

Cabral, Sónia; Martins, Pedro S.; Pereira dos Santos, João; Tavares, Mariana

Working Paper

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GLO Discussion Paper, No. 645

Provided in Cooperation with:
Global Labor Organization (GLO)

Suggested Citation: Cabral, Sónia; Martins, Pedro S.; Pereira dos Santos, João; Tavares, Mariana (2020) : Collateral Damage? Labour Market Effects of Competing with China – at Home and Abroad, GLO Discussion Paper, No. 645, Global Labor Organization (GLO), Essen

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Collateral Damage? Labour Market Effects of Competing with China – at Home and Abroad*

Sónia Cabral^{†1}, Pedro S. Martins^{‡2,3,4}, João Pereira dos Santos^{§3}, and Mariana Tavares^{¶5}

¹Banco de Portugal

²Queen Mary University of London

³Nova School of Business and Economics

⁴Institute for the Study of Labor

⁵Maastricht University

August 2020

Abstract

The increasing range and quality of China's exports is a major development internationally with potentially far-reaching effects. In this paper, on top of the direct labour market effects of imports from China studied in previous research, we also measure the indirect effects stemming from increased export competition in third markets. Our findings, based on matched employer-employee data of Portugal covering the 1991-2008 period, indicate that workers' earnings and employment are significantly negatively affected by China's competition, but only through the indirect 'market-stealing' channel. In contrast to earlier evidence, the direct effects of Chinese imports are mostly non-significant. The results are robust to a number of checks and also highlight particular groups more affected by indirect competition, including women, older and less educated workers, and workers in larger, older and domestic firms.

Keywords: International trade; Labour market; Matched employer-employee data; China; Import competition

JEL Codes: F14, F16, F66, J31

*The authors thank the comments of João Amador, David Autor, Dan A. Black, Andrea Ciani, Robert Gold, Karsten Mau, Pedro Portugal, Jens Suedekum, José Tavares, Erwin Winkler, and seminar participants at the 9th EGIT Research Meeting (Düsseldorf), the University of Essex, Queen Mary University of London, the 12th PEJ Meeting, the ZEW Summer School on Topics and Methods in Labor Market Research, and the 22nd IZA Summer School in Labor Economics. Pedro S. Martins and João Pereira dos Santos thank financial support from the European Union (VS/2016/0340) and Fundação para a Ciência e Tecnologia (PD/BD/128121/2016), respectively. This paper was written while João Pereira dos Santos was visiting Banco de Portugal, whose hospitality is gratefully recognised. The opinions expressed in the paper are those of the authors and do not necessarily coincide with those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

[†]Banco de Portugal, Economics and Research Department, R. Francisco Ribeiro 2, 1150-165 Lisboa - Portugal. E-mail: scabral@bportugal.pt

[‡]Queen Mary University of London, Mile End Road, London, E1 4NS, United Kingdom. E-mail: p.martins@qmul.ac.uk

[§]Nova School of Business and Economics, Universidade Nova de Lisboa, Campus de Campolide, 1099-032 Lisboa - Portugal. E-mail: joao.santos@novasbe.pt

[¶]Maastricht University, Minderbroedersberg 4-6, 6211 LK Maastricht, Netherlands. E-mail: m.pimenteltavares@maastrichtuniversity.nl

1 Introduction

The impact of international trade on labour markets is a classical question (Stolper and Samuelson, 1941) that is currently subject to greater interest. Over recent decades, not only has international trade grown strongly but its pattern has also evolved significantly: global value chains emerged as a new paradigm for the international organisation of production while new, labour-intensive countries have become key players in the world market (Hanson, 2012).

In this context, a number of recent studies has examined the micro-level effects of rising imports on different groups of workers (e.g., Autor et al., 2014 and Dauth et al., 2019), generally focusing on the cases of large developed economies or countries with specialisation patterns different from those of emerging economies. This research has documented substantial adjustment costs in the domestic industries (and their workers) most exposed to imports from developing countries, in particular China. These distributional consequences have also led to qualifications regarding the, until recently, very positive views on the welfare gains from international trade.

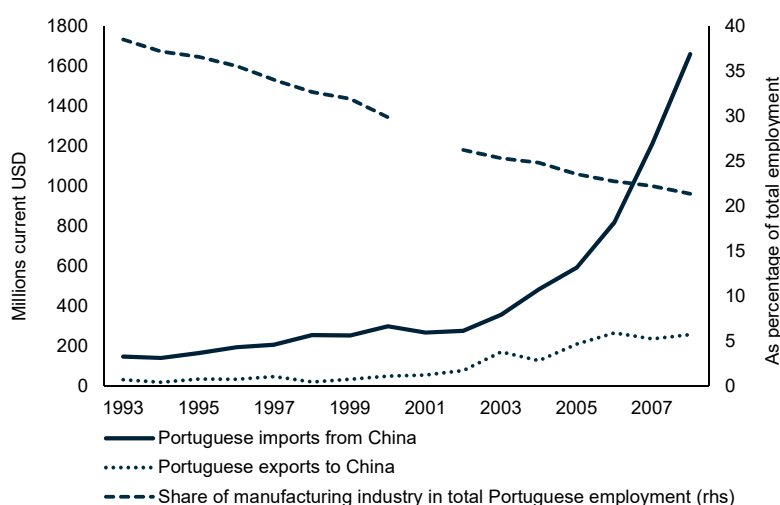
In this paper, we approach this topic from a novel perspective. In contrast to earlier research, we study the *indirect effects* stemming from the increased competition that one country can generate in the export markets of other economies, focusing explicitly on the effects of China's exports. In other words, China may affect the labour market of country A not only because of its exports to that country; such effect can also emerge by reducing the exports of country A to country B when China increases its exports to country B. In our study, we propose different measures of this indirect effect and analyse their labour market effects.

We note that this indirect, 'market-stealing' effect can become increasingly important for high-income countries, including the US or Germany, as China's exports become more diversified and sophisticated, and less reliant on low-wage labour. For less developed countries, the additional competitive pressures in international markets posed by developing economies in East Asia, in particular China, have already been in play for several years. In fact, the large export market share gains of China in low-tech, low-skill products, like textiles, clothing, footwear, electric appliances, and toys, were accompanied by losses in the export shares of those industries of several other countries.

Our empirical evidence on both the direct and indirect labour market effects of China's emergence in international trade is based on the case of Portugal. As a (small) open economy with a comparative advantage profile more comparable to that of China than most other developed economies (Cabral and Esteves, 2006), Portugal is an interesting country not only to revisit the direct relationships examined in the literature but also to illustrate the largely undocumented indirect effects that we study here.

Portuguese imports from China grew strongly over this period, reaching a level in 2008 that was more than eleven times higher than the one of 1993 (Figure 1). A different direct impact, also examined as a robustness exercise, are the enhanced export opportunities to China. Over this period, Portuguese exports to China grew strongly, but are still around six times smaller than Portuguese imports from China in 2008, suggesting that the impact of the export channel should be smaller. At the same time, the share of total employment in manufacturing in the country nearly halved over the period we consider (1993-2008) and economic growth during this period was low (except for 1996-2000).

Figure 1: Portuguese international trade with China and manufacturing employment in Portugal



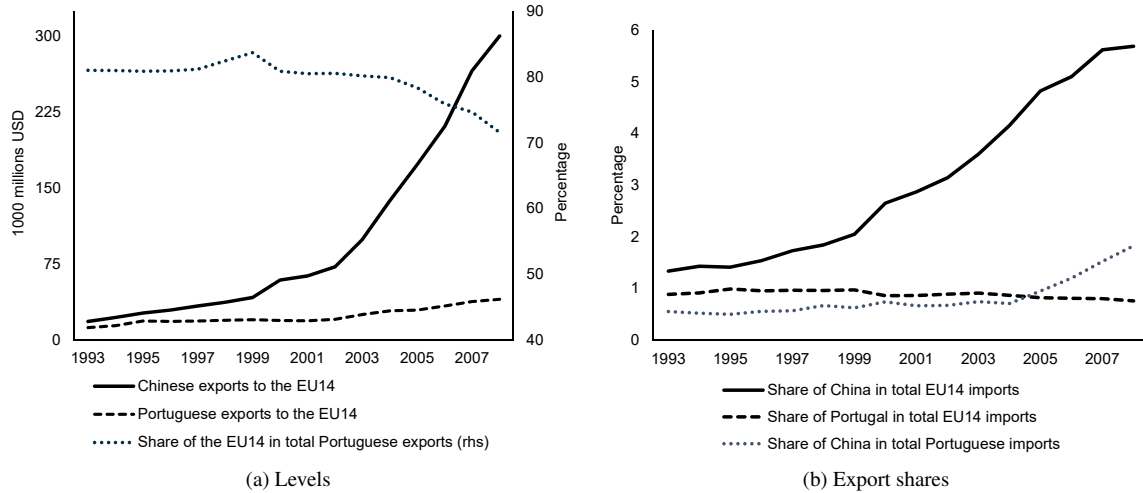
Sources: CEPII - CHELEM database and Quadros de Pessoal (QP)

Notes: Portuguese goods imports from (exports to) China in millions of current US dollars on the left scale and share of full-time employees working in the Portuguese manufacturing industry, as a percentage of total full-time private employment on the right scale. Worker-level data is not available for 2001 in QP database.

On top of the direct effects, stemming from much larger increases in exports from China to Portugal than the other way around, Figure 2 highlights the potentially intensified competition from China faced by Portuguese firms in terms of exports to the other 14 original Member States of the European Union (EU14). These markets represent a very large but declining share of total Portuguese exports: 81 percent in 1993 and 71 percent in 2008. **Given the openness of the economy, Portuguese exports to the EU14 amount, on average, to more than 15 percent of GDP in this period.** The total values of Chinese and Portuguese exports to the EU14 were not very different in the early 1990s but Chinese exports grew sharply afterwards while the growth of Portuguese exports was subdued. The export market share of China in the EU14 increased from 1.3 percent in 1993 to almost 6 percent in 2008 while the share of Portugal in total EU14 imports remained below 1 percent throughout the whole period. The rise of the export share of China in the EU14 market was also much stronger than the increase of China's share in Portuguese goods imports. Hence, such a strong increase in competition in a key destination market like the EU14 can have a big impact in the Por-

tuguese manufacturing sector, possibly larger than the effect of direct import competition, unlike other countries with different exporting profiles.

Figure 2: Bilateral trade between China, Portugal and the European Union



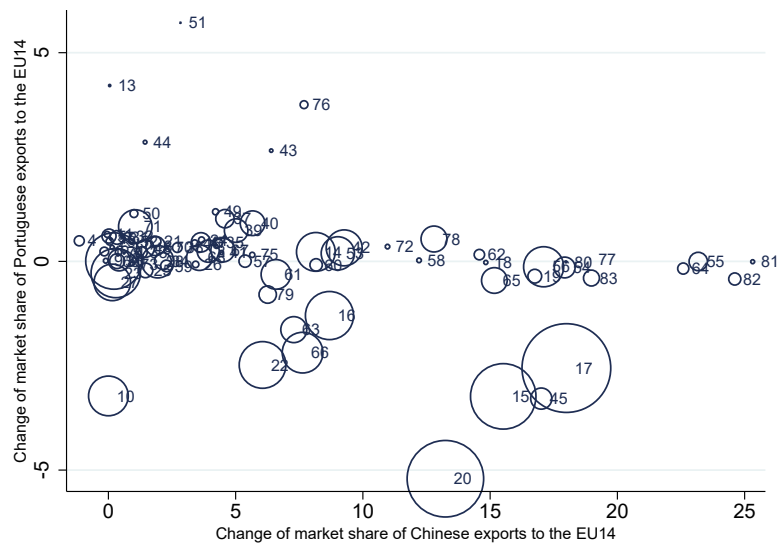
Source: CEPII - CHELEM database.

Notes: Chinese and Portuguese bilateral trade with the 15 original Member States of the European Union excluding Portugal (EU14). Data in 1,000 millions current US dollars. Shares in percentage.

Zooming in, Figure 3 depicts a form of the indirect effects that we consider in this paper, the changes in industry market shares of China and Portugal in the EU14 market between 1993 and 2008, indicating a negative relationship between the two variables: Larger increases in the EU14 market shares of China’s exports tend to be associated with larger losses in the market shares of Portuguese exports. This is particularly the case in industries that accounted for a substantial proportion of Portuguese exports in 1993. This pattern is also consistent with the evidence in Dauth et al. (2014) that rising Chinese exports lead to a strong diversion of German imports from other (mostly European) countries.

Our empirical analysis of the labour market impacts of the direct and indirect effects of China’s emergence is based on a matched panel covering all firms with at least one employee in Portugal over the period 1991 to 2008. Our main sample comprises individuals that were full-time employed both in 1991 and in 1993, who are then followed until 2008 so that we can examine their cumulative wage earnings and years of employment over the 1994-2008 period. We exploit the comprehensiveness and richness of the data to examine how these workers were affected by China’s exports not only to Portugal but also to other markets that Portuguese firms exported to. Our identification strategy is inspired by a number of influential articles by David Autor, David Dorn, Gordon Hanson, and several co-authors which combine nationwide changes in sector-specific import exposures with the national industry affiliation of workers (Autor et al., 2014; Autor et al., 2015; Acemoglu et al., 2016). As before, we exploit the fact that the significant rise of China from a closed to a market-oriented

Figure 3: Changes in export market shares of China and Portugal in the European Union (1993-2008)



Source: Authors' calculations based on the CEPII - CHELEM database.

Notes: EU14 refers to the 15 original Member States of the European Union excluding Portugal. Export market shares computed as Chinese (Portuguese) exports to the EU14 divided by total imports of the EU14, by industry. Changes in percentage points from 1993 to 2008. The size of each circle is proportional to the value of Portuguese exports of that industry to the EU14 in 1993. The description of the 83 manufacturing industries considered is included in Table 1 of the online Appendix.

economy and the world's largest exporter was sudden, largely unexpected, and motivated by exogenous factors such as changes in domestic policies and in trade agreements.¹ To account for possible endogeneity issues due to unobserved domestic conditions, rather than by rising Chinese productivity and market accessibility factors, these papers propose an instrumental variable (IV) approach, which we also follow.

Consistent with previous research, we find evidence of negative effects from China's emergence in international trade in the labour market of another developed economy, in this case Portugal. However, the negative labour market effects associated with China's emergence stem mainly from the resulting losses in Portugal's export market shares, not from the growth in Portuguese imports from China. Indeed, in striking contrast to evidence for other countries, the direct effects of China import competition on the domestic labour market of Portugal are mostly non-significant. This evidence is in line with the recent results of Branstetter et al. (2019), who also find significant employment declines in firms with more exposure to Chinese competition in European export markets, but minimal effects of direct competition in Portugal. Moreover, our estimated (indirect) impacts of competition from China exhibit some heterogeneity across individuals and firms, with older, less educated, female workers and individuals employed in larger, older and domestic firms suffering higher employment and earning losses.

¹See, for instance, Hsieh and Ossa (2016) and Brandt et al. (2017).

Overall, it is important to underline that this evidence does not amount to a full evaluation of the welfare consequences of international trade liberalisation, as it focused on the relative effects on workers of increased import competition (in both the domestic market and third-country export markets). On the other hand, our methodology and findings contribute to a better understanding of the full range of existing and potential labour market effects around the world following from the emergence and growth of China - and potentially also from other developing countries. Furthermore, these direct and indirect mechanisms may also be relevant in the context of the potential changes in the globalisation process driven by the Covid19 recession.

The remaining of the paper is organised as follows. Section 2 discusses some of the related research that frames this study. Section 3 details our data sources and identifying assumptions whereas Section 4 outlines our econometric framework. Section 5 presents our estimation results. Finally, Section 6 concludes.

2 Related Literature

A number of recent papers have analysed how domestic labour markets adjust to the changes in international trade associated with the integration of low- and middle-income countries into the global economy. In this section, we present a non-exhaustive review of studies that are related to our study and provide a framework for our analysis (see Autor et al. (2016) for an extensive review). This literature has focused on three main levels of analysis: the local labour market, the firm, and the worker.

In the first level of analysis, the seminal contribution of Autor et al. (2013) examines the effect of rising Chinese competition on US local labour markets, exploiting cross-market variation in exposure stemming from differences in industry specialisation. Instrumenting US imports with changes in Chinese imports by other high-income countries, they conclude that rising imports from China caused higher unemployment and reduced wages in US local labour markets that host import competing manufacturing industries. The same methodology is followed by Dauth et al. (2014) for Germany, Balsvik et al. (2015) for Norway, Donoso et al. (2015) for Spain, Costa et al. (2016) for Brazil, and Malgouyres (2017) for France.

Other papers study additional dimensions of firms' reactions in response to the same type of trade shocks. In a seminal paper, Bernard et al. (2006) show that plant survival and growth are lower in US manufacturing industries facing higher exposure to imports from low-wage countries. Evidence that greater Chinese import competition tends to increase plant exit and reduce firms' sales and/or employment growth is available for Chile (Álvarez and Claro, 2009), Mexico (Iacovone et al., 2013), Belgium (Mion and Zhu, 2013) and Denmark (Utar, 2014).

Empirical evidence at the worker-level, the level of analysis that we also follow in this paper, is scarcer. Autor et al. (2014) study the effects of increased Chinese trade exposure on earnings and employment of US workers from 1992 to 2007. Their findings suggest that workers employed in industries that were subsequently exposed to greater Chinese import competition experienced lower cumulative earnings. These workers also faced an elevated risk of receiving public disability benefits vis-à-vis other individuals working in less exposed manufacturing industries.

Dauth et al. (2019) examine the impact of rising international trade exposure on individual earning profiles of German manufacturing workers. They complement Autor et al. (2014) by focusing on both imports and export shocks, not only from China but also from Eastern European countries, and by studying the effects among heterogeneous employer-employee matches. Their results contrast significantly with those found for the US. For Germany, this particular globalisation episode was mainly positive, but there were winners and losers. High-skilled workers benefited the most from the increased export opportunities, while the incidence of import shocks fell mostly on low-skilled workers.

Ashournia et al. (2014) exploit data from Danish workers and find that Chinese import competition decreases wages for low-skilled employees. Using data for Finland, Hakkala and Huttunen (2016) show that production workers are the most adversely affected by Chinese import penetration in terms of job-loss risk and earnings losses. Recently, De Lyon and Pessoa (2020) conclude that import competition from China significantly decreases UK workers' years of employment and earnings, with initially better-paid workers suffering lower losses.

Most studies on the impact of China's emergence in international trade on the labour markets of developed countries are focused on what we refer to as the direct effects of China's imports. Some of these studies also compute a measure of the indirect effects, which they then add to the measure of the direct effects to show that their results are robust to this alternative metric (e.g., Autor et al. (2013) and Autor et al. (2014) for the US, Balsvik et al. (2015) for Norway). Hence, they do not allow the two variables to have separate and distinct effects nor examine the indirect effect by itself because their results are mostly driven by the direct effect.

As explained above, we argue that the impact of indirect effects stemming from greater export competition from China may be as important for some countries. In this regard, Flücker and Ludwig (2015) use product-country level data and show that increased Chinese competition in the export markets induces a contraction in the European countries' manufacturing sectors, with significant negative effects on output and employment. At the firm-level, Utar and Ruiz (2013), using data for Mexican exporters, show that intensified Chinese competition in the US had a negative effect on employment, especially on the most unskilled labour sectors. Using quarterly data at the regional level, Robertson et al. (2020) conclude

that US imports from China are associated with a reduction of employment in Mexico’s apparel and textile sectors and that the effects are stronger for the least educated.

Our paper is mostly related to the contemporaneous work of Branstetter et al. (2019), who also examine separately the impacts of direct and indirect Chinese competition in Portugal. As in our paper, Branstetter et al. (2019) find minimal effects of direct import competition and substantial negative effects of increased Chinese competition in Portugal’s main EU export markets. We think that the two papers are complementary and reinforce each other’s results. Both papers study a similar research question reaching similar conclusions but using a different - but complementary – identification strategy. Branstetter et al. (2019) examine firm-level outcomes using variation based on each firm’s mix of products and destination markets while our focuses on worker outcomes exploiting variation in competition across industries. Moreover, our approach allows us to examine which specific groups of workers were more affected by the increased international trade exposure to China.

Overall, our paper contributes to this literature by focusing on worker-level effects and on quantifying the magnitude of indirect effects of international competition in export markets, which can likely appear in other countries with similar production structures.

3 Data and Identification

3.1 Industry Trade Shocks

One of the main structural changes of the world economy in recent decades has been the integration of China in international trade. Since the early 1990s and, in particular, after its accession to the World Trade Organisation (WTO) in 2001, Chinese trade flows have exhibited strong growth, gaining market shares and creating significant competitive challenges to most developed countries.

This section describes the measures of workers’ exposure to trade with China between 1993 to 2008. First, we consider a standard measure of direct import competition from China in the Portuguese domestic market. Second, we assess the indirect effect of competition from China in foreign markets to which Portuguese producers export. Third, we describe the instrumental variable approach used. [The description of the data sources used is included in Section 1 of the online Appendix.](#)

Following Autor et al. (2014), the direct import exposure to China of a specific Portuguese industry j over the τ period 1993-2008 can be measured as the change of its import penetration ratio:

$$\Delta IPdir_{j,\tau} = \frac{\Delta M_{j,\tau}^{chn \rightarrow prt}}{WB_{j,93}}, \quad (1)$$

where $M_j^{chn \rightarrow prt}$ represents Portuguese imports from China for a specific industry j and $\Delta M_{j,\tau}^{chn \rightarrow prt}$ is the change of the latter over the period τ , 1993-2008. $WB_{j,93}$ is the total wage bill of industry j in 1993, which is used as a proxy of the initial industry size. Due to data restrictions, it is not possible to use the initial domestic absorption to normalise each industry's imports, as in Autor et al. (2014). We thus follow Dauth et al. (2019) and use the total wage bill instead.

As we discussed before, the level of bilateral trade between two countries does not necessarily reflect the degree to which the two countries compete in international markets. In fact, the strong growth of Chinese exports can impact the Portuguese manufacturing sector not only through intensifying competition in the domestic market, but also in foreign markets where Portuguese firms compete with Chinese firms. In the case of Portugal, as in many other countries, we expect this effect to be particularly relevant given that the product specialisation of the Portuguese exports is relatively similar to China's in this period (Cabral and Esteves, 2006), with a relatively large role of labour-intensive products when compared to other developed economies. The EU14 as a whole constitutes the most important destination of Portuguese exports, representing on average around 80 percent of total in 1993-2008, and Chinese exports to the EU14 grew strongly over this period. Hence, we select the other 14 original member-states of the European Union as the third markets where the competition from Chinese products will be assessed.

The main measure of indirect import competition from China in each industry j from 1993 to 2008 that we propose in this paper is:

$$\Delta IPind_{j,\tau} = \frac{\sum_{C=1}^{14} \omega_{j,93}^{prtC} \Delta M_{j,\tau}^{chn \rightarrow C}}{WB_{j,93}}, \quad \text{with} \quad \omega_{j,93}^{prtC} = \frac{M_{j,93}^{prt \rightarrow C}}{M_{j,93}^{\rightarrow C}} \quad (2)$$

where $\omega_{j,93}^{prtC}$ is the share of Portugal on total imports of each EU14 country C in each industry j in 1993, $M_{j,93}^{prt \rightarrow C}$ are imports from Portugal by country C and industry j ($= X_{j,93}^{prt \rightarrow C}$, i.e., industry j Portuguese exports to country C) and $M_{j,93}^{\rightarrow C}$ are the total imports of country C of industry j . This weight is then multiplied by the change in the absolute value of imports of country C from China from 1993 to 2008 by industry j , $\Delta M_{j,\tau}^{chn \rightarrow C}$. The measure is normalised by the wage bill of industry j in Portugal in 1993, similarly to Equation (1), to account for the different relative sizes of the industries in Portugal.

Equation (2) is a measure of competition of Chinese products in the EU14 market, computed as a weighted average of the change in Chinese exports to each EU14 country by industry, where the weights are the initial shares of Portuguese exports in the imports of each individual destination market. The notion of individual market used herein refers to each j,C market, measured as imports of industry j by EU14 destination country C corresponding to a total of 1,162 individual markets (83 industries * 14 countries). Intuitively, this means that,

in each industry and destination country, Portuguese exports will be affected by the increased competition from China in a way that is proportional to its initial export share in that individual industry-country market. For instance, a Portuguese industry with a large market share in Spain in 1993 can be expected to be more exposed to competition from China if Spain subsequently increases the level of its imports from China of these products compared to a Portuguese industry that only has a minor export market share in Spain.

The direct and indirect measures above, when taken together, reflect the competition from China faced by Portuguese firms both in the domestic market, Equation (1), and in its main destination markets, Equation (2). As discussed in the literature, a problem with Equation (1) as a metric of trade exposure is that the observed changes in Portuguese bilateral trade flows with China can reflect also Portuguese supply and demand shocks rather than just China's growing productivity and falling trade costs. To capture the China-driven effect on Portuguese trade with China, we follow the literature and instrument this direct import competition variable using Chinese exports to other countries with comparable income levels. Our instrument group consists of 7 non-EU high and upper middle-income countries: Argentina, Chile, Uruguay, Mexico, Turkey, Israel and New Zealand.² We expect correlations in industry-level demand and supply shocks between Portugal and these countries, and potential exogenous effects of shocks in these countries on the Portuguese labour market, to be minor. The instrument is defined as follows:

$$\Delta IPO_{j,\tau} = \frac{\Delta M_{j,\tau}^{chn \rightarrow O}}{WB_{j,91}}, \quad (3)$$

where $M_j^{chn \rightarrow O}$ are imports of the 7 selected countries from China in industry j . The measure is normalised by the wage bill of the respective industry j in Portugal in 1991.

Given the relatively small size of the Portuguese economy, the measure of exposure to competition from China in export markets defined in Equation (2) is arguably determined independently of Portuguese trade and labour market dynamics (see Balsvik et al. (2015) for a similar argument for Norway). That is, the increase in imports of the EU14 from China is not determined by the growth of Portuguese exports to these markets. However, we cannot exclude the possibility that product demand shocks in the EU14 are driving the rise of imports from China. In a robustness check, we construct a measure of import competition from China in the EU14 market based in the gravity model of trade. This metric neutralises import demand shocks in EU14 countries and captures the differential rise of attractiveness of China relative to Portugal that is due to changes in China's sectoral productivity and trade costs. The fact that the results are consistent suggests that correlated demand shocks in destination countries are not overly important to our baseline estimates. Moreover, we cannot

²The countries were selected based on their income similarity to Portugal using data on GDP per capita on purchasing power parities (PPP) in constant 2011 international dollars over the 1993-2008 period from the World Development Indicators of the World Bank, excluding all members of the EU.

rule out that the growth in imports from China is due to EU14, not Chinese, productivity shocks. However, there is now ample evidence in the literature that the Chinese gains of export share in world market are mostly supply-driven, reflecting the increase in China's competitiveness and access to foreign markets after the accession to the WTO (e.g., Autor et al., 2016). The same internal forces driving China's export growth also reduce the probability that our estimates of the indirect effect of Chinese import competition are biased due to common supply-shocks in the EU14. Hence, we argue that the growth in imports from China of a given industry by each EU14 country is exogenous to the domestic conditions in that industry in Portugal and do not instrument the measure of indirect competition of Equation (2).

3.2 Worker-level Outcomes

The labour market database is *Quadros de Pessoal* (QP), an administrative dataset covering virtually all employees and private firms based in Portugal, including their unique and time-invariant identifiers, the firm-worker match, and large number of firm and worker characteristics.

Our main sample includes individuals full-time employed both in 1991 and in 1993, who are followed until 2008. We use two main worker-level outcomes: real wage earnings and years of full-time employment, both computed over the 1994-2008 period. We follow Autor et al. (2014) and define the wage outcome variable as the cumulative real earnings of a worker from 1994 to 2008, divided by the average earnings of 1991 and 1993 (base wage). As to the second main outcome variable, on employment over the period, we use the number of times that an individual is present in the data set, which implies that the individual has a private sector labour contract in that year.

3.3 Descriptive Statistics

Table 1 provides descriptive statistics for our main variables. The key dependent variable, relative cumulative earnings, was multiplied by 100 and presents an average value of 1,040. This means that, on average, cumulative real earnings from 1994 to 2008 (a 14-year period, as data for 2001 is not available) were more than 10 times higher than the average earnings experienced in 1991 and 1993. Manufacturing workers cumulatively earned, on average, 9.5 times their initial average monthly earnings, while non-manufacturing workers, who were not directly exposed to the shocks (defined in terms of imports and exports of goods), cumulatively earned 11.1 times their initial average monthly earnings.

Our second dependent variable is defined as cumulative years of full-time employment in the private sector over the same 14-year period. We find that, on average, a worker has almost

Table 1: Descriptive Statistics

Variable	Mean	Std. Dev.	P25	P75
All workers				
Base Wage (average 1991 and 1993)	844.233	577.713	490.380	994.886
Dependent variables (1994-2008)				
Cumulative Earnings	1040.914	710.148	513.844	1485.4
Cumulative Employment	7.982	4.295	5	12
China Shock variables (1993-2008)				
$\Delta IPdir_j$	0.901	5.346	0	0.695
$\Delta IPind_j$	3.303	7.577	0	2.448
ΔIPO_j	0.044	0.483	0	0.031
Manufacturing workers				
Base Wage (average 1991 and 1993)	718.913	474.587	452.232	799.618
Dependent variables (1994-2008)				
Cumulative Earnings	953.145	624.877	503.127	1343.705
Cumulative Employment	7.681	4.058	5	11
China Shock variables (1993-2008)				
$\Delta IPdir_j$	1.914	7.668	0.358	1.367
$\Delta IPind_j$	7.020	9.794	0.444	15.598
ΔIPO_j	0.094	0.701	0.017	0.069

Notes: The main sample includes 602,073 workers employed in 1991 and 1993 in both the manufacturing and non-manufacturing sectors. The sample of workers employed only in manufacturing in 1991 and 1993 includes 283,272 workers. By definition, non-manufacturing workers have zero trade exposure with China. Base wages in 2008 euros. Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993 (base wage); Cumulative years of full-time employment in the private sector. The variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1), the variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2). The variable ΔIPO_j is the instrument of the variable $\Delta IPdir_j$, which is defined in Equation (3) and uses imports from China of seven selected countries. Given the large scale of the flows, the instrument variable is divided by 1000.

8 years with positive earnings, which represents around 57 percent of the outcome period. Considering the 25th and 75th percentiles, this variable ranges between 5 and 12 years of employment (main sample) and 5 and 11 years (manufacturing only).

Among workers initially employed in a manufacturing industry, the average increase in the direct import penetration ratio was 1.9 percentage points. However, the average increase in China's indirect import competition is almost four times bigger (7.0 percentage points).³ The 25th/75th percentile dispersions are also higher in the case of the indirect import competition indicator (over 15 percentage points) than in the case of the direct import penetration (1 percentage point). That is, from 1994 to 2008, a manufacturing worker at the 75th percentile experienced a 35 times stronger increase in indirect import competition than a worker at the 25th percentile (almost 4 times stronger for the direct import penetration measure). The instrument displays values that are similar to the ones of the indicator of direct import penetration.

Given that our analysis is based on industry-specific trade shocks, it is also relevant to see which manufacturing industries are more exposed to Chinese imports, both in the domestic market and in the main foreign markets where Portuguese firms compete with China. Table 2

³The linear correlation between the measures of direct and indirect Chinese import competition defined in Equations (1) and (2) respectively, measured by the Pearson correlation coefficient, is 31.63 per cent. The correlation coefficient between the instrument of the direct import competition of Equation (3) and the measure of indirect competition of Equation (2) is similar (32.76 per cent).

depicts the 10 Portuguese manufacturing industries with the highest values of the measures of trade exposure. These sectors comprise industries typically referred to in the literature examining the evolution of China's export structure in the last decades, and are consistent with China's pattern of comparative advantage and with its growing export shares in electronics and machinery (Amiti and Freund, 2010). In fact, four of the industries that are common in both measures of Chinese import competition belong to electrical machinery, telecom, and office machines, namely computers, office machinery and equipment; other electrical equipment; communication equipment and consumer electronics; and domestic appliances. The other sector that is common in both measures is sports goods. Other Portuguese industries that recorded high rises in imports from China include some intermediate goods as man-made fibres; electronic components and boards; and basic iron and steel. On the contrary, the other industries where the increased competition from China in third-country export markets was mostly felt are consumer goods, like games and toys; musical instruments; knitted and crocheted fabrics and apparel; and footwear. The last two industries, in particular, are very important in Portugal's export bundle.

Table 2: China Shock variables (1993-2008) - Most exposed manufacturing industries

Direct import exposure to China, 1993-2008 - Top 10 industries		
Industry	Description	$\Delta IPdir_j$
55	Manufacture of computers and office machinery and equipment	446.1
76	Manufacture of bicycles and invalid carriages	76.2
66	Manufacture of other electrical equipment	61.0
81	Manufacture of sports goods	48.1
56	Manufacture of communication equipment and consumer electronics	27.7
58	Manufacture of watches and clocks	25.5
65	Manufacture of domestic appliances	21.4
35	Manufacture of man-made fibres	19.0
54	Manufacture of electronic components and boards	16.8
47	Manufacture of basic iron and steel	12.9
Indirect import exposure to China, 1993-2008 - Top 10 industries		
Industry	Description	$\Delta IPind_j$
66	Manufacture of other electrical equipment	186.6
55	Manufacture of computers and office machinery and equipment	122.4
82	Manufacture of games and toys	91.5
56	Manufacture of communication equipment and consumer electronics	41.8
65	Manufacture of domestic appliances	33.0
81	Manufacture of sports goods	29.6
80	Manufacture of musical instruments	23.9
15	Manufacture of knitted and crocheted fabrics and apparel	22.9
63	Manufacture of wiring and wiring devices	19.6
20	Manufacture of footwear	15.7

Notes: The description of the 83 trade-exposed manufacturing industries is included in Table 1 of the online Appendix. The variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1) and the variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2).

4 Econometric strategy

Our empirical analysis takes a medium-run perspective regarding the international trade impact of China on workers' cumulative wages and employment. The equation of the direct effects of import competition is specified as follows:

$$Y_{i,\tau} = \beta_0 + \beta_1 \Delta IPdir_{j,\tau} + \beta_3 X_{i,93} + \beta_4 X_{f,93} + \beta_5 X_{j,93} + \varepsilon_{i,\tau}, \quad (4)$$

where $Y_{i,\tau}$ is the dependent variable of interest for worker i employed in firm f in industry j in 1993, namely the cumulative earnings over 1994 to 2008 normalised by the average earnings in 1991 and 1993; or the number of years when that individual was employed in the private sector over the same 1994-2008 period. The coefficient of interest is β_1 , which measures the impact of the change in direct import exposure to China from 1993 to 2008, with $\Delta IPdir_{j,\tau}$ defined in Equation (1), based on the industry j in which the worker was employed in 1993.

The econometric estimations of the next section will also assess the impact of changes in indirect competition from China in export markets. The extended version of the previous equation considering the roles of the direct and indirect variables together is specified as follows:

$$Y_{i,\tau} = \beta_0 + \beta_1 \Delta IPdir_{j,\tau} + \beta_2 \Delta IPind_{j,\tau} + \beta_3 X_{i,93} + \beta_4 X_{f,93} + \beta_5 X_{j,93} + \varepsilon_{i,\tau}. \quad (5)$$

where the indirect dimension $\Delta IPind_j$ is defined in Equation (2). As in Autor et al. (2014), all regressions include individuals working in the 83 manufacturing industries that were trade-exposed to China, as well as workers employed in non-manufacturing sectors, which, by definition, have zero (goods) trade exposure. In the robustness section, we also estimate the regressions using only the smaller sample of workers initially employed in the manufacturing industry.

A number of workers' characteristics that potentially affect wages (and may be correlated with different import exposures) are included in the vector $X_{i,93}$, depending on the specification, namely a female dummy variable, eight formal schooling categories, and eight formal categories of worker's qualifications. We also included quadratic polynomials in age and in tenure to account for the fact that wages tend to increase at a decreasing rate with years in the labour market and with years of experience in the same firm.

$X_{f,93}$ is a vector of firm-level controls in 1993 that includes two variables capturing the size of the firm - the number of employees and the logarithm of turnover (annual sales) -, the share of equity owned by the government, and twenty eight regional dummies (NUTS 3 level). In addition, the share of foreign equity (a measure of foreign ownership) is also included, in

line with evidence of differentiated wage and hiring policies of foreign-owned firms (Hijzen et al., 2013).

Despite the large set of controls already included, we may still miss some potentially relevant controls at the sector level, such as technology-related variables. In fact, trade and technology are two of the major forces shaping labour markets in developed countries, so controlling for potentially confounding effects of technological change is important. Unfortunately, there is no available data for Portugal at the industry level in 1993 that could account for differential rates of technological progress across industries, like for instance the share of R&D expenditures or the level of computer investments. However, some studies, like Autor et al. (2015) or Acemoglu et al. (2016), control for technical change when estimating the effects of trade shocks and still obtain significant negative results of import competition. To minimise this potential issue and absorb additional heterogeneity across individuals, we include dummy variables for 9 broad aggregate sectors computed based on the 83 trade-exposed manufacturing industry (the omitted category is the non-manufacturing sector).⁴ This means that the regressions estimate the impact of the trade shock from differences across sub-industries of each given broad sector. Moreover, we add a measure of overall import penetration of the industry in 1993, to control for other shocks associated with a greater level of imports of an industry that can be confounded with trade with China.⁵

Furthermore, robust standard errors are clustered at the start-of-the-period industry level. More precisely, within the manufacturing industry standard errors are clustered at the level of the 83 industries of the trade shock. For non-manufacturing sectors, the standard errors are clustered at the 3-digit level of ISIC rev.4. Overall, standard errors are adjusted for 235 clusters.

As discussed in the previous section, the regressions estimated by two-stage least squares (IV) use the variable described in Equation (3) as instrument of the direct effects of import competition. The main descriptive statistics of the control variables used in the analysis is included in Section 3 of the online Appendix.

5 Empirical results

In the regression tables of this section, OLS results are contrasted with IV regressions. Panel A presents the estimates in which the dependent variable is cumulative earnings, while Panel B reports results for the number of years of employment as the dependent variable. To rule

⁴The 9 aggregates are food, drinks and tobacco; textiles, clothing and footwear; wood and paper; chemicals; plastics, glass and rubber; metals; machinery, equipment and electronics; transport equipment; others. The description of the manufacturing industries in each aggregate is included in Table 1 of the online Appendix.

⁵In a robustness test, we also decomposed the measure of overall import penetration in 1993 in two variables: import penetration from China and import penetration from the rest of the world. All results are basically unchanged and are available from the authors upon request.

out other possible confounding mechanisms, vectors of controls are added at the individual, firm, and sectoral levels, as described in the previous section.

5.1 Baseline Results

In this section, we present the baseline results for the full sample. The results considering only the direct impact are presented in Table 3, in which the key regressor of interest is $\Delta IPdir_j$ as in Equation (1), instrumented with imports from China of seven other countries as in Equation (3). As can be seen, the instruments appear to be strongly partially correlated. Regardless of the specification and estimation method, we always find a non-statistically significant association between the Chinese direct import penetration measure and both cumulative earnings (Panel A) and cumulative years of employment (Panel B).⁶ These results indicate that, in contrast to the countries considered so far in the literature, imports from China did not have a significant negative effect upon the Portuguese labour market outcomes up to 2008.

Table 3: Baseline Results: Direct Effects

	OLS		IV			
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Cumulative Earnings						
$\Delta IPdir_j$	-1.469 (1.440)	-0.116 (0.608)	-0.386 (0.959)	-0.363 (0.537)	-0.205 (0.388)	0.251 (0.662)
Panel B. Cumulative Employment						
$\Delta IPdir_j$	-0.676 (0.637)	-0.250 (0.543)	-0.299 (0.426)	-0.196 (0.274)	-0.251 (0.286)	-0.019 (0.544)
First stage ΔIPO_j			9.093*** (0.635)	9.086*** (0.630)	9.026*** (0.585)	8.366*** (0.693)
First stage F test			204.884	208.108	237.734	145.841
Individual controls	No	Yes	No	Yes	Yes	Yes
Firm controls	No	Yes	No	No	Yes	Yes
Sector controls	No	Yes	No	No	No	Yes

Notes: N = 602,073. Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. The variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1). The variable ΔIPO_j is the instrument of the variable $\Delta IPdir_j$, which is defined in Equation (3) and uses imports of seven selected countries from China. Given the large scale of the flows, the instrument variable is divided by 1000. All regressions include a constant. All controls are considered at the start-of-period level (1993). Workers' controls include a female dummy variable, eight formal education categories, eight formal categories of worker's qualifications, age and age squared, and tenure and tenure squared. The vector of firm-level controls includes the number of employees, the natural logarithm of turnover, the share of public equity, the share of foreign equity, and twenty eight regional location dummies at the NUTS3 level. The vector of sector-level controls include a set of dummy variables for 9 broad aggregate categories computed based on the 83 trade-exposed manufacturing industry and a measure of overall import penetration of the industry. Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

As we discussed above, the emergence of China in the global arena can affect firms in developed countries not only through the direct impact of increased Chinese imports in the domestic market but also through increased export competition in third markets. Table 4 presents the results of estimating by OLS the impact of Chinese indirect competition in EU14 markets, as defined in Equation (2), without controlling for direct import penetration.

⁶In all specifications, standard errors are clustered at the start-of-period sector-level. All controls have the expected signs. Results reporting the complete set of estimates are available from the authors upon request.

In contrast to the baseline results of the direct impact, the effects on earnings and employment of the increased competition from China in the main Portuguese export markets are all negative and statistically significant. Using the point of estimates in Column (4) of Panel A and the descriptive statistics of Table 1, we can compare the relative reduction in cumulative wage earnings of an individual initially employed in an industry at the 75th percentile of the Chinese indirect trade competition (15.598 percentage points) with a worker employed in an initial industry at the 25th percentile of the same distribution (0.444 percentage points). The implied relative reduction in cumulative wage earning is 22.0% ($1.453 * (15.598 - 0.444)$). Performing the same calculation for Panel B, the differential impact on years of employment for a worker in the 75th percentile relative to a worker in the 25th percentile of the distribution of the indirect measure of trade exposure is -15.9% ($1.050 * (15.598 - 0.444)$), almost 2 months during the period. We interpret these results as evidence that China's expanding role in global trade represented a major negative shock for the labour market of Portugal, in line with evidence for other countries. However, a major difference relative to earlier research on other countries is that, in the case of Portugal, we find that the impact is driven by the indirect effects.

Table 4: Baseline Results: Indirect Effects

	OLS			
	(1)	(2)	(3)	(4)
Panel A. Cumulative Earnings				
$\Delta IPind_j$	-7.576*** (2.790)	-4.690*** (1.665)	-4.641*** (1.559)	-1.453*** (0.664)
Panel B. Cumulative Employment				
$\Delta IPind_j$	-3.148*** (1.177)	-1.965*** (0.739)	-2.414*** (0.806)	-1.050*** (0.398)
Individual controls	No	Yes	Yes	Yes
Firm controls	No	No	Yes	Yes
Sector controls	No	No	No	Yes

Notes: N= 602,073. Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. The variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2). All regressions include a constant. All controls are considered at the start-of-period level (1993). Workers' controls include a female dummy variable, eight formal education categories, eight formal categories of worker's qualifications, age and age squared, and tenure and tenure squared. The vector of firm-level controls includes the number of employees, the natural logarithm of turnover, the share of public equity, the share of foreign equity, and twenty eight regional location dummies at the NUTS3 level. The vector of sector-level controls include a set of dummy variables for 9 broad aggregate categories computed based on the 83 trade-exposed manufacturing industry and a measure of overall import penetration of the industry. Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***).

Table 5 presents the estimation results of our preferred regression (Equation (5)) that adds the direct and indirect effects of Chinese competition. Looking first at the direct impact, in a context in which we also control for the indirect effect, we find that the coefficient remains non significant both in Panel A and Panel B in the OLS specifications. However, when moving to the IV analysis, the coefficients are positive in the first three specifications, even if again not significant in the most detailed specification that includes the sector-level controls. This suggests that the positive coefficients obtained in the first IV specifications reflect other sectoral upward trends that are confounded with the trade shock and have a positive impact

in workers' wage and employment outcomes. When we control for confounding sectoral shocks through the inclusion of nine broad industry dummies and, hence, examine the impact of trade exposure within the same broad industry rather than comparing workers across very different fields of economic activity, the estimated parameters for the direct effect in Column (6), for both cumulative earnings and years of employment, become statistically non-significant.

When turning to our measure of indirect import penetration defined in Equation (2), we find again evidence of strongly negative effects in all six specifications. In Panel A, the coefficients range from -8.3 in Column (1) to -1.5 in (2) for the OLS regressions and from -8.8 in Column (3) and -1.65 in (6) for the IV regressions and are always statistically significant, at least at the 5% level. These results indicate that the indirect dimension related to increased competition from China in third-country export markets has a sizeable negative effect on the wages and employment of workers in affected industries.

Table 5: Baseline Results: Direct and Indirect Effects

	OLS		IV			
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Cumulative Earnings						
$\Delta IPdir_j$	2.733 (1.777)	0.413 (0.624)	4.656** (2.157)	2.730* (1.449)	2.696** (1.343)	1.012 (0.903)
$\Delta IPind_j$	-8.268*** (2.767)	-1.534** (0.686)	-8.754*** (2.772)	-5.462*** (1.683)	-5.419*** (1.646)	-1.652** (0.729)
Panel B. Cumulative Employment						
$\Delta IPdir_j$	1.060 (0.731)	0.120 (0.496)	1.772** (0.903)	1.091* (0.609)	1.231** (0.609)	0.511 (0.595)
$\Delta IPind_j$	-3.417*** (1.179)	-1.073*** (0.411)	-3.597*** (1.197)	-2.273*** (0.763)	-2.769*** (0.865)	-1.150** (0.447)
First stage ΔIPO_j			8.743*** (0.355)	8.702*** (0.321)	8.681*** (0.302)	8.094*** (0.614)
First stage F test			608.161	736.980	828.587	173.853
Individual controls	No	Yes	No	Yes	Yes	Yes
Firm controls	No	Yes	No	No	Yes	Yes
Sector controls	No	Yes	No	No	No	Yes

Notes: N = 602,073. Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. The variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1) and the variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2). The variable ΔIPO_j is the instrument of the variable $\Delta IPdir_j$, which is defined in Equation (3) and uses imports of seven selected countries from China. Given the large scale of the flows, the instrument variable is divided by 1000. All regressions include a constant. All controls are considered at the start-of-period level (1993). Workers' controls include a female dummy variable, eight formal education categories, eight formal categories of worker's qualifications, age and age squared, and tenure and tenure squared. The vector of firm-level controls includes the number of employees, the natural logarithm of turnover, the share of public equity, the share of foreign equity, and twenty eight regional location dummies at the NUTS3 level. The vector of sector-level controls include a set of dummy variables for 9 broad aggregate categories computed based on the 83 trade-exposed manufacturing industry and a measure of overall import penetration of the industry. Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

Finally, we add up the direct and indirect effects to measure the overall economic impact of China's import penetration. More specifically, we compare a 1993 manufacturing worker at the 3rd quartile of each import penetration distribution (1.367 percentage points for the direct impact and 15.598 for the indirect impact) and a similar manufacturing worker at the 1st quartile of import exposure (0.358 for the direct impact and 0.444 for the indirect) as depicted in Table 1. The resulting relative reduction in earnings in the outcome period us-

ing the estimates of the more comprehensive specification of Column (6) of Table 5 is 24.0% ($1.012 * (1.367 - 0.358) - 1.652 * (15.598 - 0.444)$). Given the non-statistical significance of the direct effect, considering only the indirect effect and comparing again all-similar manufacturing workers located in the 25th and 75th percentiles of the distribution of the indirect import exposure, the implied differential reduction in cumulative wages is 25.0% of the base wage. In other words, the overall negative effect is virtually exclusively driven by the indirect effect.

For cumulative employment years, considered in Panel B, the results are similar, with increased competition from China in export markets decreasing the number of years spent on employment between 1994 and 2008. The reduction in years of employment for a manufacturing worker initially employed in an industry at the 75th percentile of Chinese indirect import exposure relative to a worker at the 25th percentile is 17.4% of a year ($-1.150 * (15.598 - 0.444)$), or around 2 months during the period.

The lack of evidence of negative direct effects and the existence of significant negative effect may be driven by the magnitude of the shock itself, with greater penetration of Chinese imports in the EU14 markets than in Portugal. In addition, some of the consumer goods that registered a stronger increase of EU14 imports from China represented an important share of Portuguese exports, like clothing and footwear for instance. Another possible reason for the non-existence of negative direct effects in Portugal may reside on product quality upgrading by firms in sectors that experience a rise in their domestic trade competition from Chinese imports.⁷ However, this argument could also apply to the indirect effects of Chinese competition. Other potential explanations concern differences in labour market institutions between Portugal and other countries (in particular the US), including widespread sectoral collective bargaining agreements, which set minimum wages for virtually all workers, especially in manufacturing. More restrictive employment protection law in Portugal may potentially reduce the impact of China in terms of job loss and the earnings losses that would otherwise follow. But again, we don't see why these arguments would only apply to the effect of direct import competition. Hence, we think that the absence of a significant direct effect and the evidence of a significant negative indirect effect relate mostly to the nature of the shocks themselves, their magnitude and product composition. The Portuguese pattern of export specialisation increased the exposure to China in third markets in the 1993-2008 period, especially as firms faced constraints in moving resources to expanding activities in terms of exports and innovation due to structural rigidities.

Overall, we conclude that, unlike previous research, China can affect negatively the labour markets of developed economies not only or not at all through its increase in exports to the country. In fact, for Portugal, this direct effect is very small and even positive or insignificant

⁷This interpretation would be consistent with evidence for other countries: Bloom et al. (2016) find that Chinese import competition increases innovation within surviving firms in Europe, while Mion and Zhu (2013) find that import competition from China induces skill upgrading in low-tech manufacturing industries in Belgium.

in some cases. More importantly, China's emergence in international trade can drive an intensified competition in third-country markets, leading to trade diversion, which can then generate significant negative labour market effects, as in the case of Portugal studied here.

5.2 Heterogeneity in the Impact of the Increased Trade Exposure

A consensus is emerging in the economics literature regarding not only the effects of international trade on aggregate welfare but also on the within-country income inequality impacts of trade liberalisation (see Autor (2018) and Crozet and Orefice (2017) for two recent policy-oriented discussions of the impact of international trade in the labour market). The adverse impacts of trade tend to be very concentrated among specific groups of workers, industries and locations more vulnerable to trade competition. The implementation of appropriate public policies aimed at protecting trade-exposed workers and mitigating or even reversing the costs of trade adjustment (including, for instance, hiring incentives, in-work subsidies, and training) requires the identification of the individuals that tend to be more negatively exposed to globalisation.

In this section, we investigate which specific groups of workers were more affected by the increased international trade exposure to China, taking into account both the direct and indirect channels. More specifically, we extend the main analysis above to explore potential heterogeneity in the impact of the increased direct and indirect competition from China according to important workers' dimensions available in our data set such as age, gender and schooling.

In recent decades, the literature has also uncovered heterogeneous firm-level responses to trade liberalisation along the lines of Melitz (2003), showing that there are both winners and losers among firms within an industry (Melitz and Treffer, 2012). In this spirit, we also examine whether the effects are distinct for individuals working in firms with different characteristics in the pre-shock period, namely size, age and foreign ownership. From a labour market perspective, we expect more negative effects for less skilled workers, as they face more elastic labour demands. The same can apply in the case of those workers that benefit from rents before the shock, perhaps because of the characteristics of their firm, as these workers will exhibit greater scope for wage declines following a spell of unemployment.

The tables of this section report only the estimated IV coefficients (the OLS estimates and the IV first-stage statistics are included in Section 5 of the online Appendix). Panel A of Table 6 divides the sample of workers considering those with above and below the sample median age in 1993 (35 years old). We find that the indirect effects on earnings fall exclusively on older workers. These workers tend to be paid higher, above market-level wages, as they usually benefit from good matches with their employers (Snell et al., 2018) and rent sharing (Martins, 2009, Duan and Martins, 2019). