of both the expected value and statistical uncertainty using within group variation.

In Online Appendix E, we show that our estimates are robust to various alternative specifications. In particular, we show that our results are robust to the use of finer industry classifications, finer categories of wage coordination, and time-varying regional controls. We further show that the results remain the same when, in an iterative fashion, we exclude the manufacturing sectors one at a time, and the countries one at a time; and when we change the group of countries used to calculate our instrument for import exposure. We also show that the negative employment effect in countries without wage coordination is driven by the most exposed manufacturing industries. Finally, a number of papers raise concerns about Bartik-type instruments (see Bartik, 1991) such as the ones we use (Borusyak et al., 2018; Jaeger et al., 2018; Adao et al., 2019; Goldsmith-Pinkham et al., 2020). In Online Appendix F, we thoroughly address the most relevant of these concerns. In particular, we document that our results are robust to controlling for pre-trends in manufacturing employment, and to standard errors that account for residual correlation across areas with similar employment structure.

To rule out endogeneity concerns related to reverse causation between coordination and employment shocks, we measure coordination prior to the trade shock. However, as coordination is measured at one point in time only, we cannot completely rule out spurious correlations with unobserved factors that reflect other explanations than differences in coordination. We thus proceed by testing our results against other plausible explanations. First, however, we

address some important issues related to the impact and measurement of trade flows.

4.2. Direction and content of trade flows

So far, we have only explored trade flows going from China to Europe. We have also restricted the analysis to trade in final consumption goods. In this section, we expand our measure of trade exposure.

The integration of China into the world economy resulted in new market opportunities for European firms (see, e.g., Dauth et al., 2014). Because we have ignored exports, we might be concerned about an omitted variable bias. In particular, one might be concerned if countries with wage coordination export relatively more, and if import and export exposure are correlated across regions. To test for this, we formulate an alternative definition of trade exposure and construct a measure of net imports for each industry by subtracting the corresponding exports from Europe to China. Following equation (7), this can be written as

$$\Delta(\textit{Net import exposure}_{it}) = \sum_j \frac{L_{ijt}}{L_{jt}} \frac{(\Delta Import_{jt} - \Delta Export_{jt})}{L_{it}}, \qquad (12)$$

where $\Delta Export_{jt}$ is the change in exports in industry j, between periods t and $t+1$. Like Autor et al. (2013), we instrument for this measure using two variables: the instrument for import exposure in equation (9) and an analogous instrument for exports, using trade flows from the group of other high-income countries to China. The first two columns of Table 3 present estimates based on this specification, using trade in final consumption goods. The regression coefficients are very similar as in our baseline specification, but somewhat larger in magnitude.

The rest of the estimates shown in the table incorporate trade in intermediates and capital goods. This is likely to be particularly relevant for exports, as Europe's export of final consumption goods to China is small. Estimates for net import exposure are shown in Columns 3 and 4, while estimates using the baseline import exposure measure are shown in Columns 5 and 6. Not surprisingly, the magnitude of the coefficients decreases when we use this broader set of tradable goods. Yet, our findings do not change qualitatively. The implied employment effect is even larger in these specifications, as Chinese imports are of much larger magnitude when we include all types of goods.

4.3. Alternative explanations

A key question is whether our finding is caused by wage coordination in itself or by some other country-level characteristics correlated with coordination.

Table 3. Alternative measures of trade exposure

	Net import exposure				Import exposure	
	Manuf.	Non-manuf.	Manuf.	Non-manuf.	Manuf.	Non-manuf.
	(1)	(2)	(3)	(4)	(5)	(6)
Δ*Net Import Exposure*	−1.457***	−0.965	−1.129**	−1.704		
	(0.517)	(0.899)	(0.439)	(1.272)		
Δ*Net Import Exposure*	1.831***	0.855	1.223***	0.749		
× *Coordination*	(0.581)	(1.201)	(0.473)	(1.209)		
Δ*Import Exposure*					−1.197**	−1.586
					(0.515)	(1.530)
Δ*Import Exposure*					1.014**	0.730
× *Coordination*					(0.407)	(1.030)
Observations	366	366	366	366	366	366
R^2	0.612	0.473	0.614	0.471	0.609	0.472
Type of goods	Consumption	Consumption	All	All	All	All

Notes: The dependent variable is the four-year change in manufacturing employment/working-age popualtion (in percentage points), 2000–2008. Robust standard errors clustered on NUTS 2 are shown in parentheses. All regressions include regional controls and country times period fixed effects. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

To explore this, we first present some descriptive statistics for the baseline year, where we separate countries by their level of wage coordination.

