THE ECONOMIC JOURNAL

The Economic Journal, 1–30 https://doi.org/10.1093/ej/uead068 © The Author(s) 2023. Published by Oxford University Press on behalf of Royal Economic Society.
Advance Access Publication Date: 1 September 2023

TRADE SHOCKS, LABOUR MARKETS AND MIGRATION IN THE FIRST GLOBALISATION*

Richard Bräuer and Felix Kersting

This paper studies the economic and political effects of a large trade shock in agriculture—the grain invasion from the Americas—in Prussia during the first globalisation (1870–913). We show that this shock led to a decline in the employment rate and overall income. However, we do not observe declining per capita income and political polarisation, which we explain by a strong migration response. Our results suggest that the negative and persistent effects of trade shocks we see today are not a universal feature of globalisation, but depend on labour mobility. For our analysis, we digitise data from Prussian industrial and agricultural censuses on the county level and combine them with national trade data at the product level. We exploit the cross-regional variation in cultivated crops within Prussia and instrument with Italian and United States trade data to isolate exogenous variation.

Globalisation shocks belong to the fundamental drivers of structural change. Blanchard and Katz (1992) showed that local labour markets successfully funnel workers to unaffected regions in response to adverse economic shocks. Thus, when Autor *et al.* (2013; 2020) demonstrated that globalisation shocks after 2000 created persistent economic decline and political polarisation as well as long-lasting income losses for workers, it raised the question of how local economies react to structural change fostered by globalisation in other contexts: can we generalise these sluggish adjustments to other globalisation periods?

We address this question by studying labour market adjustment during the first globalisation from 1870 to 1913 in Prussia. During this time, a wave of agricultural imports from regions newly connected to the world market swept into Germany, the so-called 'grain invasion' (O'Rourke, 1997). To analyse the economic and political effects of this shock, we apply the approach by Autor *et al.* (2013) to the Prussian counties within Germany. We find that globalisation also caused regional decline: a one-SD increase in the trade shock causes a decrease in the employment rate of 2.1% over 15 years. However, instead of absorbing the losses, workers migrated to booming

* Corresponding author: Felix Kersting, School of Economics and Business, Humboldt-Universität zu Berlin, Berlin, 10178, Germany. Email: f.kersting@hu-berlin.de

This paper was received on 7 October 2021 and accepted on 23 August 2023. The Editor was Ekaterina Zhuravskaya.

The data and codes for this paper are available on the Journal repository. They were checked for their ability to reproduce the results presented in the paper. The replication package for this paper is available at the following address: https://doi.org/10.5281/zenodo.8233803.

In particular, we thank Wolf-Fabian Hungerland, who was involved in the project at its earlier stages and provided the German trade statistics. This paper benefited greatly from reports from Ekaterina Zhuravskaya (the Editor) and three anonymous referees, as well as from discussions with Thilo Albers, Jan David Bakker, Matthias Brachert, John Brown, Robert Gold, Markus Lampe, Sibylle Lehmann-Hasemeyer, Matthias Mertens, Marta Prato, Ferdinand Rauch, Miriam Fritzsche, Claudia Steinwender, Feodora Teti, Nikolaus Wolf and Yanos Zylberberg. We wish to thank the participants at conferences and seminars at the EGIT Research Meeting (Düsseldorf), the RTG Workshop 'Ports, Cities, and Borders in International Trade' (Jüchen), the Trade Policy Afternoon Workshop (Vienna), the Institute for the World Economy (Kiel) and the Empirical Economics Seminar (Trier) for helpful comments. We kindly thank Christopher M. Meissner and Chenzi Xu for sharing unpublished US trade data, Sebastian Geschonke for sharing unpublished data on bilateral tariffs and Markus Lampe for sharing tariff data with us. Can Aycan and Ulrike Unterhofer provided excellent research assistance. Felix Kersting acknowledges financial support by Deutsche Forschungsgemeinschaft through CRC TRR 190 (project number 280092119) and the Joachim Herz Foundation.

cities in Germany: the same SD shock causes a population loss through migration of 1.5%. Contrary to Autor *et al.* (2013), we do not observe strong and persistent knock-on effects on the whole region beyond the workers immediately affected. We also do not find evidence for the strong political polarisation effects documented for contemporary shocks. To understand the different results, we adopt an economic geography estimator by Allen and Donaldson (2022). We show that cities experienced substantial immigration if they had previously received migration from counties affected by the trade shock. In addition, we provide evidence that affected counties start to specialise more in livestock farming, a sector less prone to international competition. We thus conclude that labour mobility and local adjustments can neutralise the negative economic effects of the regional decline caused by globalisation shocks.

As an exogenous shock, we leverage the grain invasion (O'Rourke, 1997): cheap grain from the Americas flooded the European market. Starting from almost zero grain imports from the United States and Argentina in the 1880s, the annual German import volume dramatically rose to more than 400 million marks by 1913. This shock was roughly half as strong as the contemporary China shock to the United States.[1] We relate this growing trade exposure with Prussia's agricultural census containing the cultivation areas for various crops within each county using a shift-share approach. For causal identification, we use three different instrumental variables (IVs) to instrument the competitive gains of the United States and Argentina—by far the biggest import sources—in the German market: first, we use the competitive gains of those countries in Italy, second, we use US exports to independent Asian and African countries and, third, we use the decline in US agricultural prices. This way, we can isolate the supply shock undoubtedly happening in the Americas—through railways and the steamboat connecting large areas of land to the global market at low costs—from developments in Germany that might pull grain imports into Germany. Italy works well as a comparison market, as it is another newly formed, rapidly industrialising country without strong institutional ties to Germany. Independent Asian and African countries like Japan and China—though less comparable to Germany—had even fewer such ties to Germany and are thus useful to create another exogenous instrument. The same logic applies to the decline in US prices for agricultural products. The results of the three approaches all point in the same direction with similar magnitudes and highly significant coefficients throughout.

Our results contrast with the findings in the present and require further inquiry. We combine an economic geography model by Allen and Donaldson (2022) with the trade shock identification of Autor *et al.* (2013). We find that not only do more workers emigrate from hard-hit counties, but also that the cities these counties were connected to before the trade shock also experience relatively more immigration. In these immigrant-receiving cities, we do not find significant decreases in the employment share, i.e., no indication of issues with integrating displaced workers into the urban labour markets. We also study the adjustment process within the rural counties affected by the trade shock. We find small changes in crop composition and a slight shift in the economic structure towards services. Based on several harvest and livestock censuses we show that affected counties tend to specialise more in livestock farming, a sector less prone to international competition. Overall, while local counties seem to adjust somewhat, the majority of macroeconomic adjustment comes through reallocating labour to urban counties. Our analysis indicates that 'the effect of trade shocks' differs with the economy in question.

[1] The most affected quintile of US counties experienced imports per worker between 10% and 33% of an average worker wage ($42.000 in 2000). The most affected quintile of Prussian counties was affected by imports per worker of between 5% and 19% of an average worker wage of 635 marks in 1895 (Desai, 1968).

To further validate our identification strategy, we have to ensure that we measure the differential effect of the trade shock and not overall structural change. It is important to stress that we exploit variation *within* the agricultural sector, not between rising industrial towns and declining rural districts. As with every shift-share approach, exogeneity of either the shifts (in our case technology shock in the Americas) or the shares (in our case local crop shares) is sufficient for identification (Goldsmith-Pinkham *et al.*, 2020; Borusyak *et al.*, 2022). We capture the exogenous technology shock in the Americas with our three instrumental variables and show that the results are highly stable throughout. We also follow Goldsmith-Pinkham *et al.* (2020) to collect evidence for the exogeneity of our shares. Though our identification hinges on the exogeneity of one crop (wheat), we confirm that counties with worsening growth performance have higher shares of the most affected crops. Moreover, our results pass a test for pre-trends, i.e., certain crops were not already correlated with economic growth before the trade shock. Also, we incorporate the calculation of SEs as suggested by Adao *et al.* (2019) to account for a potential correlation in the error term across counties with similar shares.

Our paper speaks and contributes to two strands of literature. First, our study adds to the literature in economic history on the first globalisation.[2] While Pascali (2017, p. 2848) concluded that the first globalisation 'was highly detrimental in countries characterised by a per capita GDP below the top twenty-fifth percentile in 1850, while it had a very limited negative impact on the economic performance of rich countries', we explore the local consequences within one (rich) country. We thus contribute to the debate on the economic and political effects of the first globalisation among economic historians. Closely related to our paper, Heblich *et al.* (2020) demonstrated a strong migration response after the repeal of the Corn Laws in the UK. Suesse and Wolf (2020) showed that farmers in the eastern part of Prussia adjusted to the effects of the first globalisation by establishing credit cooperatives and switching to animal husbandry. Our findings are in line with both papers. Gomellini *et al.* (2022) provided evidence that growing trade exposure fostered the North-South gap in Italy. In addition, our results fit the long-term predictions of trade models for the first globalisation (O'Rourke, 1997; O'Rourke and Williamson, 1999).[3] Our result of a strong migration response validates the assumption on labour mobility typically used in these models. When it comes to the political responses, an influential literature has argued that trade shocks increased demand for protectionism (Gourevitch, 1977; Rogowski, 1987; Irwin, 1989; Lehmann, 2010). In contrast, Scheve and Serlin (2023) explored a different mechanism and showed that rising import competition from Germany led to more support for the Liberal Party and welfare state reforms in the UK during this period. Moreover, recent studies explore the role of industrialisation for political preferences during this period. In the case of Russia, Castañeda Dower and Markevich (2022) showed that industrialisation led to more support for the Bolsheviks. In contrast, our results for Prussia indicate no political radicalisation as a response to rapid economic change driven by the first globalisation arguably due to the adjustment process.

Second, our paper contributes to the literature on the effect of contemporary trade shocks by highlighting the importance of the migration response.[4] Faber *et al.* (2019) and Greenland *et al.* (2019) studied workers' migration responses after the China shock: the analysis of Greenland

[2] On the first globalisation, see the classic book by O'Rourke and Williamson (1999); for a recent synthesis, see O'Rourke (2019).

[3] Comparing our findings with the effect of declining grain prices in two-sector models used in O'Rourke (1997), our effects on labour income suggest that the negative effect on income due to migration in cities (by an increase in labour supply) equals the positive effect on real wages due to declining prices for agricultural products.

[4] See, for the labour market effects, among others, Autor *et al.* (2013) and Dauth *et al.* (2014). For political effects, see Colantone and Stanig (2018), Autor *et al.* (2020) and Dippel *et al.* (2022). For welfare analysis, see Caliendo *et al.*

et al. (2019) provided evidence for a migration response, while Faber *et al.* (2019) did not find this result. We add a new approach of estimating the migration response by combining the ideas of Autor *et al.* (2013) and Allen and Donaldson (2022). Since Imperial Germany was industrialising at the time, our findings also speak to Dix-Carneiro and Kovak (2017) on Brazil and Erten and Leight (2019) on China. Imperial Germany managed to use trade integration to accelerate structural change like China. Similar to Dix-Carneiro and Kovak (2017), we argue that labour mobility is key to benefiting from globalisation during industrialisation.

The rest of the paper proceeds as follows. Section 1 describes the first globalisation in Germany and our way to measure it. Section 2 introduces our estimation strategy and presents our main findings. Section 3 analyses the adjustment process within the affected counties and within Prussia. Section 4 concludes.

1. Measuring the First Globalisation, Labour Markets and Politics in Nineteenth-Century Germany

1.1. *Germany's Experience of the First Globalisation*

One major aspect of the first globalisation was the integration of the Americas into the world economy. The Americas could enter the world markets forcefully because of the rapid expansion of agriculture, railroads and people into the interior of North and South America.[5] In addition, technology improvements in the field of transportation, especially steamships, reduced trade costs between the Americas and Europe (O'Rourke and Williamson, 1999, ch.3; Pascali, 2017). Both developments led to falling transport costs that especially mattered for the trade of rather cheap goods like grains.

Figure 1 shows the resulting development of agricultural imports into Germany. From 1883 until 1895, the level of imports was slowly increasing, but from 1895 onwards, imports were accelerating rapidly, reaching their peak in 1901, a year of crop failures in Germany. This shift led to an increase in the share of agricultural imports from the Americas to almost 20 percentage points. We split this time into two periods: the first between the census years of 1882 and 1895, the second starting with the 1895 census and ending with the outbreak of World War I. We sometimes have to deviate slightly from this periodisation, because not all variables are available at exactly these period start and end dates. The periodisation is in line with the historical literature (Torp, 2005, p. 74). During the second time period, the United States became the most important import country for the German economy and Argentina was ranked seventh in this statistic as of 1913 (Torp, 2005, p. 83). The increase in agricultural imports was primarily driven by wheat, fodder and oil plants—in contrast, for instance, to the relatively unchanged trade balance for rye (Appendix Figure 2). These imports also mattered relative to the local production. Imports of grain amounted to 10% of the local production in 1880; this share increased to more than 50% in 1910 (Torp, 2005, p. 87). Another important source of new grain imports was Russia, which we discuss in detail later in this section and in Section 2.3 containing several robustness checks of our empirical strategy.

(2019). Michaels *et al.* (2012), Bustos *et al.* (2016), Fajgelbaum and Redding (2022) and Nagy (2022) look at structural transformation in general.

[5] The length of the railroad network in Argentina increased more than ten-fold between 1880 and 1910 (from 2.313 to 27.713 km); in the United States, the length was doubled (from 150.091 to 386.714 km; Torp, 2005, p. 33). On the economic integration in this period within the United States, see Donaldson and Hornbeck (2016) as well as Costinot and Donaldson (2016), and within Argentina, see Fajgelbaum and Redding (2022).

Fig. 1. *German Agricultural Trade with the United States and Argentina.*
Notes: The figure shows the development of trade (in million marks) with agricultural products between Germany and the United States and Argentina.
Source: See Online Appendix A.

During this period, the German economy integrated with world markets. While Germany had a negative balance of trade in total, economic integration had different consequences for the industrial and agricultural sectors. In 1882, 43% of the active workforce still worked in agriculture and 34% in industry. Twenty-five years later, the share in agriculture dropped by 8 percentage points and the share of industry increased by 6 percentage points. The balance of trade became more and more negative for food and live animals (Standard International Trade Classification (SITC) section 0) and crude materials (SITC section 2), while manufacturing, especially machinery (SITC section 7), exported more and more (Hungerland and Wolf, 2022).

The economic pressure of world agricultural markets led to fierce debates on trade policies in Imperial Germany. They played a major role in German politics, also because tariff revenue was crucial for the budget of the newly created federal government, and all tariff changes had to pass the German parliament (Lehmann, 2010, p. 153). Notably, the conservatives advocated the protection of the German economy from world markets.[6] The so-called 'alliance of rye and iron' became a powerful interest group pushing for the protection of agricultural and certain industrial sectors through tariffs (Torp, 2010). Starting in the late 1870s, Germany introduced average levels of protectionism compared to other European countries of the time (Hungerland and Lampe, 2021). The level of protectionism remained roughly constant over the period we analyse. Chancellor Caprivi partially changed the trade policy in the early 1890s. This shift was due to the necessity to renegotiate trade agreements after several central agreements from France expired, which stood at the core of the European trade architecture. Overall, Caprivi managed to secure the status quo (Torp, 2005, p. 182ff.).

Bilateral tariffs with Russia and the Americas are of special interest for our analysis as potential confounding aspects of the first globalisation. Based on new data on bilateral tariffs published in official German statistics and provided by Geschonke (2022), we do not observe changing levels of protectionism for agricultural products from the Americas between the 1890s and 1907. What is more, there was only a late increase in the bilateral tariffs between Germany and Russia—the other most important trade partner for agricultural products— for wheat and even a decline for

[6] We describe the position of each party in more detail in Section 1.3.

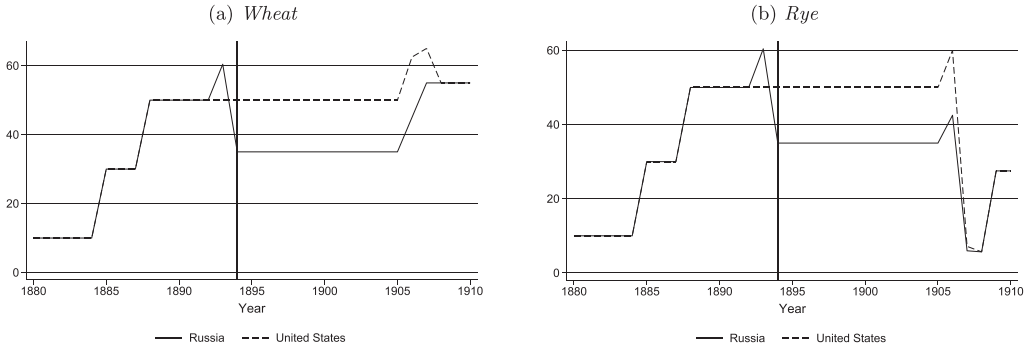


Fig. 2. *Wheat and Rye Tariffs.*
Notes: The figure shows the tariff per unit in marks for (a) wheat and (b) rye.
Source: See Online Appendix A.

rye (Figure 2). Note, however, that rye trade only played a very minor role.[7] Major changes throughout would have been worrisome because then the increase in imports from the Americas could be due to a composition effect in the trade structure.

1.2. *Measuring Trade Exposure*

We determine how hard any specific rural county was hit following Autor *et al.* (2013): we measure the share of national demand satisfied by foreign imports for all farmers in a county. Since there were no internal tariffs or other market barriers, we assume that all producers are selling to a national market for each crop, and thus face similar pressure, whether or not goods are actually imported to their specific county. Goods for which high transport costs inhibit a national market (e.g., fresh vegetables) are also not imported in meaningful quantities. Thus, our measure for each county i in year t is

$$\Delta AgriculturalTradeExposure_{i;t}^{Americas} = \left(\sum_{s} \Delta NetImp_{s;t} \frac{Area_{i;s;initial}}{Area_{s;initial}} \right) \frac{1}{Emp_{i;initial}}.$$

The term $NetImp_{s;t}$ denotes the change in net imports of crop s. We distribute this change in net imports by the initial (i.e., 1882) share of land used for crop s in county i ($Area_{i;s;initial}$) relative to the land used to produce this good in Prussia ($Area_{s;initial}$). This gives us a measure of the competitive pressure on producers of this good in a county. We divide this sum by the number of workers at the start of the first period in 1882 and sum over all crops s. This yields the average exposure of the workers within a given county, whether or not they work in agriculture, a measure comparable to that used in contemporary studies. This is done because the y variables (employment, migration, income and political outcomes) are also at the level of the whole county, not only its agricultural population.

[7] The overall pattern we observe is in line with the recent literature that stands in contrast to some older research on this topic. Torp (2005, p.183, own translation) wrote: 'What was achieved, however, was largely securing the status quo with regard to the trading partners. [...] For this reason, the question repeatedly raised in historical research as to whether the Caprivian trade agreements would have given a boost to German exports and brought additional growth to the economy as a whole—both of which would require a significant change from the previous state of affairs—is already wrongly posed at the outset.'

This measure captures the change in the level of trade exposure (relative to the start of the period) as an approximation of the market share foreign products have in German agricultural production. That is, if a county faces a change of net imports of 100 marks per worker per year (compared to an average wage of 635 marks in 1895 based on Desai, 1968), we use this as a measure of how much additional domestic demand is fulfilled by foreign workers. Series of agricultural trade have a higher variance than the manufacturing series used today (see Figure 1). To exclude the possibility of random crop failures driving our results, we take the average of all changes in trade pressure a county experienced throughout our observational periods, instead of just taking the difference between the first and last values.

Figure 3(a) shows the counties and their relative average trade exposure for the second period from 1895 to 1910. Darker constituencies were more negatively affected. The variation is very plausible: the eastern part of Prussia is negatively affected by trade shocks. Crucial for our identification, there is a considerable difference between the trade shock and the share of agricultural employment shown in Figure 3(b). These differences reflect the different crops cultivated in the counties. Note, for instance, that in the northeastern part of Prussia most counties had a very high share of agricultural employment, while the average trade shocks differ substantially. Our identifying variation relies on this within-region variation as we use province fixed effects and control for the share of agricultural employment.

To perform this analysis, we link two disjunct subsets of data: country-industry-level trade data and county-level census data. Their different units of analysis require harmonisation. The German trade data compiled by Hungerland and Wolf (2022) contain trade flows in and out of Germany on the SITC four-digit level for every year between 1880 and 1913.[8] We match the trade data to the agricultural censuses provided by the Prussian statistics. These censuses include information on cultivation areas for 47 different crops on a county level. Thereby, we capture on average for each county 99.8% of the agricultural area. In contrast to the occupation censuses, which only give information on the number of workers in agriculture in general, the agricultural censuses provide us with county-level variation within the agricultural sector. The cultivation areas remain relatively unchanged over time. Still, following the literature, we use the initial shares to calculate the trade shock.

To link the trade data with the agricultural censuses, we manually build conversion tables between different crops and SITC categories. This procedure leads to 14 harmonised crop categories matched with SITC categories.[9] Based on our conversion table, we capture 94% of all agricultural imports from the Americas. We construct our trade shocks using the net imports of various crops from the United States and Argentina, the two fastest-growing economies in the Americas and major agricultural exporters. They are also the main German trade partners in the Americas.

1.3. *Other Key Variables*

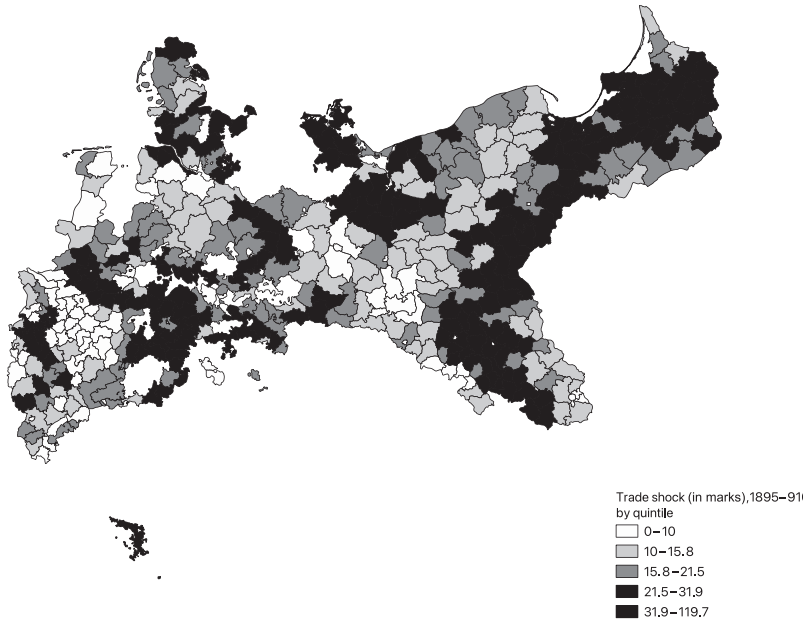
In this section, we introduce other key variables. First, we describe our dependent variables: net migration, employment, income, political consequences and agricultural intensification.[10]

[8] See Hungerland and Altmeppen (2021) for an in-depth exploration of the SITC in this context.

[9] See Online Appendix Table C1 for an overview of how we harmonise and group the cultivation areas, Online Appendix Table C2 on the conversion between crop type and SITC codes, and Online Appendix Table C3 for the imports by crop type.

[10] Descriptive statistics are provided in Online Appendix Table B1 and Figure B4. A detailed list of all sources is provided in Online Appendix A.

(a) *Average agricultural trade shock, 1895–910*



(b) *Share of agricultural employment, 1882*

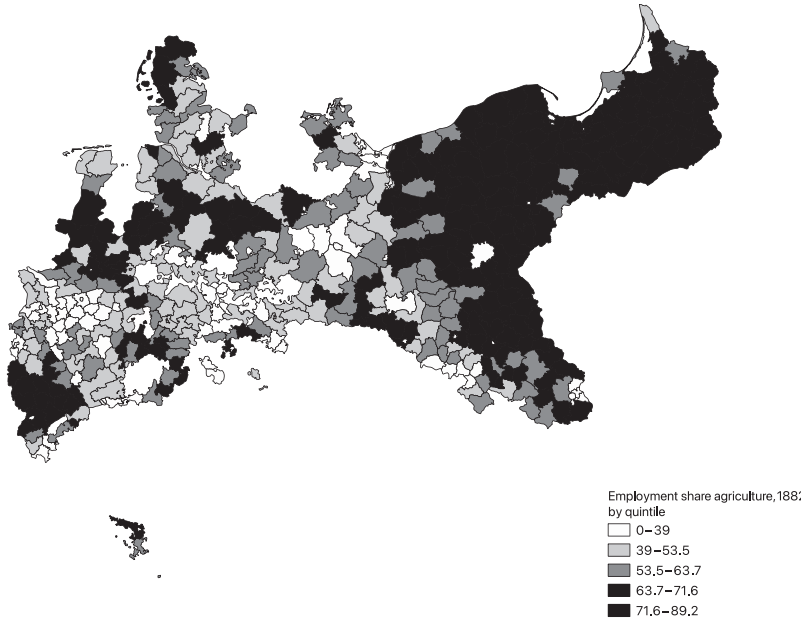


Fig. 3. *Agricultural Trade Shock and Agricultural Employment.*
Notes: Panel (a) shows the average agricultural shock between 1895 and 1910. Panel (b) shows the employment share in agriculture as of 1882.
Source: See Online Appendix A.

Table 1. *Variable Definitions.*

Name	Definition	Formula
Net migration	Avg. yearly change rate in pop. growth due to migration; 1895–910	$\left(\left(1+\frac{\Delta Pop_{i;t-t-5}-\sum_{x=t-4}^{x=t}(Net\text{-}birth_{ix})}{Pop_{i;t-5}}\right)^{1/5}-1\right)\times 100$
Empl. share	Avg. yearly change of the employ. rate; 1895–907	$\left(\frac{Emp_{1907}}{Pop_{1907}}-\frac{Emp_{1895}}{Pop_{1895}}\right)\frac{1}{12}\times 100$
Income	Avg. annual growth rate in income; 1895–910	$\left(\left(\frac{Inc_{1910}}{Inc_{1895}}\right)^{1/15}-1\right)\times 100$
Income per capita	Avg. annual growth rate in income per capita; 1895–910	$\left(\left(\frac{Inc_{1910}/Pop_{1910}}{Inc_{1895}/Pop_{1895}}\right)^{1/15}-1\right)\times 100$
Crop shares	Avg. annual change in crop share; 1894–901	$\left(\frac{Area^{Crop}_{1901}}{Area_{1901}}-\frac{Area^{Crop}_{1894}}{Area_{1894}}\right)\frac{1}{7}\times 100$
Sector share	Avg. annual change in sector share (agriculture, industries, services); 1895–907	$\left(\frac{Emp^{Sector}_{1907}}{Pop_{1907}}-\frac{Emp^{Sector}_{1895}}{Pop_{1895}}\right)\frac{1}{12}\times 100$
Agric. intensification (value)	Avg. yearly growth rate of agricultural value; 1895–909	$\left(\left(\frac{\sum Harvest^{crop}_{1909}\times Price^{crop}_{1909}}{\sum Harvest^{crop}_{1895}\times Price^{crop}_{1895}}\right)^{1/12}-1\right)\times 100$
Agric. intensification (production)	Avg. yearly growth rate of agricultural production; 1895–909	$\left(\left(\frac{\sum Harvest^{crop}_{1909}\times Price^{crop}_{1882}}{\sum Harvest^{crop}_{1895}\times Price^{crop}_{1882}}\right)^{1/12}-1\right)\times 100$
Animals per worker	Avg. yearly growth rate of the number of farm animals (cows, sheep, pigs, horses) per worker; 1892–906	$\left(\left(\frac{Animals_{1906}/Agricultural\_emp_{1907}}{Animals_{1892}/Agricultural\_emp_{1895}}\right)^{1/14}-1\right)\times 100$
Political consequences	Change in vote share for a party in national elections; 1893–912	$(Share_{1912}-Share_{1893})\times 100$

Source: See Online Appendix A.

Second, we also explain the way we capture migration patterns between the Prussian counties. Table 1 provides an overview over all variables discussed in this section.

Net migration. To measure net migration, we are interested in average yearly changes, relative to the initial population. For this purpose, we decompose total population growth into its components: migration and 'natural' population growth. We calculate the difference between the reported 'natural' population growth based on births and deaths for each year and the actual population growth between two censuses conducted every five years provided by Galloway (2007). The difference captures net migration.

Employment. We rely on the three occupational censuses conducted in 1882, 1895 and 1907 as well as the population censuses conducted every five years as our main sources. We aggregate the occupation categories to construct a coherent panel containing the employment rate as the share of the working-age population counted in the population census. We then compute the average yearly change of the employment rate between 1895 and 1907 as our key dependent variable. We also compute the share of employment in agriculture, industry and services as well as the change of these shares to study structural change. It is important to highlight that there

were no unemployment benefits during the time frame we study and thus there is no registry of those looking for work. The employment rate could fall because people lose work or because they voluntarily leave the labour force.

Income. By using the rich information from Prussia's income tax statistics and additional sources provided in Bartels *et al.* (2023), we calculate yearly income and income per capita growth starting in 1891.[11] The income tax statistics are only available on the level of districts (a more aggregated level than counties, 37 in total in Prussia). They distinguish between labour and capital income taxes; we only include labour income taxes.[12] The statistics also differentiate between income taxes paid by tax units living in urban and rural areas. We link these data to census data on the urban and rural populations on a county level. Thereby, we distribute the income taxes paid by the urban population to a county based on its share of urban population within one district and we do the same for the rural population. This procedure would assume that the average income of an urban and rural tax unit is the same within one district. To circumvent some concerns regarding this assumption, we weight the income allocated to each county within one district by relative productivity. We do so by using wages of urban and rural day labourers (*Tagelöhner*) as of 1892 provided by Becker *et al.* (2014). Specifically, our weighting factor consists of the counties' wage relative to the average district wage. In doing so, we calculate labour income and labour income per capita. While our variable is significantly better than just an imputation from district averages, we expect some random measurement error in this dependent variable. However, such measurement error does not bias OLS results, much less our IV estimation. Nonetheless, income remains our most problematic outcome variable, also because of the relatively short time series, which precludes us from observing pre-trends.

Political consequences. To measure the political consequences of the first globalisation, we rely on the national elections provided by Caramani (2004). Perhaps surprisingly, Germany's franchise was Europe's 'most democratic franchise at the time' (Sperber, 1997, p. 1) with high turnouts so that parliamentary election results are a good indicator for the political sentiment, especially on trade issues.[13]

The political parties differed in their stance on trade policy:[14] the socialist, often Marxist, Social Democrats were viewed with suspicion and fear by the establishment and represented the leftist alternative to the status quo. Around 1900, the Social Democrats started to oppose protectionist policies.[15] The Protestant national liberal party supported the government on this issue at some times and opposed it at others. The liberal parties often advocated for free trade. The Catholic party had no firm stance on tariffs (being split between industrial and agricultural regions). The conservative parties advocated for the protection of especially agricultural producers through tariffs. To the very right, various radically nationalist, folkish and anti-Semitic parties dreamed of a radically different society. The German Agrarian League (*Bund der Landwirte*) especially

[11] For more information on the calculation of the reference total income, see Appendix C of Bartels *et al.* (2023).

[12] Our results also hold when including capital income.

[13] Imperial German elections were held directly in single-member constituencies with representatives elected by a majority, following the principle of 'one man, one vote'. There were no major changes in the election law. Suffrage covered all men above age 25 with the exception of people under tutelage, in bankruptcy or on poor relief. Women were not allowed to vote, so our analysis is limited to the male half of the population. In contrast, the elections for the state of Prussia were still held with the restrictive three-class suffrage. That is the main reason why we do not include the elections for the state of Prussia.

[14] In Online Appendix A, we list all parties in more detail. For more details on the role of agriculture in German politics during this period, see Aldenhoff-Hübinger (2002).

[15] This stance on trade policy was similar in other European countries (Huberman, 2008).

strongly advocated a more isolated economy. After its foundation in 1893, the party advocated more protectionism and criticised the government for their lack of action.

To analyse the political effects of the trade shock, we include all party groups described above. Specifically, we investigate the changes in vote shares for the first period covering the elections in 1881 and 1893 and for the second period covering the elections in 1898 and 1912.

Agricultural intensification. We observe agricultural output from the harvest census conducted every 2–3 years in all Prussian counties, which also includes animals. We combine this information with the acreage per crop in each county to measure agricultural intensification per crop. To arrive at a county-level measurement, we value the recorded harvest at both current and 1882 prices and measure the change in output per acre. We also divide the number of animals per agricultural worker to measure agricultural intensification.

Migration matrix. Prussian data on citizens' provinces of birth form the backbone of our analysis of migration flows and structural change through labour reallocation. These contain the province of birth for the current population of every province every 10 years. The province definitions are only harmonised after 1890 and we do not observe migration or population growth by origin province, so we refrain from computing migration numbers directly from these data. Instead, we compute the shares of the stock of migrants from origin province O in the various destination provinces D and infer the 'closeness' of the destination to the origin province from this. This yields a province-to-province matrix of migration shares for every year. Surveying the different years, the correlation of shares over time is always above 0.9, which gives us confidence that the migration patterns are stable over time and thus can be inferred from migrant stocks the way we do. We use the 1890 matrix in our analysis to avoid any effect of the trade shock on this matrix.

To extend this matrix to the county level, we have some additional data available: we do not observe place of birth at the county level, but we observe whether people were born in either this county, another county in the same province, in Prussia, in Germany or abroad. For each province, we can thus compute the share of intra-province migrants living in each county of the province. We can also compute the share of out-of-province born migrants that lives in each county. Lastly, we can observe county- and province-level net migration from the population census and can thus see the share of county emigrants that also leave the province (described above).

The actual county-to-county matrix is then calculated as follows. Consider the example origin county o of Memel in the Province East Prussia O (at the easternmost tip of Prussia). We know from the difference between county and province net migration in East Prussia the share of county emigrants that leave East Prussia. We multiply this share with the share of East Prussian migrants going to, e.g., the Province of the Rhineland D. Within this province, we know the share of migrants from other Prussian provinces that live, e.g., in the county of Cologne d. Multiplying these three shares gives us a measure of what share of emigrants from Memel end up in Cologne. For the emigrants from Memel that stay in the province of East Prussia, the computation is easier: we can directly multiply them with the share of migrants from East Prussia in each of the counties of East Prussia.

Using the above computation, we assume that the ratios of origin provinces within categories are the same across counties in a province. In doing so, we follow the modern literature on intra-national migration, which has to accommodate the same data issues (Allen and Donaldson, 2022). However, we think that this is a very defensible assumption given the relatively fine-

grained level of our province variable enhanced by the information on where within provinces different classes of migrants were working.

2. The Impact of the Grain Invasion

2.1. *Empirical Strategy*

The identification strategy has often been used in similar exercises and we refer the reader to Autor *et al.* (2013) and Dauth *et al.* (2014) for more details on the methodology. The intuitive idea is to use economic or political developments in foreign countries as exogenous shocks to competition at home. The most prominent example and original application is China's WTO ascendency and the resulting manufacturing exports into most developed economies. Congruently, we analyse the supply shock from the grain invasion coming from the Americas and exploit variation in initial agricultural specialisation in Prussia at the beginning of the rise of the Americas as an exporter of agricultural products.

We have detailed in Section 1 what technological factors led to the increase in grain production in the Americas. We use this expansion to measure the effects of an import shock in Germany. However, besides the economic channels we are interested in, there might also be a direct technology channel: the same technological improvements that enabled the Americas' grain exports could have also improved the growth potential of the Prussian grain sector, e.g., vegetable cultivation or husbandry. We can argue that this is not the case because the major technological advancements were related to transportation (railways, canals, steamboats) and not directly to agriculture. These led to grain exports by connecting land previously not used intensively to the world market. However, such land did not exist in Prussia anymore during our period of analysis: the big railway boom had already happened in the middle of the century, with a final burst of activity after the foundation of the Empire in 1871, during which the extensive existing networks in the different German states were connected.[16] Thus, the technological advancements that enabled the productivity shock in the Americas had already been realised to a large extent in Prussia. The foreign shock is thus not connected to the potential for additional growth within Prussia.

In our analysis, we aim to compare two different counties in Prussia with similar characteristics, but producing slightly different agricultural products (e.g., wheat versus rye). Because the Americas predominantly exported wheat, the wheat-producing county was hit by a sizeable competition shock, the effect of which we can uncover by comparing its trajectory to its rye-producing, but otherwise similar counterpart. The validity of this strategy depends on first isolating a truly exogenous productivity boost abroad, i.e., making sure that the increase in wheat imports is due to American developments, not German market conditions. To assure this, we follow the original IV strategy proposed by Autor *et al.* (2013). Second, it requires identifying counties with similar growth prospects to compare and we use control variables to achieve this.

Following Autor *et al.* (2013), we isolate the exogenous component of the trade shocks, by looking at other countries. Ideally, we would use a group of countries with two characteristics. First, the countries should not be closely integrated with German agriculture. That way, they are arguably not affected by confounding demand shocks out of Germany. Second, the countries should preferably be economically comparable to Germany. Finding countries that fit these

[16] Service on the 'Ostbahn' connecting Berlin with rural East Prussia started in 1851 and work on the final tracks was finished in 1867. For more details on the railroad expansion, see Hornung (2015).

characteristics for the first globalisation is challenging. To assuage any exogeneity concerns, we construct three different instruments.

First, we use Italy as the comparison country. At the time, Italy was another newly formed industrialising country with increasing urbanisation and a declining agricultural sector. It was also connected to the Americas by emigration and trade in agricultural produce. Both economies also imported their raw produce from the world market instead of their colonies. What is more, Italy's industrial centres in northern Italy were connected to the world market via Genoa, while the Prussian (and German) industrial infrastructure was geared towards the Rhine and Hamburg. Thus, there is no mechanical reason to expect a correlation in trade flows. For all these reasons, Italy seems a good proxy for the exposure in Germany. On the other hand, both countries are geographically close and developments in Germany could conceivably affect Italy as well, rendering the instrument endogenous. We do not expect this to be a large problem, however, since imports from Germany to Italy account for on average 0.5% of Italian agricultural imports. Their highest value at 2% of all imports is in 1912, at the very end of our sample. Hence, we can be reasonably certain that, e.g., changes in German agricultural productivity do not affect the Italian market directly. Nonetheless, one could be concerned about political spillovers or effects mediated through changing European grain prices without direct imports.

To assuage such concerns, we construct two additional instruments. For our second instrument, we rely on the trade relationship between the United States and a group of independent non-European countries, i.e., countries with no colonial ties to Europe. The most important countries in that group are Japan and independent China.[17] These countries have only few political and economic ties to Germany, alleviating any endogeneity concerns. However, because some of them are in very different economic situations, their grain market might be a worse measure of the shock the grain invasion posed to German producers, though they are still sufficiently predictive of the German market.

As a third way to capture exogenous and supply-driven changes in trade exposure, we use the decline in US agricultural prices (on the East Coast) as a measure of the pressure that the grain invasion exerted on world markets. This instrument arguably also captures any effects that work through the price effect alone, without any actual trade happening. Such effects are overlooked by instruments that are computed from the actual flow of goods.

To construct our first instrument, we use Italian trade data by Federico *et al.* (2011), from which we only include the growing pressure coming from the United States and Argentina, the main global competitors for European agriculture. Trade in agricultural products between Italy and the Americas is similar to trade between Germany and the Americas (Figure 1 and Online Appendix Figure B1). While there is no upward trend with low levels of trade volume in the first period (1882–95), this pattern dramatically changes in the second period (1895–910) with a high increase in imports from the United States and Argentina to the end of the second period.

For our second instrument, we rely on US trade data by Meissner and Xu (2022), from which we use the exports to several countries mostly in Asia (China, Japan, Korea, Turkey, but also Liberia). The pattern in Online Appendix Figure B3 looks reassuring and similar to the German and Italian cases. We find lower volumes of trade for the first period and rapidly increasing volumes for the second period.

[17] As opposed to the colonial enclaves, e.g., Macao and Hong Kong.

The third instrument uses price data from Allen and Unger (2018) for US East Coast states and cities. We take these data and link them manually with the categories in our trade data. From that, we can compute the value of the harvest of Prussian counties in US prices. The percentage difference between the county harvest in 1910 US prices and the 1895 US prices measures how much a county was reliant on crops for which US prices fell relatively quickly. Falling US prices are a proxy for an increased supply for these crops of the recently connected interior of the country.

With these considerations in mind, we construct three IVs for every county i and the different crop types s in Prussia:

$$\Delta AgriculturalTradeExposure_{i;t}^{Americas} = \left(\sum_{s} \Delta Instrument_{s;t} \frac{Area_{i;s;initial}}{Area_{s;initial}} \right) \frac{1}{Emp_{i;initial}}.$$

The term $Instrument_{s;t}$ denotes the change in the respective instrument for crop s. We distribute this change in our instruments by the initial (i.e., 1882) share of land used for crop s in county i ($Area_{i;s;initial}$) relative to the land used to produce this good in Prussia ($Area_{s;initial}$). We use these IVs in the following specification to instrument the changes in agricultural trade exposure between 1895 and 1910:

$$\Delta Y_i = \beta_0 + \beta_1 \Delta AgriculturalTradeExposure_{i}^{Americas} + X_i{}'\beta_2 + \epsilon_i.$$

We regress the change of county-level outcome (e.g., employment, income or migration) during these years ($\Delta Y_{i;t}$) on changes in average net exposure with additional controls for province fixed effects and start-of-period variables X_{it}, which we introduce below.

Control variables. We employ a set of control variables. We control for the share of land ownership in large estates provided by Galloway (2007). Historians highlight the role of land distribution in migration decisions. More specifically, Bade (1980, pp. 288–90) stated that the distribution of land was more equal in Prussia's western provinces and linked the unequal distribution in the east to more emigration, especially due to the influence of landowners with large landholdings—the famous *Junker*.[18] We also control for the distance to the next large city, which makes it harder to emigrate. Lastly, we control for counties' technological sophistication with the amount of horsepower installed in the county as of 1875 coming from Prussian statistics. Thus, any potential confounding variable would have to be something that is uncorrelated with any of these factors.

Discussion of IV. The quality of our instruments depends on two conditions. First, our instrument should be able to explain the change in the trade shock to avoid a weak instrument problem, i.e., the Italian experience and the US exports to Asia and Africa should be predictive of German market conditions. This might not hold if, e.g., consumer demand was very different. As such, our instrument easily passes standard relevance tests.

Second, there should be no strong direct links between the trade shock and local supply and demand shocks. We circumvent potential concerns by using all three instruments. If, e.g., Italy and Germany coordinated their tariff policy, Italian trade shocks would no longer be connected to German market conditions only through the grain invasion. Fortunately for our design, Italy signed various contracts of recognition with the German Customs Union, though policy was not coordinated. The majority of Italian trade went through Mediterranean ports to world markets, not specifically to Germany. In addition, if anything, the trends in trade policy go in opposite

[18] Note that we capture this general difference by including province fixed effects, but improve precision by including the variable for each county.

directions in Italy and Germany: while we see in some cases a decline in German tariffs for industrial products during the 1890s, we observe rising tariffs for Italy (Federico and Vasta, 2015). However, even if such links existed, our additional instruments would be unaffected, as, e.g., prices in the United States for agricultural products were not affected by trade policy.

Another threat to our identification is that farmers might have anticipated rising imports and moved away from contested products before the actual trade shock. This would bias the results towards zero since our measure of import competition would no longer capture the actual pressure faced by regions. To account for this anticipation effect, we use the original distribution of cropland as of 1883 for our shock measure. Thus, we are confident that our main results are impervious to anticipation effects.

Imperial German tariff policy is an important potential confounder that these instruments address well by confirming that other countries experience the same import shocks. However, Imperial Germany's trading partners might also change their policies, which warrants some discussion. In order to affect our estimation, foreign countries would have to change their trade policy in a way that hurts shocked counties with an affected crop like wheat more than counties with unaffected crops like vegetables. Since Imperial Germany imported agricultural goods and exported manufacturing goods, this is only possible if some industries are spread out over rural counties that produce specific crops. However, the correlations between crucial exporting industries like machinery and chemistry with different crops do not differ substantially. The strongest correlation we observe (0.13) is between our most affected crop (wheat) and the growing chemical industry, biasing our results towards zero. While this evidence is already reassuring for our identification, tariff evolution for the goods of these industries could differ substantially. To exclude this possibility by controlling for export barriers, we would need product-level tariff data from all major trading partners of Germany between 1895 and 1913, which does not exist. The closest surrogate we know of is the work by Tena-Junguito *et al.* (2012) and Lampe (2020), who collected tariff data from France, Russia and the United States for 10 product groups in manufacturing, capturing 36% of German exports in 1910. During this time, the average tariff rose by 0.39% of the value. Most tariffs fell slightly, with the notable exception of some textiles (woollen textiles in the United States and silk textiles in Russia). However, Imperial Germany was not a major textile exporter and thus likely unaffected. The small variance in tariff changes and the broad product categories do not create much county-level variance. Since the observed correlations between industries and crops are very low and the tariff barriers we observe are pretty stable, we conclude that our results are likely unaffected by changes in export barriers, at least as far as one can know given the data situation.

Crucial for our identification strategy is also the shift-share construction of the shock measure. We structure our discussion of the implications of this construction along the lines of Goldsmith-Pinkham *et al.* (2020) and Borusyak *et al.* (2022) in Section 2.3 after presenting our main results.

2.2. *Main Results*

Table 2 shows results from estimating by OLS and IV with varying outcome variables. To control for potential endogeneity issues, we use the three different IVs introduced in Section 2.1. First, we use the penetration of US and Argentinian trade into Italy as an instrument to capture the rise in their competitiveness that is exogenous from developments in Germany (panel B). Second, we rely on US exports to independent Asian and African countries, whose connection to German grain supply or politics was very weak during this time (panel C). Our third instrument

Table 2. *Effect of Trade Shock on Migration, Employment and Income.*

	Migration (1)	Employment (2)	Income (3)	Income p.c. (4)
Panel A: OLS				
Shock agriculture (in marks)	−0.006***	−0.008***	−0.008*	0.001
	(0.002)	(0.002)	(0.004)	(0.001)
Panel B: 2SLS (Italy)				
Shock agriculture (in marks)	−0.007***	−0.010***	−0.009**	0.001
	(0.002)	(0.002)	(0.004)	(0.002)
Adjusted SEs (Adao *et al.*, 2019)	[0.003]	[0.002]	[0.006]	[0.003]
F-statistic excluded instrument	300.56	300.56	290.51	290.51
Panel C: 2SLS (Asia)				
Shock agriculture (in marks)	−0.007***	−0.012***	−0.007	0.002
	(0.002)	(0.002)	(0.005)	(0.002)
F-statistic excluded instrument	277.41	277.41	269.22	269.22
Panel D: 2SLS (US prices)				
Shock agriculture (in marks)	−0.018***	−0.012***	−0.026***	0.003
	(0.004)	(0.003)	(0.006)	(0.003)
F-statistic excluded instrument	90.81	90.81	90.01	90.01
Panel E: 2SLS (Italy) with Russian trade				
Shock agriculture (in marks)	−0.005***	−0.007***	−0.007***	0.000
	(0.002)	(0.002)	(0.003)	(0.001)
F-statistic excluded instrument	301.31	301.31	287.36	287.36
Mean dependent variable	−0.52	0.63	3.14	2.22
SD dependent variable	0.88	0.62	1.54	0.65
Province FEs	✓	✓	✓	✓
Further controls	✓	✓	✓	✓
Observations	452	452	448	448

Notes: Unit of observation: county. SEs, clustered at the district level, are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variables are average yearly population growth due to migration (1895–910), employment rate (1895–907), yearly county income growth and income per capita growth (1895–910). Controls include the share of employment in agriculture, share of land owned by large farm owners (more than 50 hectares), horsepower per worker and the distance to the nearest big city. The difference in the numbers of observations in columns (1) and (2) in comparison to columns (3) and (4) is due to missing data for the district of Sigmaringen. In panel B, we calculate the SEs as suggested by Adao *et al.* (2019) in square brackets.
Source: See Online Appendix A.

is constructed from the decline in grain prices in the US East Coast. We use the decline in agricultural prices as a measure of the pressure that the grain invasion exerted on world markets (panel D).

Given that OLS suffers from the multiple endogeneity problems discussed in Section 2.1, we mainly interpret the IV results. However, it should be noted that these various biases seem to largely cancel each other out, for the OLS result is not qualitatively different from the IV result. We discuss the challenges to this identification, robustness checks and validation exercises in Section 2.3.

To put the coefficient sizes into perspective, the average import shock is roughly 20 marks per worker, with an SD of 14 marks per worker. Our dependent variables are expressed as yearly growth rates since they are measured at slightly different points in time. Our shock period covers

15 years overall so a one-SD shock will produce a percentage change of roughly 210 times the coefficient.

Migration. Trade shocks induced workers to emigrate from an affected county in sizeable numbers: an increase in the average trade shock by one SD corresponds to roughly 1.5% of the population emigrating (Table 2, panel B, column (1)). Overall, the average shock of 20 marks per worker caused 2.1% of the rural population to emigrate out of the affected counties, not taking into account general equilibrium effects. Given that the average yearly net migration rate was −0.53%, one SD explains roughly 18% of the yearly migration rate.[19] The results remain basically unchanged when relying on US exports to independent Asian and African countries as the IV (panel C, column (1)). The coefficient becomes larger when using US prices as an instrument (panel D, column (1)). With this instrument, we arguably also capture the additional effects that US supply has on Prussia via lowering market prices for grain, not only via directly exporting to Germany. Thus, one could argue that these larger estimates are actually more reflective of the overall effect of the 'grain invasion'. Still, to be as conservative in terms of effect size as possible, we base our further discussion on those instruments based on actual imports. This also allows us to stay comparable to contemporary studies.

Employment. We regress trade pressure on the employment rate (among the working-age population) as a rough inverse of the unemployment rate frequently used in modern economies. A one-SD trade shock depresses the employment share among the working-age population by roughly 2.1%.[20] We interpret this as rising unemployment and underemployment in the affected counties. Again, the results remain similar when using US exports as the IV and tend to increase when relying on US prices as the IV (see Table 2, panels C and D, column (2)).

Income. We regress trade shocks on total income and income per capita in the county. We find a negative effect of the trade shock on income (Table 2, panels A–D, column (3)), which is quantitatively in line with the decline in workers and population. Consequently, we do not observe a decline in income per capita (Table 2, panels A–D, column (4)). We find a similar pattern for the other instruments.

Political consequences. Given that we find a strong migration response and no decline in income per capita, we expect no economically motivated shift in political polarisation. The results in Table 3 are in line with this reasoning: we do not find any significant effect of the trade shock on the voting share of radical right (column (3)) or conservative parties (column (2)). We also find no effect of the trade shock on political mobilisation (column (7)) or the socialist left (column (1)) in Table 3.[21]

[19] As a robustness check, we include a Gini for land inequality as the control variable in Online Appendix Table B6. The results only slightly change.

[20] 15 years × 14 marks per worker × 0.01 (as estimated in panel B, column (1)).

[21] While we cannot find any evidence of a protectionist reaction after 1895, we know from the historical literature that Germany and many other European countries experienced a turn towards protectionism in the 1870s. It is therefore possible that shocked regions may have already shown political reactions before the period we observe, as argued by Lehmann (2010). However, there are at least three reasons for other interpretations. First, the 1878 election campaign was significantly influenced by two failed assassination attempts on the emperor and the demand for more law and order against the socialists (Sperber, 1997, p. 173f.). Second, an important motive for the tariffs was the enlargement of the federal budget, and, thus, a key domestic political issue (Torp, 2005, p. 160f.). Third, among the 204 MPs, who early on advocated more protectionist legislation, rural eastern Prussia was not overrepresented and neither was the protectionist conservative party (Torp, 2005, p. 163ff.). The push for higher tariffs was instead spearheaded by catholic "Center" MPs in constituencies around booming cities, at least partly to limit the expansion of these urban centres (Torp, 2005, p. 163ff.). Another reason for their support was the interest to send a conciliatory signal to protestant state elites in order to end the *Kulturkampf* (Torp, 2005, p. 169). Nevertheless, we cannot rule out potential political effects due to globalisation shocks in the 1870s. However, if there was or is a general pattern of globalisation shocks causing political backlash, we should be observing it in our time period, too. The baseline level of protectionism would just be higher.

Table 3. *Effect of the Trade Shock on Elections, 1898–1912.*

	Socialist (1)	Cons. (2)	Rightwing (3)	Liberal (4)	Catholic (5)	Particular (6)	Turnout (7)
Shock agriculture (in marks)	−0.048 (0.068)	−0.049 (0.125)	−0.064 (0.096)	0.053 (0.096)	0.196 (0.161)	−0.098 (0.103)	−0.039 (0.045)
Mean dep. var.	5.34	−2.60	−1.89	3.46	−4.86	1.31	16.60
SD dep. var.	6.80	14.41	9.70	13.19	11.29	8.25	7.70
F-statistic excl. inst.	288.25	297.62	288.87	307.42	281.11	341.59	290.07
Province FEs	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓
Observations	226	226	226	226	226	226	226

Notes: Unit of observation: constituency. SEs, clustered at the district level, are reported in parentheses. The dependent variables refer to the change in support for a party group between 1898 and 1912. For details on the party groups, see Section 1.3 and Online Appendix A. Controls include the share of employment in agriculture, share of land owned by large farm owners (more than 50 hectares), horsepower per worker, distance to the nearest big city and the initial share of the dependent variable.
Source: See Online Appendix A.

Summary. Overall, the Prussian counties affected most by the grain invasion show fewer signs of economic stress than what we expected from similar estimates using contemporary data. We hypothesise that this is because of the markedly larger migration response. We show in Section 3 that these migrants get absorbed into the main cities of Prussia and thus contribute to faster structural change away from agriculture, compared to contemporary settings. We also discuss possible reasons for this difference. However, before we turn to these implications of our estimates, we discuss challenges to our identification strategy and alternative specifications to address them.

2.3. *Validation of the Empirical Strategy*

In principle, Bartik-type instruments require standard identifying assumptions. However, because these instruments are themselves computed as the sum of shifts (in imports) and shares (in crops), it is harder to parse what these assumptions mean intuitively. Goldsmith-Pinkham *et al.* (2020) and Borusyak *et al.* (2022) disentangled two different sets of identifying assumptions, each of which is sufficient to guarantee the exogeneity of the Bartik instrument: in our setting, these translate to either the exogenous assignment of import shocks to crops or the exogeneity of the crop shares. In the following, we discuss both, starting with the exogeneity of import shocks.

Exogenous assignment of shocks. In this line of reasoning, the identifying assumption is that the transportation and productivity developments described in Section 1 caused productivity improvements in the Americas, but did not affect domestic growth through other channels. The Prussian agricultural sector was on a negative growth trajectory amid rapid urbanisation and industrialisation. However, we compare crops *within* the agricultural sector; thus, our identification would be threatened if the technology shock in the United States had different effects on the producers of different agricultural products in Germany, other than through trade. In principal, we see three ways in which this could have happened. The first and main concern is that the shock caused tariffs, subsidies or other protectionist policies for parts of agriculture, whose effects we measure together with the trade shock. The second is that unproductive or declining sectors in Germany attracted import competition. The third is that the technologies newly utilised in the Americas spread to Prussia and raised the productivity of Prussian crop producers directly. We have argued in Section 2.1 why we are confident that our different instruments, especially taken

together, address concerns one and two and why we think that the third concern is not valid. We further strengthen these results with robustness checks reported in Online Appendix B8. Online Appendix Table B8 reports the overidentification tests for using the instruments jointly. In this table, we also report results when weighting counties with their population.

As a remaining concern, we study in detail the influence of Russian trade during our time period. Russia offers a unique challenge to the identification insofar as it is tentatively allied to Imperial Germany and a significant grain exporter undergoing extensive railway expansion. Because of the potential political ties and accompanying tariff discussions, we do not include it in the main specification. However, despite some discussion, Imperial import tariffs for Russian grain did not actually change much during our time frame (see Section 1). These are the most important tariffs for our identification strategy, since they would make imports from Russia endogenous to the political situation in Germany. In any event, we deploy our instruments to control for the potential endogeneity of German-Russian tariffs. Importantly, grain imports from Russia did not increase rapidly until 1910, at the very end of our sample period. Thus, we expect that Russian grain does not drive our results. To confirm this, we add Russia to our shocking countries and bundle it together with the United States and Argentina. We find only slightly smaller coefficients when adding the changing Russian trade exposure to our trade shock (both to the German and Italian trade exposure) in panel E of Table 2. This treatment assumes that imports from Russia also increased because of supply conditions within Russia and that this poses an exogenous shock to Prussian consumers. Plausibly, the same technology advances that made imports from the United States and Argentina feasible also worked in favour of imports from agricultural lands within the Russian empire. Our results are not altered significantly by including this additional Russian shock.

Exogeneity of shares. The results so far suggest that the shocks were exogenously assigned to the shares. We also present some evidence that the shares are exogenous to growth. To be more confident that the crop shares do not have inherent growth potential that we wrongly attribute to trade, we compare the growth performance of agricultural regions with certain crops before and after the trade shock. This is intuitively similar to looking not at growth, but at its acceleration. The identification is thus in the second derivative. Specifically, Online Appendix Figures B5 and B6 report the results of this exercise following Goldsmith-Pinkham *et al.* (2020): the sample is not generally large enough to produce significant results, but regions with a high share of wheat experienced both a lowered employment share and net emigration in the shock period, compared to the 1882–95 period. Conversely, regions relying on rye and potatoes grew faster in the shock period (1895–910) than before. This pattern is well explained by our trade shock, which consists mainly of wheat, oil fruits and fodder (mostly maize) imports to Germany.

To show the contribution of specific crops to our identification analytically, we compute the Rotemberg weights of crops. However, we distribute total net imports into Prussia slightly differently (see Section 1.2) than implied by the standard Bartik-type instrument: we have no information on employment per crop in each county. However, after some rearranging, our approach is equivalent to treating the change in net imports for a crop as the crop-specific shock ($g_k t$ in the notation of Goldsmith-Pinkham *et al.*, 2020) and counties' shares of Prussian land devoted to a specific crop divided by county employment as the county-crop specific shares ($z_l k0$ in teh notation of Goldsmith-Pinkham *et al.*, 2020). We can then employ their estimator accordingly, ignoring the fact that the shares within each county do not add up to one, which is not required for identification. Identification of our effects mainly rests on the import shocks from wheat (45%), fodder (26%) and oil seeds (11%). Together, these staple crops emphasised in

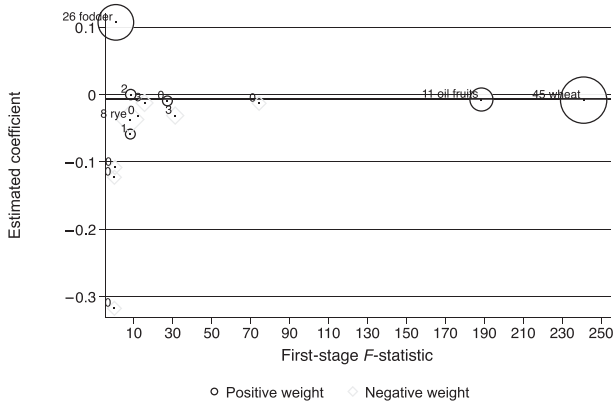


Fig. 4. *Heterogeneity of Estimates.*
Notes: The figure shows the result of using only one crop share as the exogenous instrument at a time. Open dark circles denote crops with a positive Rotemberg weight in the overall regression and open light diamonds those with negative weights. The size of the symbols and the small numbers relate to the contribution of each crop to the overall estimate. Only important crops are named. The black line denotes our mainline estimate for comparison.
Source: See Online Appendix A.

the literature and central to the economic intuition behind our shock thus reassuringly contribute to more than 80% of the identification.

To further understand the contribution of the various crops, we estimate our main regression using the crop share instruments one at a time and plot the resulting coefficients and *F*-statistics. Figure 4 reports the result from this exercise (equivalent to Figure A2 in Goldsmith-Pinkham *et al.*, 2020). Reassuringly, all coefficients with associated *F*-statistics larger than 10 are in line with our main estimate. Notably, fodder has a large weight, but also a very low *F*-statistic and is the only individual estimate at odds with our main specification. It is balanced out in the mainline regression by a group of small weight crops that also have low *F*-statistics, but estimated effects larger than the baseline regression. Though IV estimates with such low *F*-statistics should perhaps not be interpreted at all, it is interesting to note that in Section 3.1 we document that affected counties move towards more animals per farm worker and thus demand more fodder, which might explain why fodder-specialised counties actually profit from the shock. These production linkages between crops are ignored in our analysis, as is standard in this literature.

Pre-trends. Existing pre-trends could potentially threaten our results if rural counties with different crops had been on different growth trajectories even before the trade shock. Thus, pre-trends and the exogeneity of shares are closely linked. To find potential pre-trends, we test whether county growth between 1882 and 1894 is uncorrelated to the later shock, conditional on controls. We present the associated regression in Table 4, similar to the validation exercise performed by Autor *et al.* (2013). For the preferred results based on 2SLS in columns (1) and (2) of Table 4, we see no significant correlation between the future trade shock on past migration changes. We observe a similar finding for employment growth in column (2). Unfortunately, we do not have pre-shock data for incomes, as the series starts in 1891.

To further strengthen our empirical approach, we not only control for the level of our variables at the beginning of our shock period, but also the growth history of the county.[22] We estimate

[22] We thank an anonymous referee for this suggestion.

Table 4. *Controlling for Pre-Trends.*

	(1)	(2)	(3)	(4)
Panel A: Future trade shocks and Y variables				
Effect of the trade shock on employment and migration, first period				
	2SLS		OLS	
	Migration	Employment	Migration	Employment
Future shock agriculture (in marks)	0.009	−0.010	−0.002	0.000
	(0.026)	(0.010)	(0.004)	(0.003)
Mean dependent variable	−0.64	0.15	−0.64	0.15
SD dependent variable	0.91	0.32	0.91	0.32
F-statistic excluded instrument	8.53	8.53		
Province FEs	✓	✓	✓	✓
Controls	✓	✓	✓	✓
Observations	452	452	452	452
Panel B: Controlling for employment pre-trend				
	Migration	Employment	Income	Income p.c.
Shock agriculture (in marks)	−0.009***	−0.009***	−0.012***	0.001
	(0.002)	(0.002)	(0.004)	(0.001)
Past employment growth (in %)	0.102	−0.097	−0.153	−0.020
	(0.131)	(0.119)	(0.219)	(0.067)
F-statistic excluded instrument	277.66	277.66	264.29	264.29
Panel C: Controlling for employment and migration pre-trend				
	Migration	Employment	Income	Income p.c.
Shock agriculture (in marks)	−0.006***	−0.009***	−0.008**	0.001
	(0.002)	(0.002)	(0.004)	(0.001)
Past employment growth (in %)	0.301***	−0.129	0.128	0.017
	(0.093)	(0.092)	(0.181)	(0.064)
Past migration (in %)	0.510***	−0.082*	0.723***	0.094***
	(0.106)	(0.046)	(0.140)	(0.027)
F-statistic excluded instrument	278.26	278.26	264.71	264.71
Mean dependent variable	−0.52	0.63	3.14	2.22
SD dependent variable	0.88	0.62	1.54	0.65
Province FEs	✓	✓	✓	✓
Further controls	✓	✓	✓	✓
Lagged further controls	✓	✓	✓	✓
Observations	452	452	448	448

Notes: Unit of observation: county. SEs, clustered at the district level, are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. In panel A the dependent variables are average yearly population growth due to migration (1880–95) and employment rate (1882–95). In panels B and C the dependent variables are average yearly population growth due to migration (1895–910), employment rate (1895–907), yearly county income growth and income per capita growth (1895–910). Controls include the share of employment in agriculture, share of land owned by large farm owners (more than 50 hectares), horsepower per worker, distance to the nearest big city. Lagged controls include the lagged share of agriculture in employment.
Source: See Online Appendix A.

two additional different specifications (Table 4): in both, we add lags of the share of agriculture in employment (the only control variable for which we have a sufficient history). In panel B, we control for lagged employment shares, in panel C, we add lagged migration rates to the specification. We cannot add lagged income and income per capita due to data limitations. Our coefficients remain qualitatively unchanged, though the emigration coefficient drops slightly in the third specification. Effectively, the results in panels B and C are no longer identified from the change of the dependent variables, but from the acceleration of change compared to the previous period, i.e., the second derivative.

Inference. To account for potential correlations between regression residuals across regions with similar crop shares that would potentially lead to wider confidence intervals, we apply the inference methods proposed by Adao *et al.* (2019). With this approach, we can calculate SEs that account for this potential cross-regional correlation in the regression residual. In Table 2, we see that this leads to minor changes in the SEs. Still, the results for our preferred specifications remain basically unchanged.

3. The Adjustment Process

Our results indicate a strong migration response to the trade shock in agriculture. This suggests a mechanism through which the Imperial German economy could avoid the negative consequences of trade shocks that are measured in modern economies and which are notably absent in the above regression results. In this section, we detail how the trade shock accelerated structural change both within the affected counties (Section 3.1) and—through migration—beyond (Section 3.2).

3.1. *Local Adjustment*

Within the affected counties, we study the effects of the trade shock on sector composition and technological progress in the agricultural sector. We apply our approach described in Section 2 and use different dependent variables capturing local adjustments.

Rural counties were not notably better at switching to new sectors or crops compared to the industrial centres affected by trade shocks today. To the contrary, Table 5 (panel A) shows that counties did not generally move away from the crops most affected by foreign competition (fodder, wheat and oil seeds). The only significant coefficient indicates a shift away from oil seeds of 0.2% of the available land as a response to a one-SD shock.[23] We find no wheat or fodder reaction. This is likely because these rural counties are locked into their specific crops by weather and soil conditions. This result is in line with the long strand of literature that uses the fact that locations are only suitable to some crops as an instrument.[24]

In panel B of Table 5, we explore whether the sector composition within counties affected by trade shocks changes. Sector composition is measured as the share of employment within each of the major sectors.[25] There is a move towards services: a one-SD increase in trade exposure increases the share of the service sector by 1%. This is a sizeable effect compared with Autor *et al.* (2013), who could not find any positive effect of the China shock on employment in non-affected sectors. To round out the analysis of structural change within counties, we study the effect of imports on the mode of production within agriculture.

Columns (1) and (2) of panel C in Table 5 show the effect of imports on crop yields per acre, valued in either current or constant prices. We use revenue at constant prices as a pseudo-quantity measure. This rules out that the negative coefficient is driven by imports depressing the prices for agricultural products, even though production has not changed. Evidently, the withdrawal of farmhands through emigration depresses crop yields per acre, no matter which prices are used.

[23] For the calculation, 14 marks per worker (one SD in trade shock) × 15 years × 0.001.

[24] For example, Sokoloff and Engerman (2000) argued for the effect of soil suitability on institutions and through them on long-run growth. More recently, de Zwart and Soekhradj (2023) also used soil suitability to evaluate colonial policies in Java, while Andersen *et al.* (2016) studied the economic impact of agricultural innovations in Denmark, relying on the same empirical strategy.

[25] The service sector includes—following the definition of the occupation census—trade, insurance, transport, public employment and accommodation.

Table 5. *Local Adjustment.*

	(1)	(2)	(3)
Panel A: crops			
	Wheat	Fodder	Oil seeds
Shock agriculture (in marks)	0.001	0.000	−0.001**
	(0.001)	(0.002)	(0.001)
Mean dependent variable	0.03	0.26	−0.01
SD dependent variable	0.17	0.44	0.04
Panel B: industries			
	Agricuture	Industry	Services
Shock agriculture (in marks)	−0.005***	0.001	0.004***
	(0.001)	(0.001)	(0.001)
Mean dependent variable	−0.05	−0.05	0.10
SD dependent variable	0.33	0.25	0.27
Panel C: intensification			
	Revenue	Revenue (1882 prices)	Animals per worker
Shock agriculture (in marks)	−0.029***	−0.031***	0.030***
	(0.010)	(0.009)	(0.008)
Mean dependent variable	5.18	3.48	−0.25
SD dependent variable	2.00	1.97	1.76
Province FEs	✓	✓	✓
Further controls	✓	✓	✓
Observations	452	452	452

Notes: Unit of observation: county. SEs, clustered at the district level, are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$. In panel A the dependent variables are yearly changes in the share of cultivation areas for wheat, fodder, and oil fruits between 1893 and 1901 (in percent). In panel B the dependent variables are yearly changes in agricultural, industrial and service employment as a share of working age population between 1895 and 1907 (in percent). In panel C the dependent variables are the change in harvest value per unit of land (in current prices), change in harvest value per unit of land (in 1882 prices) and change in animals per worker. Controls include the share of agricultural employment, share of land owned by large farm owners (more than 50 hectares), horsepower per worker and the distance to the nearest big city.
Source: See Online Appendix A.

However, landlords in affected counties intensify agriculture by investing in more animals per farm worker. This result is in line with the findings of Suesse and Wolf (2020) on agricultural diversification for the eastern provinces in Prussia. This change is a productivity-enhancing investment, a move away from the hit sectors and a move up the value chain: recall that fodder was imported in great quantities, which the farmers are now able to use to their advantage.

All in all, there is some limited evidence for structural change within the affected countries, counter to the literature on the China shock today. However, the major channel of structural change is the 1.5% of the population leaving the affected counties. We discuss the effects on their destination counties in the following subsection.

3.2. *Adjustment between Regions*

In addition to structural change within counties, we look at reallocation through migration. In Section 2.2 we already documented large migration responses to trade shocks. However, the questions of where the workers go are left unaddressed. To develop this argument, we presuppose a relatively standard gravity-type migration or spatial economics model (Allen and Donaldson, 2022) to guide our analysis.

In such models, workers are spread over n locations and have a different productivity in each of these. In our setting, this could be because some counties are centres of industrialisation

while others contain only wheat farms struggling with competition from the Americas. Workers that move between any county pair incur an exogenous mobility cost $\theta_{o,d}$, where o denotes the origin county and d denotes the destination. This cost represents the movement costs themselves, but also the cost of leaving one's social network, learning another regional dialect or language (note that the eastern provinces of Prussia like Poznan, a hard hit region, have a sizeable Polish-speaking minority) and other such utility costs. Workers observe employment opportunities in all locations and then have to decide whether to move to any of them or not.

In this setup, a trade shock will decrease labour demand in specific sectors in specific locations. Workers can be affected by this because they are employed in the affected sector or because the regional labour markets they are interested in become depressed because others are laid off. Some workers will find that their own labour market has worsened so much that they will leave, while others will find that the labour market at the destination they would have gone to has worsened and they no longer move. Some counties will see workers leaving because of worsening conditions, others will see an influx of workers from affected counties. In our historical application of the grain invasion, there are rural counties that are originally affected by the shock. These are the counties that we investigated the same way that Autor *et al.* (2013) investigated the counties hit by the China shock. However, this leaves the question of what happens to the urban counties that receive a majority of these migrants. We already argued that German citizens at the time were more mobile than modern workers. However, this is only productive if the destination counties can integrate these migrants into their labour markets.

To study long-run population equilibria, Allen and Donaldson (2022) retrieved structural estimates for all parameters in their model. Specifically, they estimated the attractiveness of the labour market in every county and a matrix of $\theta_{o,d}$ movement cost parameters. We approach this problem from a slightly different perspective: we conduct a reduced-form estimation that relies only on the migrants' optimisation problem to estimate the partial equilibrium migration response in which we are interested.

It follows from equation (9) of Allen and Donaldson (2022) that the ratio of emigrants moving from county o to two different destinations is determined by the attractiveness of the two destinations and the two migration costs:

$$\frac{m_{o;d=1;t}}{m_{o;d=2;t}} = \frac{W_{d=1,t}/\theta_{o,d=1,t}}{W_{d=2,t}/\theta_{o,d=2,t}}.$$

Here $m_{o;d;t}$ is the migration from county o to county d, $W_{d=1,t}$ is the welfare after moving and $\theta_{o,d=2,t}$ is the iceberg-type movement cost of moving from county o to county $d = 2$. This suggests a simple estimation that captures the intuition of the model without following it directly: one can determine the 'closeness' between an origin and a destination by the number of emigrants that take this route as a share of all emigrants from the origin. Intuitively, this corresponds to the probability that someone will immigrate to the destination, given that he has already decided to emigrate from the origin. This logic is independent of the finer details of which model one assumes, though the specific functional forms chosen in Allen and Donaldson (2022) make it line up with fundamentals particularly well. While in principle the relative attractiveness of regions and transportation costs can change, we observe that in our time frame, these shares and thus the inferred closeness of counties is stable: the correlation between these migration shares at different points in time is always above 0.90. We are thus confident that these shares capture structural factors in our application. The highest shares we observe in our sample are usually between rural counties in Brandenburg and West Prussia and the large cities nearby, e.g., Berlin,

Table 6. *Indirect Effects: City Outcomes.*

	Migration (1)	Population (2)	Employment share (3)	Industry share (4)
Ind. shock agriculture (in marks)	0.010*	0.014**	−0.002	0.001
	(0.006)	(0.007)	(0.002)	(0.001)
Shock agriculture (in marks)	0.010	0.082	0.066	0.018**
	(0.043)	(0.065)	(0.042)	(0.008)
Mean dependent variable	0.82	2.55	−0.14	0.06
SD dependent variable	1.15	1.57	0.51	0.30
Province FEs	✓	✓	✓	✓
Further controls	✓	✓	✓	✓
Observations	62	62	62	62

Notes: Unit of observation: county. SEs, clustered at the district level, are reported in parentheses. ** $p < 0.05$, * $p < 0.1$. Dependent variables: average yearly population growth due to migration (1895–910), yearly population growth (1895–910), employment rate among the working age population (1895–907) and the share of industry jobs (1895–907) as a share of all employment (1895–907) (all in percent). Controls include the share of agricultural employment, share of land owned by large farm owners (more than 50 hectares), horsepower per worker and the distance to the nearest big city.
Source: See Online Appendix A.

Potsdam and Stettin. As is presupposed by Allen and Donaldson (2022), geographical distance explains a large part of movement shares and does not change over time.

Without employing any further modelling, we thus use these emigration shares in our reduced-form exercise to construct a 'closeness' matrix between all 452 counties in our data. We then compute the indirect import shock for urban counties as the sum of all import shocks to rural counties, weighted by the movement probability between each rural origin and the different urban destinations:

$$Ind.ImportShock_{d,t} = \sum_{0}^{O}(ShareEmigration_{o;d;1890} \times \Delta AgriculturalTradeExposure_{ot}^{Americas}).$$

Different destinations d get assigned different indirect exposure measures because the exposure of all rural counties (the same for every d) is weighted by the different movement probabilities to different destinations. Each city faced the same set of agricultural shocks for each rural county, but some are more exposed than others, as evident by their higher immigration shares from affected counties. For example, Berlin has high indirect exposure, mainly from Prussian rural counties. This might be because it is close to affected counties and contains a sizeable immigrant population from the area. Our data basis for this analysis is the migration probability matrix discussed in Section 1.3. We take the shares from 1890, before our shock period, to avoid any potential of the trade shock influencing the matrix of movement probabilities.

We then estimate the effect of indirect exposure as

$$\Delta Y_i = \beta_0 + \beta_1 AgriculturalTradeExposure_{ot}^{Americas} + \beta_2 Ind.ImportShock_{d,t} + X_i\prime\beta_2 + \epsilon_i,$$

where $X_i\prime$ denotes the usual set of control variables and β_2 is the coefficient of interest for the indirect trade exposure. We only estimate this equation for urban counties, i.e., counties with a share of agricultural workers below 25%. The results are reported in Table 6.

The effects for the direct agricultural shock are often insignificant and economically small, since cities experience an average agricultural shock of only 3.9 marks per worker (SD of 4.6 marks per worker). In contrast, the indirect shocks through the counties where cities' migrants come from are very large (mean of 82 marks per worker; SD of 185 marks per worker), which leads to economically substantial effects: given the above coefficients, a one-SD shock will

increase cities' population growth by roughly 2.6% per year (roughly 47% over 15 years), three-quarters of that through migration. The rest would be made up of migrants' children, but one should note that the difference between population growth and immigration is not statistically significant and should not be over-interpreted. The employment share decreases comparatively little (with an insignificant coefficient) and the industry share remains constant, suggesting that most of the migrants have found (in many cases industrial) work in 1910.

We also view our results as largely in line with the seminal study by Harris and Todaro (1970): the model views migration as driven mainly by the differences between expected earning in the city versus the countryside, same as Allen and Donaldson (2022). However, Harris and Todaro (1970) came to different conclusions because their 'shock' is a change in the minimum wage in cities: this increases urban wages, but draws in additional workers until unemployment equalises expected earning across the two regions again. In our application, the shock makes rural work less attractive and 'forces' workers into the cities. However, capital does not seem to be fixed. To the contrary, investment in industry was particularly high, reaching growth rates of more than 15% (Wehler, 2006, p. 597). Thus, urban jobs kept pace with increased migration and unemployment does not seem to have been a major issue. This enabled the Prussian economy to react so well to the shock.

3.3. *Comparison to Today*

The large migration response we observe constitutes a fundamental difference between the effects of trade shocks during the first globalisation and today. In the last part of this section, we discuss potential reasons for the different responses during the first and second waves of globalisation. During today's phase of globalisation, we observe mixed evidence for a migration response after the 'China shock' in the United States. Greenland *et al.* (2019) provided evidence for a migration response, while Faber *et al.* (2019) did not find this result (similar to Autor *et al.*, 2013). In contrast, all of our results point to a strong migration response.

There is a large literature explaining why today's workers hesitate to move in response to shocks, starting with the seminal work by Neal (1995): workers accumulate firm-, industry- and occupation-specific skills, some of which they can no longer use when switching jobs. Studying displaced workers, the literature has shown that depending on the occupation, each of these components can be large (Sullivan, 2010). Today, workers especially face large adjustment costs due to specific human capital (Traiberman, 2019). Moreover, low-skilled workers with lots of industry-specific human capital are especially hurt by import shocks (Dauth *et al.*, 2021). Hence, large, industry-wide trade shocks make the transition to similar occupations difficult, because these are likely also depressed.

In contrast, workers of the first globalisation faced fewer migration barriers (O'Rourke and Williamson, 1999). In addition, workers had little social insurance, e.g., no unemployment insurance. A closer look at the migration within Prussia provided by Kaiserliches Statistisches Amt (1910) yields details on migrants' characteristics (Online Appendix Table B9): low-skilled migrants from rural regions faced good employment prospects in urban centres and made up a large part of the urban population.[26] For instance, more than 30% of all workers in industrialising Brandenburg (including Berlin) were migrants from other provinces (Online Appendix Table B9, column 3). We observe similar patterns in other more industrialised provinces like Westphalia

[26] The census allows us to define low-skilled migration as factory workers, wage workers, day labourers and apprentices (Kaiserliches Statistisches Amt, 1910, p. 1).

and the Rhineland. Comparing the skill level of locals and migrants shows that migrants were—on average—lower skilled than locals in industrialised provinces (Online Appendix Table B9, columns 1 and 2).[27] The jobs these immigrants took were often physically demanding and paid comparatively low wages. Nevertheless, they gave rural workers a viable alternative to the countryside that many of them took once trade shocks had worsened their original employment. Importantly, these job changes occurred in a dynamic labour market with high job fluctuation, at least by today's standards (Brown and Neumeier, 2001).

Overall, these descriptive results suggest that movement frictions play a larger role in contemporary settings. To explicitly explore this comparison and also the role of social insurance, one would need individual-level data that is unfortunately not available for our time period.

4. Conclusion

Our paper analyses the economic and political effects of a major trade shock in the agricultural sector during the first globalisation. We find that trade shocks led to a decline in population, employment rate and total income in the affected counties. However, trade shocks did not cause the long-run losses in per capita income nor in political stability that are observed for today's shocks. We attribute this difference to the large effects of trade shocks on domestic migration, which was considerably higher in comparison to the second globalisation: instead of bearing income losses, rural workers from affected counties moved to the booming cities, where low-paid, low-skill employment was available for a large number of new workers.

Overall, our findings are in line with the canonical labour market analysis of Blanchard and Katz (1992). The presence of the migration response and the absence of income per capita effects indicate that labour markets in Prussia seem to have mitigated trade shocks quickly—similar to US labour markets after World War II studied by Blanchard and Katz (1992) and Dao *et al.* (2017).

Still, our results do not mean that the welfare and distributional consequences of the trade shock in the setting are clear. Nor can we determine exactly why the migration response of workers was stronger during the first globalisation. It could have been due to the large number of low-skilled jobs in the cities or to the weaker welfare state. Future research should try to distinguish these factors more precisely. Nevertheless, from an economic policy perspective, these findings show the importance of labour market mobility as an adjustment mechanism for trade shocks, as also recently highlighted by Banerjee and Duflo (2019, ch.3). For today's policymakers, it therefore seems important to better understand the migration response after economic shocks.

Halle Institute for Economic Research, Germany
Humboldt-Universität zu Berlin, Germany

Additional Supporting Information may be found in the online version of this article:

Online Appendix
Replication Package

[27] The opposite is the case in more rural provinces with a lower share of labour migrants.

References

Adao, R., Kolesár, M. and Morales, E. (2019). 'Shift-share designs: Theory and inference', *The Quarterly Journal of Economics*, vol. 134(4), pp. 1949–2010.

Aldenhoff-Hübinger, R. (2002). *Agrarpolitik und Protektionismus: Deutschland und Frankreich im Vergleich, 1879-1914*, Göttingen: Vandenhoeck & Ruprecht.

Allen, B. and Unger, R. (2018). 'The Allen Unger commodities dataset', IISH Data Collection, V1, https://hdl.handle.net/10622/3SV0BO (last accessed: 1 March 2023).

Allen, T. and Donaldson, D. (2022). 'Persistence and path dependence: A primer', *Regional Science and Urban Economics*, vol. 94, 103724.

Andersen, T.B., Jensen, P.S. and Skovsgaard, C.V. (2016). 'The heavy plow and the agricultural revolution in medieval Europe', *Journal of Development Economics*, vol. 118, pp. 133–49.

Autor, D.H., Dorn, D. and Hanson, G.H. (2013). 'The China syndrome: Local labor market effects of import competition in the United States', *American Economic Review*, vol. 103(6), pp. 2121–68.

Autor, D.H., Dorn, D., Hanson, G.H. and Majlesi, K. (2020). 'Importing political polarization? The electoral consequences of rising trade exposure', *American Economic Review*, vol. 110(10), pp. 3139–83.

Bade, K. (1980). 'Massenwanderung und arbeitsmarkt im deutschen nordosten von 1880 bis zum ersten weltkrieg. überseeische auswanderung, interne abwanderung und kontinentale zuwanderung', *Archiv für Sozialgeschichte*, vol. 20(1), pp. 265–323.

Banerjee, A.V. and Duflo, E. (2019). *Good Economics for Hard Times: Better Answers to Our Biggest Problems*, London: Penguin UK.

Bartels, C., Kersting, F. and Wolf, N. (2023). 'Testing marx. capital accumulation, income inequality, and socialism in late nineteenth-century Germany', *The Review of Economics and Statistics*, forthcoming.

Becker, S.O., Cinnirella, F., Hornung, E. and Woessmann, L. (2014). 'iPEHD—the ifo Prussian Economic History Database', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, vol. 47(2), pp. 57–66.

Blanchard, O.J. and Katz, L. (1992). 'Regional evolutions', *Brooking Papers on Economic Activity*, vol. 1992(1), pp. 1–75.

Borusyak, K., Hull, P. and Jaravel, X. (2022). 'Quasi-experimental shift-share research designs', *The Review of Economic Studies*, vol. 89(1), pp. 181–213.

Brown, J.C. and Neumeier, G. (2001). 'Job tenure and labour market dynamics during high industrialization: The case of Germany before World War I', *European Review of Economic History*, vol. 5(2), pp. 189–217.

Bustos, P., Caprettini, B. and Ponticelli, J. (2016). 'Agricultural productivity and structural transformation: Evidence from Brazil', *American Economic Review*, vol. 106(6), pp. 1320–65.

Caliendo, L., Dvorkin, M. and Parro, F. (2019). 'Trade and labor market dynamics: general equilibrium analysis of the China trade shock', *Econometrica*, vol. 87(3), pp. 741–835.

Caramani, D. (2004). *Elections in Western Europe Since 1815: Electoral Results by Constituencies*, Basingstoke: Palgrave Macmillan.

Castañeda Dower, P. and Markevich, A. (2022). 'Did industrialization increase support for the radical left? Evidence from the 1917 Russian Revolution', SSRN Working Paper Nr. 3856903.

Colantone, I. and Stanig, P. (2018). 'The trade origins of economic nationalism: Import competition and voting behavior in Western Europe', *American Journal of Political Science*, vol. 62(4), pp. 936–53.

Costinot, A. and Donaldson, D. (2016). 'How large are the gains from economic integration? Theory and evidence from US agriculture, 1880-1997', Working Paper 22946, National Bureau of Economic Research.

Dao, M., Furceri, D. and Loungani, P. (2017). 'Regional labor market adjustment in the United States: Trend and cycle', *The Review of Economics and Statistics*, vol. 99(2), pp. 243–57.

Dauth, W., Findeisen, S. and Suedekum, J. (2014). 'The rise of the East and the Far East: German labor markets and trade integration', *Journal of the European Economic Association*, vol. 12(6), pp. 1643–75.

Dauth, W., Findeisen, S. and Suedekum, J. (2021). 'Adjusting to globalization in Germany', *Journal of Labor Economics*, vol. 39(1), pp. 263–302.

de Zwart, P. and Soekhradj, P. (2023). 'Colonial paradox: Sugar, property rights and land inequality in java', *Explorations in Economic History*, vol. 88, 101513.

Desai, A.V. (1968). *Reallöhne in Deutschland von 1871 bis 1913*, Köln: GESIS Datenarchiv. histat.

Dippel, C., Gold, R., Heblich, S. and Pinto, R. (2022). 'The effect of trade on workers and voters', Economic Journal, vol. 132(641), pp. 199–217.

Dix-Carneiro, R. and Kovak, B.K. (2017). 'Trade liberalization and regional dynamics', *American Economic Review*, vol. 107(10), pp. 2908–46.

Donaldson, D. and Hornbeck, R. (2016). 'Railroads and American economic growth: A "market access" approach', *The Quarterly Journal of Economics*, vol. 131(2), pp. 799–858.

Erten, B. and Leight, J. (2019). 'Exporting out of agriculture: The impact of WTO accession on structural transformation in China', *The Review of Economics and Statistics*, vol. 103(2), pp. 1–46.

Faber, M., Sarto, A. and Tabellini, M. (2019). 'The impact of technology and trade on migration: Evidence from the US', Working Paper 20–071, Harvard Business School.

Fajgelbaum, P. and Redding, S.J. (2022). 'Trade, structural transformation, and development: Evidence from Argentina 1869–1914', *Journal of Political Economy*, vol. 130(5), pp. 1249–318.
Federico, G., Natoli, S., Tattara, G. and Vasta, M. (2011). *Il Commercio Estero Italiano 1862-1950*, Roma: Editori Laterza.
Federico, G. and Vasta, M. (2015). 'What do we really know about protection before the Great Depression: Evidence from Italy', *The Journal of Economic History*, vol. 75(4), pp. 993–1029.
Galloway, P.R. (2007). 'Galloway Prussia database 1861 to 1914', https://www.patrickgalloway.com/ (last accessed: 1 March 2023).
Geschonke, S. (2022). 'Why tariffs at the micro-level matter. empirical evidence from Germany during the first globalization (1880-1913)', Working paper, Humboldt University Berlin.
Goldsmith-Pinkham, P., Sorkin, I. and Swift, H. (2020). 'Bartik instruments: What, when, why and how', *American Economic Review*, vol. 110(8), pp. 2586–624.
Gomellini, M., Missiaia, A. and Pellegrino, D. (2022). 'From global to local: Trade shocks and regional growth in italy during the first globalization', Discussion Paper 17696, Centre for Economic Policy Research.
Gourevitch, P.A. (1977). 'International trade, domestic coalitions, and liberty: Comparative responses to the Crisis of 1873–1896', *The Journal of Interdisciplinary History*, vol. 8(2), pp. 281–313.
Greenland, A., Lopresti, J. and McHenry, P. (2019). 'Import competition and internal migration', *The Review of Economics and Statistics*, vol. 101(1), pp. 44–59.
Harris, J.R. and Todaro, M.P. (1970). 'Migration, unemployment and development: A two-sector analysis', *American Economic Review*, vol. 60(1), pp. 126–42.
Heblich, S., Redding, S.J. and Zylberberg, Y. (2020). 'The distributional consequences of trade: Evidence from the repeal of the corn laws', Working paper, Princeton University.
Hornung, E. (2015). 'Railroads and growth in Prussia', *Journal of the European Economic Association*, vol. 13(4), pp. 699–736.
Huberman, M. (2008). 'Ticket to trade: Belgian labour and globalization before 1914', *The Economic History Review*, vol. 61(2), pp. 326–59.
Hungerland, W.F. and Altmeppen, C. (2021). 'What is a product anyway? Applying the standard international trade classification (SITC) to historical data', *Historical Methods*, vol. 54(2), pp. 65–79.
Hungerland, W.F. and Lampe, M. (2021). 'Globalisierung und Außenhandel', in (U. Pfister, J.-O. Hesse, M. Spoerer and N. Wolf, eds.), *Deutschland 1871: Die Nationalstaatsbildung und der Weg in die moderne Wirtschaft*, pp. 335–58, Tübingen: Mohr Siebeck.
Hungerland, W.F. and Wolf, N. (2022). 'The panopticon of Germany's foreign trade, 1880–1913. new facts on the first globalization', *European Review of Economic History*, vol. 26(4), pp. 479–507.
Irwin, D.A. (1989). 'Political economy and peel's repeal of the corn laws', *Economics & Politics*, vol. 1(1), pp. 41–59.
Kaiserliches Statistisches Amt. (1910). *Statistik des Deutschen Reichs. Neue Folge. Band 210.*, Berlin: Puttkammer & Mühlbrecht.
Lampe, M. (2020). 'European trade policy in the 19th century', in (J. H. Hamilton, ed.), *Oxford Research Encyclopedia of Economics and Finance*, New York: Oxford University Press.
Lehmann, S. (2010). 'The German elections in the 1870s: Why Germany turned from liberalism to protectionism', *The Journal of Economic History*, vol. 70(1), pp. 146–78.
Meissner, C.M. and Xu, C. (2022). 'US trade performance, 1866-1914: A view from new granular data', Working paper, University of California Davis.
Michaels, G., Rauch, F. and Redding, S.J. (2012). 'Urbanization and structural transformation', *The Quarterly Journal of Economics*, vol. 127(2), pp. 535–86.
Nagy, D. (2022). 'Trade and urbanization: Evidence from Hungary', *American Economic Journal: Microeconomics*, vol. 14, pp. 733–90.
Neal, D. (1995). 'Industry-specific human capital: Evidence from displaced workers', *Journal of Labor Economics*, vol. 13(4), pp. 653–77.
O'Rourke, K.H. (1997). 'The European grain invasion, 1870-1913', *The Journal of Economic History*, vol. 57(4), pp. 775–801.
O'Rourke, K.H. (2019). 'Economic history and contemporary challenges to globalization', *The Journal of Economic History*, vol. 79(2), pp. 356–82.
O'Rourke, K.H. and Williamson, J.G. (1999). *Globalization and History: The Evolution of a Nineteenth-Century Atlantic Economy*, Cambridge, MA: MIT Press.
Pascali, L. (2017). 'The wind of change: Maritime technology, trade, and economic development', *American Economic Review*, vol. 107(9), pp. 2821–54.
Rogowski, R. (1987). 'Political cleavages and changing exposure to trade', *American Political Science Review*, vol. 81(4), pp. 1121–37.
Scheve, K. and Serlin, T. (2023). 'The German trade shock and the rise of the neo-welfare state in early twentieth-century Britain', *American Political Science Review*, vol. 117(2), pp. 557–74.
Sokoloff, K.L. and Engerman, S.L. (2000). 'Institutions, factor endowments, and paths of development in the new world', *Journal of Economic Perspectives*, vol. 14(3), pp. 217–32.

Sperber, J. (1997). *The Kaiser's Voters: Electors and Elections in Imperial Germany*, Cambridge: Cambridge University Press.
Suesse, M. and Wolf, N. (2020). 'Rural transformation, inequality, and the origins of microfinance', *Journal of Development Economics*, vol. 143, 102429.
Sullivan, P. (2010). 'Empirical evidence on occupation and industry specific human capital', *Labour Economics*, vol. 17(3), pp. 567–80.
Tena-Junguito, A., Lampe, M. and Fernandes, F.T. (2012). 'How much trade liberalization was there in the world before and after Cobden-Chevalier?', *The Journal of Economic History*, vol. 72(3), pp. 708–40.
Torp, C. (2005). *Die Herausforderung der Globalisierung. Wirtschaft und Politik in Deutschland 1860–1914*, Göttingen: Vandenhoeck & Ruprecht.
Torp, C. (2010). 'The 'coalition of "rye and Iron" under the pressure of globalization: A reinterpretation of Germany's political economy before 1914', *Central European History*, vol. 43(3), pp. 401–27.
Traiberman, S. (2019). 'Occupations and import competition: Evidence from Denmark', *American Economic Review*, vol. 109(12), pp. 4260–301.
Wehler, H.U. (2006). *Deutsche Gesellschaftsgeschichte. Dritter Band 1849-1914*, München: C.H. Beck.

The Economic Journal, 1–30 https://doi.org/10.1093/ej/uead068 © The Author(s) 2023. Published by Oxford University Press on behalf of Royal Economic Society. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.
Advance Access Publication Date: 1 September 2023