In Panel A of Table 4, we present average values using regions as the unit of observation. The overall manufacturing employment share is almost identical in the two groups of countries (and Table 1 shows that the employment shares for the top five importing industries are similar). There are slightly fewer female employees in countries with coordination and a somewhat lower population share of high-skilled workers. The population share of medium-skilled workers is, however, much higher, meaning that the fraction of low-skilled workers is lower.

In Panel B of Table 4, we show country-level characteristics. Countries with wage coordination have much higher union density, higher coverage rate, smaller working-age populations, and somewhat stronger employment protection legislation. The employment share in high-tech manufacturing is about the same in the two groups of countries.

The descriptive statistics in Table 4 make it clear that countries with wage coordination differ from those with uncoordinated wage systems on several dimensions. We conduct two types of tests to assess whether these differences can explain our findings. As a first test, we weight countries with wage coordination such that, on average, they match countries with uncoordinated systems on a set of relevant characteristics. We do this by entropy balancing,

Table 4. Descriptive statistics at baseline

	Uncoordinated (1)	Coordinated (2)	Diff. (3)	p-value (4)
Panel A. Regional level				
Manufacturing employment share	16.1	16.2	0.2	0.83
Female employment share	42.9	41.8	−1.1	0.11
Population share, high-skilled	21.8	19.9	−1.9	0.09
Population share, medium-skilled	31.2	45.7	14.6	0.00
Panel B. Country level				
Union density	19.7	36.7	17.0	0.05
Coverage rate	67.5	70.3	2.7	0.89
Employment protection	2.1	2.6	0.5	0.24
Share high-tech manufacturing	0.9	1.1	0.3	0.38
Working-age population (in millions)	33.8	25.2	−8.6	0.43
Observations	147	219		

Notes: The first two columns in the table display (unweighted) average values for the group of countries with and with wage coordination, using NUTS 2 regions as the unit of observation. The third column shows the differences in means, while the fourth column displays the corresponding p-value. The variables in Panel A vary at the level of regions, while those in Panel B are measured at the level of countries.

following the procedure in Hainmueller (2012).[17] Our second test consists of estimating a set of "horse race" regressions. To do this, we interact different country-level variables with import exposure and include them, one by one, as additional regressors. To ease presentation, we first standardize the additional variables to mean zero and standard deviation one. The regression estimates for both tests are shown in Table 5 and we comment on each column below. For brevity, we display the estimates for non-manufacturing employment in Online Appendix D.

Column 1. Differences in the share of low-skilled workers do not explain our results. In this column, we consider possible implications of previous research that have documented that the China shock affected low-skilled workers relatively more than other workers (Autor et al., 2013, 2014). Even though our estimates are identified from variation within countries and time periods, the difference in average education attainments might still be a concern.

In the first column of Panel A in Table 5, therefore, we weight countries to make sure that the share of low-skilled workers is the same in the

[17] We weight countries with coordination as these countries are more numerous, which eases the balancing.

Table 5. Regression with other country-level variables

	Share of low-skilled (1)	Union density (2)	Coverage rate (3)	Employment protection (4)	High-tech manufacturing (5)	Working-age population (6)	Regional variables (7)
Panel A. Weighted regressions							
Δ*Import Exposure*	−1.419***	−1.300***	−1.404***	−1.197***	−1.398***	−1.365***	−1.340***
	(0.496)	(0.460)	(0.485)	(0.436)	(0.484)	(0.474)	(0.489)
Δ*Import Exposure*	1.408**	1.876***	1.640***	1.748***	1.616***	1.775***	1.309**
	(0.555)	(0.611)	(0.545)	(0.533)	(0.543)	(0.555)	(0.540)
Observations	366	366	366	366	366	366	366
R^2	0.625	0.626	0.624	0.673	0.623	0.622	0.596
Post-balancing difference (coord. − uncoord.)	0.0	5.7	0.9	0.0	0.0	0.0	
Panel B. Additional interactions							
Δ*Import Exposure*	−1.885**	−1.536***	−1.485***	−1.800***	−1.202**	−1.588***	−1.997**
	(0.779)	(0.557)	(0.468)	(0.446)	(0.584)	(0.516)	(0.880)
Δ*Import Exposure*	2.020***	1.860***	1.774***	1.358***	1.530***	1.800***	2.005**
× *Coordination*	(0.733)	(0.690)	(0.539)	(0.403)	(0.582)	(0.562)	(0.842)
Δ*Import Exposure*	0.213	−0.227	0.348*	0.715**	0.188	−0.199	
× Additional variable	(0.274)	(0.414)	(0.196)	(0.354)	(0.280)	(0.266)	
Observations	366	366	366	366	366	366	366
R^2	0.612	0.612	0.615	0.617	0.613	0.613	0.618

Notes: The dependent variable is the four-year change in employment/working-age population (in percentage points), 2000–2008. Robust standard errors clustered on NUTS 2 are shown in parentheses. All regressions include regional controls and country × period fixed effects. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

two groups of countries. This amounts to scaling down the influence of observations from countries with wage coordination and relatively few low-skilled workers, such as Norway, Sweden, and Germany, and scaling up the influence of countries with wage coordination and relatively more low-skilled workers, such as Italy and Greece. Doing this, the interaction coefficient decreases somewhat in magnitude, but remains highly significant.

In first column of Panel B, we show the second test, which is to add an interaction term between import exposure and (country-level) population shares of low-skilled workers. The coefficient on the additional interaction is close to zero, while our coefficients of main interest increase in magnitude. Based on the two tests, we thus conclude that it seems unlikely that our findings are driven by differences in education attainments.

Columns 2 and 3. Differences in unionization rates and coverage rates do not explain our results. In these columns, we conduct a similar exercise for union density and coverage rate. The coverage rate measures the fractions of workers in a country covered by a collective wage-bargaining agreement. Because the differences between the two groups are large in terms of these variables, we are not able to fully balance the sample. Still, given how little the regression estimates change, we are quite confident that differences in unionization and coverage rate cannot explain our findings. If anything, our main interaction term becomes even larger.

Column 4. Differences in employment protection do not explain our results. In this column we consider employment protection legislation, measured as an index taking values from 0 to 6. The index captures the strictness of mandatory rules regulating the contractual relationship between employers and employees. It is plausible that employment would fall less in countries with stricter employment regulations, at least in the short run, simply because it is more difficult to lay off workers. Indeed, the interaction between employment protection and import exposure is positive and significant.[18] Importantly, however, the interaction with wage coordination remains highly significant. Furthermore, weighting based on employment protection has only a very limited impact on our regression.

[18]Note that this interaction is based on a (standardized) binary variable for employment protection below/above the median. We do this because employment protection is measured as an index without a clear cardinal interpretation. However, the results are robust to using the index linearly. Note also that the interaction between employment protection and import exposure is much weaker in a stacked regression using total changes for the period 2000–2008. This is consistent with the view that employment protection only has an impact in the short run.

Column 5. Differences in the the share of high-tech do not explain our results. In this column, we weight and interact using employment shares of high-tech manufacturing. One hypothesis might be that countries with a large high-tech manufacturing sector would be less affected by the China shock. Given the seeming balance between countries with wage coordination and uncoordinated systems, it is not surprising that this variable has little effect on our estimates.

Column 6. Differences in the size of population do not explain our results. In this column, we consider country-level population sizes. Countries with wage coordination are smaller on average, but this does not seem to explain our findings either.

Column 7. All differences combined do not explain our results. In this column, we weight based on all the regional variables listed in Table 4. The interaction between import exposure and coordination becomes slightly smaller in the weighted regression but it remains highly significant. In Panel B, we add four additional interaction terms, one for each of the regional variables. For brevity, we do not show these coefficients in the table. Note, however, that none of them is statistically significant at a 5 percent level. Our coefficients of interest increase somewhat in magnitude and remain highly significant, despite the quite demanding specification.

In summary, the above results show that we can eliminate several plausible ideas, other than variations in wage coordination, behind the differential employment effects. Even though we cannot completely rule out spurious correlations with remaining unobserved factors, the fact that the estimated effects of coordination are barely affected by the introduction of the extensive list of observables, related to country size, human capital, technology, and labor market institutions, strengthens a causal interpretation of the differential employment effects by wage coordination. To further evaluate such an interpretation, in the next section, we explore more detailed implications of our proposed mechanism by investigating wage responses in tradable versus non-tradable industries depending on the level of coordination, as well as differential employment responses within the tradable sector.

5. Exploring the mechanism

5.1. Wage growth is lower in countries with wage coordination

We do not have comparable wage data with sufficient regional breakdown to undertake a detailed analysis of wage responses to the China shock

similar to our analysis of employment responses. However, comparing annual wage growth in tradable versus non-tradable industries in coordinated and non-coordinated economies can help in the interpretation of our employment results.

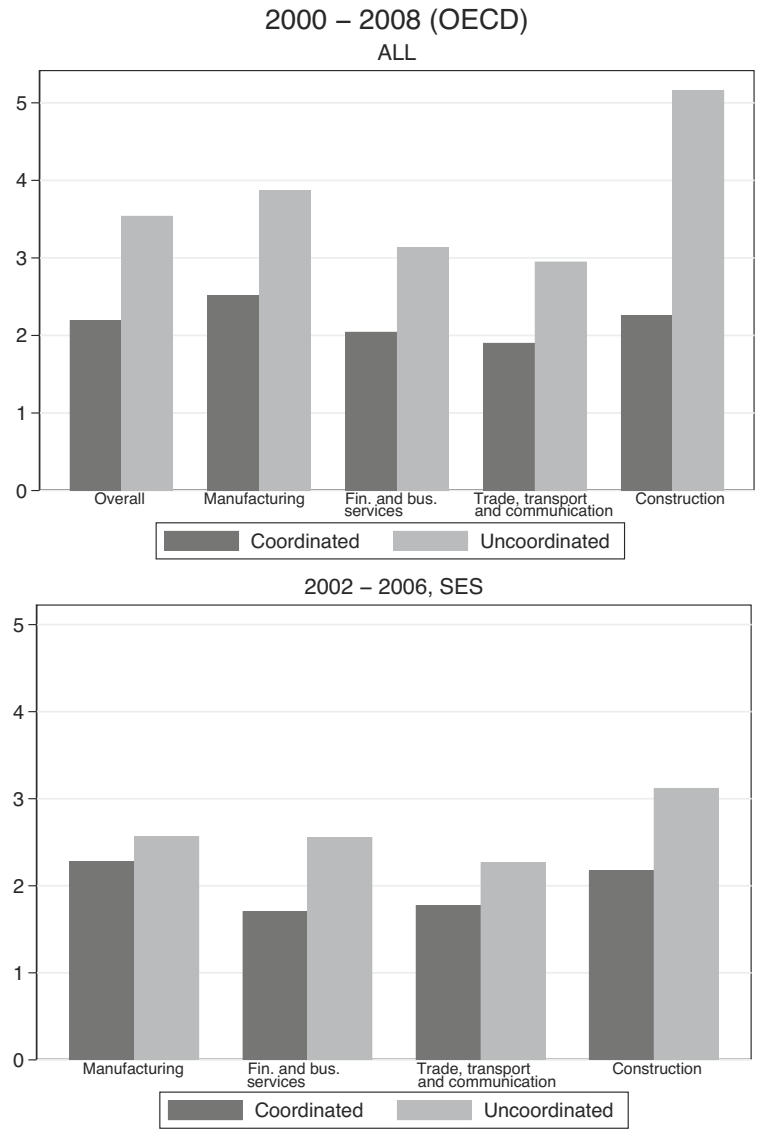
In the left panel of Figure 5, we plot average annual growth in nominal wages during the period 2000–2008. The figure is based on country-level data from the OECD, which cover the sum of gross wages, salaries, and employers' social security contributions.[19] On average, nominal wages grew by 2.3 percent per year in the countries with wage coordination, and by as much as 3.5 percent per year in the countries without wage coordination. Importantly, the figure clearly suggests that countries with coordination had wage moderation not only in the manufacturing sector, but also in the non-tradable industries.

The estimates from the OECD do not account for worker qualifications. A reduction in employment that disproportionably affects workers with low qualifications could potentially explain the larger increase in average wages for countries without coordination. To explore this, we make use of micro data from the Structure of Earnings Survey (SES) for 2002 and 2006.[20] Using these data, we are able to adjust for worker qualifications with a standard Mincer wage regression (see Online Appendix C for details). In the right panel of Figure 5, we present average annual wage growth for a permanent full-time employed man with upper secondary education. The overall wage growth estimates are somewhat lower than in the OECD data, but the figure still confirms that wages grew much more moderately in countries with wage coordination – especially in non-tradable industries.

Table 1 shows that imports from China hit manufacturing industries in Europe very unevenly. As another exercise, we therefore look at wage growth within the manufacturing sector. To do this, we make use of country-level wage estimates from the SBS for the period 2000–2007.[21] Each circle in Figure 6 represents a given (two-digit NACE) manufacturing industry, and the size of the circle depends on the employment share of the industry (the second and fourth columns of Table 1). The horizontal axis shows the share of import increase from China (the first and third columns of Table 1). The figure confirms that countries with wage coordination had more moderate wage increases – not only in the manufacturing industries directly affected by the China shock, but also in the manufacturing industries little affected by the rise of imports from China.

[19] These data do not cover Greece.
[20] These data do not cover Austria, Germany, Italy, and Ireland.
[21] We cannot extend the data to 2008 due to changes in the NACE codes.

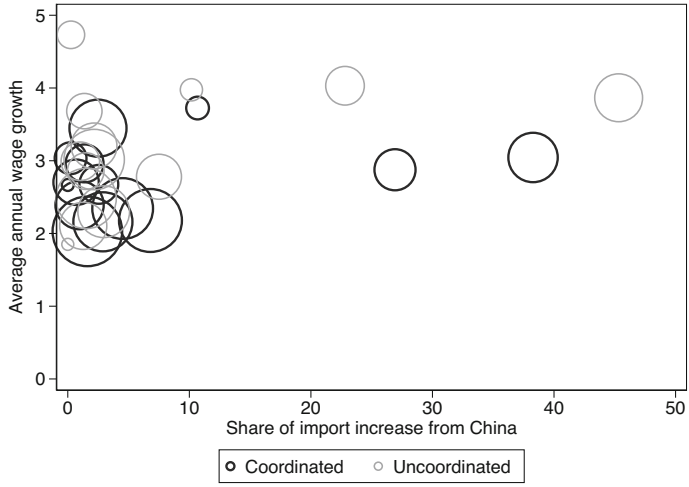
Figure 5. Average annual growth in nominal wages (in percent)



Notes: The category "Financial and business services" includes Financial intermediation (NACE code J), and Real estate, renting and business activities (NACE code K). The category "Trade, transport and communication" includes Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods (NACE code G), Hotels and restaurants (NACE code H), and Transport, storage and communication (NACE code I). Countries are weighted based on employment in each industry.

Source: The top panel is based on data from the OECD, while the bottom panel is based on micro data from the SES.

Figure 6. Manufacturing industries: average annual growth in nominal wages (in percent), 2000–2007



Notes: Countries are weighted based on employment in each manufacturing industry.
Source: The figure is based on wage data from the SBS.

5.2. Industry-level job losses vary with coordination and the reliance on non-tradable inputs

The above wage estimates support our interpretation of the estimated employment effects. The key theoretical mechanism is wage moderation in the non-tradable industries where unions and employers have market power to raise both wages and output prices. As a final test of whether our data are consistent with our suggested mechanism, we study employment responses within the manufacturing sector, and investigate whether these responses are dependent on the reliance on the non-tradable sector. To do so, we make use of harmonized input–output tables for 14 NACE two-digit manufacturing industries, and employment data for 102 NACE three-digit industries for the period 2000–2007.[22] We run two regressions at the industry × country level.

As before, we make use of country × year fixed effects, but here the variable on the left-hand side is the employment change in industry j as a fraction of the working-age population, while the key variable on the right-hand side is the change in imports of the goods produced by the same industry j. In contrast to our baseline specification, which explores whether regions were

[22]The input–output tables are taken from the OECD, while the employment data are taken from the Eurostat database.

Table 6. Industry-employment and imports from China

	(1)	(2)
Δ Import (std)	−0.0047***	−0.0048***
	(0.0011)	(0.0009)
Δ Import (std) × Coordination	0.0020*	0.0018***
	(0.0011)	(0.0007)
Δ Import (std) × Input ratio (std)		0.0000
		(0.0014)
Δ Import (std) × Coordination × Input ratio (std)		0.0032***
		(0.0010)
Input ratio (std)		−0.0008
		(0.0007)
Observations	2079	2079
R^2	0.134	0.138

Notes: The dependent variable is the four-year change in employment/working-age population (in percentage points), 2000–2007. Robust standard errors clustered on three-digit NACE industries are shown in parentheses. All variables in the second period (2004–2007) are scaled by 4/3 to adjust for the shorter time span. Both regressions include country × period fixed effects. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

differentially affected depending on their overall exposure to China, this specification explores the differential effect on manufacturing industries. We first run the following regression,

$$\Delta Y_{cjt} = \beta_1 \Delta Import_{jt} + \beta_2 (\Delta Import_{jt} \times Coord_{c,t=1999}) + \gamma Y_{cj} + \theta_{ct} + \epsilon_{cjt}, \quad (13)$$

where Y_{cj} denotes the start-of-the-period employment share in each industry j. As before, we instrument for imports using imports from China to the set of other countries. To ease interpretation of our second specification (described below), we standardize the import variable to mean zero and standard deviation one.

Estimates of equation (13) are shown in the first column of Table 6. The negative coefficient in the first row suggests, as expected, that Chinese imports had a differentially large impact on employment in the industries most directly affected.[23] The differential impact holds for countries with and without wage coordination alike: by adding the base coefficient and the

[23] We can compare the magnitude of this with our earlier estimates as follows. We first scale the import variable by total employment in each country and, in this way, we derive a measure of imports per worker as in our main analysis. We then run the regression in equation (13) without that standardization of the import variable. Given the country × year fixed effects, these changes have no impact on the regression other than to scale its coefficients. Doing this, we obtain a base coefficient of −0.6741, which is about half the size of the similar coefficient in our main analysis.

interaction term, we derive a significant and negative estimate for countries with wage coordination. Combined with our earlier finding of no effect on regional manufacturing employment in these countries, this suggests some reallocation of labor within the manufacturing sector. The positive interaction term also suggests that the employment effect on the exposed manufacturing industries is smaller in the countries with wage coordination.

Both of these patterns are in line with our proposed mechanism of wage coordination and, in particular, the fact that non-exposed industries moderate wages (as we documented above). The wage moderation eases the reallocation of labor and gives lower input prices for the exposed industries; the first mechanism dampens the overall negative employment effects, while the second mechanism dampens the negative effects on the exposed industries. Below, we explore the second mechanism further by making use of the input–output tables.

For each of the two-digit NACE industries, we compute the ratio of total inputs from non-manufacturing industries in 1999 over total input in the same year and interact this with the import variables:

$$\begin{aligned}\Delta Y_{cjt} = {} & \beta_1 \Delta Import_{jt} + \beta_2 (\Delta Import_{jt} \times Coord_{c,t=1999}) \\ & + \beta_3 \Delta (Import_{jt} \times Input\ ratio_{j,t=1999}) \\ & + \beta_4 (\Delta Import_{jt} \times Coord_{c,t=1999} \times Input\ ratio_{j,t=1999}) \\ & + \beta_5 Input\ ratio_{j,t=1999} + \gamma Y_{cj} + \theta_{ct} + \epsilon_{cjt}. \end{aligned} \tag{14}$$

The interaction terms thus capture whether manufacturing industries were differentially affected by Chinese imports depending on their initial exposure to the non-manufacturing sector and, most importantly, whether this relationship differs in countries with and without wage coordination, as captured by the β_4 coefficient. Clearly, the use of inputs from the non-manufacturing sector is likely to be correlated with other observed and unobserved industry characteristics, and we do not have a valid instrument for the input ratio. Hence, the interaction terms should be interpreted as no more than correlations. As for the import variable, we standardize the input ratio variable to mean zero and standard deviation one.

One possible reason for the smaller estimate is that the import measure used here only captures the direct employment effect for each industry; it does not capture the likely indirect effect through other industries that are both negatively affected by the China shock and buyers of the output produced by the particular manufacturing industry. For example, Acemoglu et al. (2016) find that such indirect effects from the China shock have been about equally important as the direct employment effects in the US.

Regression estimates are presented in the second column of Table 6. We find no direct effect of the input ratio on changes in employment. However, the β_4 coefficient from equation (14), shown in the fourth row, is positive and statistically significant. This is consistent with our proposed mechanism, as it suggests that the difference between countries with and without wage coordination is largest in the industries most reliant on inputs from the non-tradable sector.

6. Concluding discussion

Our paper makes a case for how unions can raise the competitiveness of the economy by taking wages out of market competition. We have shown that union wage coordination and pattern bargaining lead to wage moderation in line with the conditions in the sectors most exposed to international competition. When these sectors become even more exposed, we show that coordinating unions moderate their wages even further.

Our approach thus explains how union associations can prevent local unions, sheltered from international competition, from reaping monopoly gains and raising their wages relative to workers in more exposed industries. Excessive wage growth in non-tradable industries reduces employment not only in own industries but also in the tradable industries, as long as these industries use non-tradable intermediate inputs.

Coordinated wage setting can internalize such indirect effects and thus realize collective gains of higher overall employment by moderating potentially high wages in non-tradable industries and maybe even throughout the economy. The resulting changes in the wage structure can raise the demand for labor and stabilize overall employment against fluctuations and shocks in the world economy.

We have explored the basic ingredients of this theory by exploiting within-country variation in exposure to China in 13 European countries. Estimating the causal impact of increasing international trade in these countries, we show that (a) in countries with uncoordinated wage setting, regions that are exposed to import competition experience a clear fall in employment, mainly due to a reduction in manufacturing employment, while (b) in countries with wage coordination, regions exposed to import competition experience no such fall in employment.

These results might help resolve a puzzle in earlier research by explaining why European countries that were equally exposed to competition from China experienced such different employment consequences. The overall lesson we draw is that wage coordination matters. Comprehensive organizations in the labor market can enable large groups of workers to reap the gains from trade that otherwise might have turned out as losses. Wage coordination can provide

a majority of workers with both a greater share of the potential gains from globalization, and insurance against the potential risks.

All this is consistent with our theoretical view and is empirically robust to alternative measures of wage coordination, industry classifications, and of trade exposure. Even though we cannot completely rule out possible remaining spurious correlations between coordination and trade with unobservable factors, we have tested our main findings against an extensive set of plausible explanations using balancing methods and standard "horse race" regressions against other observable differences between coordinated and non-coordinated economies. We have ruled out reverse causation by measuring coordination prior to the trade shock.

In addition, we provide evidence that further supports our interpretation. We find more wage moderation in economies with coordinated bargaining, and we find that the trade-shock absorbing effect of coordination is larger in import competing industries that rely more heavily on inputs from the non-tradable sector. This is exactly what we would expect from the mechanisms highlighted in our theoretical model.

One might perhaps wonder whether the results are too good and too strong to be true. As we have seen, our point estimates suggest that the negative employment effects vanish completely in the coordinated case. Even if the standard errors are quite large, and a more moderate dampening cannot be rejected, this seems indeed to be an overly strong result, in particular if the mechanism is working through wage moderation in the non-tradable sector only. However, if the mechanism is working through wage moderation in both sectors, as would be the case when coordination is constrained by reciprocity norms, a sizeable dampening of the original employment shock is exactly what our model predicts. Indeed, such an interpretation is supported by the fact that pattern bargaining is a dominant mode of coordination in Europe, and by our finding that wage growth in countries with coordinated bargaining was more moderate also in the manufacturing sector.

Our results depart from the long tradition of viewing wage coordination and pattern bargaining as strategies to raise wages, a tradition that goes back at least to the explorations by Beatrice and Sidney Webb (1896) of the "principle of the standard rate". They suggested that "the organised local or national Union carries the principle further, and insists on a standard rate of payment for all its members in the town or district" (Webb and Webb, 1896, p. 356). Naturally, most economists view such arguments as union tactics to target the most efficient activities, raise wages as much as possible there, and then insist that other collective agreements should follow this high wage pattern.

Marshall and Merlo (2004), for instance, provide a fine theoretical model making exactly this point, building on the influential contribution by Horn and Wolinsky (1988). Yet, within the same framework, but with more emphasis on the employer side, Creane and Davidson (2011) establish the opposite

claim theoretically. Focusing on random shocks to either labor productivity or non-labor costs, they show that employers "prefer pattern bargaining because it allows the relatively more efficient firm to pay a lower wage than it would with sequential bargaining and this can lead to higher expected profits" (Creane and Davidson, 2011, p. 259).

Our discussion extends the repertoire further. We emphasize the reasonable case when coordination across sectors and occupations is normally coordination across workers who are complements in production and not substitutes, as is usually assumed in the literature.

Historically, institutions that facilitate all kinds of coordination in wage bargaining have been on the rise when economies face challenges of globalization and large negative shocks (Wallerstein and Western, 2000). The experience of the small open economies in northern Europe is instructive. Each union in these countries was initially strong within its own trade, but weak in its ability to collaborate across trades. This weakness became particularly evident during the Great Depression in the 1930s.

When foreign demand collapsed, workers in the exporting sectors, such as militant metal workers, had to take large wage reductions in order to stem the decline in employment. The equally militant construction workers came under no such pressure, in large part because their activities were less exposed to foreign competition. Construction workers also produced inputs to exporting firms, and some of them even worked in the export sector as well as in home construction. All this implied that higher wages in construction would raise the costs in the export sector, which would threaten the jobs of metal workers even further.

To prevent sheltered unions from obtaining higher wage gains at the cost of the workers in the export industry, the union movement tried to coordinate the wage setting and internalize some of the indirect effects. In Scandinavia, this was done – with the support of the employers – after the Basic Agreement between the national associations of unions and employers in 1935 in Norway and in 1938 in Sweden. The peak associations introduced "solidarity negotiations" where wage setting at the industry level is replaced by direct negotiations over pay by the national associations of unions and employers. The change started in the 1930s, but became institutionalized first in the 1950s as a form of pattern negotiations where overall wage setting became more in line with the conditions in the tradable sector (Moene and Wallerstein, 1995). In the same period, other European countries, but far from all, also introduced a similar coordination between unions.[24] Today, therefore, there is considerable variation in the system of wage setting across countries

[24] See, for instance Visser (2016), Calmfors and Driffill (1988), Elvander (1988), Freeman (1988), Moene et al. (1993), and Ross and Hartman (1960). Crisis and unemployment have had a strong

with a corresponding variation in the extent of coordinated wages, which we exploit in our analysis.

Can we – in support of our claims – find descriptive evidence of how the main actors perceive wage coordination and competitiveness? In Norway, for instance, the pattern bargaining is based on what is called the "front trade principle" (in Norwegian, *frontfagsmodellen*), indicating that there is a leading section of the union movement (the front trade) that "goes in the front" and then sets the pattern. It does not target the high-productivity part of the economy, however, but rather the part that is most exposed to international competition.

The Norwegian union association, LO Norway (*Landsorganisasjonen i Norge*),[25] is clearly proud of how the system rescues the country from catastrophes: "[if] other branches of industry raise their wage growth more than the front trade principle indicates, exposed industries will come under pressure [. . .] and Norwegian enterprises lose out in the competition with foreign enterprises, and Norway can experience death of manufacturing industries" (Fri Fagbevegelse, our translation). The Confederation of Norwegian Enterprise (NHO; in Norwegian, *Næringslivets Hovedorganisasjon*)[26] agrees: "wage growth must be kept within the limits of the front trade principle".

This is not just "window dressing". Central representatives for organized labor and organized capital follow the principle in practice and defend it in the media. For instance, the leader of the powerful union association of exposed manufacturing workers, Arve Bakke, openly declared under wage negotiations faced with bleak prospects in international markets: "I have no problem with going back to the rank and file with a zero-settlement" (no wage increases at all), since this will "set the tone for all other wage negotiations" (*Aftenposten*, 18/2/2015).

Our empirical results suggest that union leaders and employers in other countries might share similar perceptions, and that wage coordination and pattern bargaining generate benefits beyond wages. For example, wage coordination can help in sharing the gains of globalization. These social gains justify – or, to be feasible, might even require – a sharing of the costs of being exposed. Wage coordination in one form or another works as collective cost sharing to reap the globalization gains and make them bigger. Wage coordination also provides insurance that smooths income when the economy is exposed to international fluctuations and temporary shocks.

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influence on the extent of wage coordination and centralization of collective bargaining. Unemployment is more likely to induce more coordination if there is some level of collective bargaining in the first place, as discussed in Wallerstein and Western (2000). See also Chaison (1996), Moene (2015), and Katz (1993).

[25] https://www.lo.no/language/english/.

[26] https://www.nho.no/en/.

Our conjecture is therefore that most of our results generalize beyond the China shock. They must apply, we believe, to other types of shocks and even to instances of fiercer competition in global markets more generally. The key mechanism arising from exposition to global markets combined with complementarity through input–output linkages should be valid in the face of a range of other types of changes that directly affect prices or unit costs of firms and industries. Examples of such shocks would be other types of demand shocks, for instance related to technological change, the development of new types of goods, or more general changes in consumer preferences, but also technology shocks that affect unit costs directly, such as digitalization or various types of automation. The key point is that coordination can internalize externalities in the wage-setting process across unions organized along industry or occupational lines. We hope future research can scrutinize this conjecture empirically.

Supporting information

Additional supporting information can be found online in the supporting information section at the end of the article.

Supplementary material
Replication files

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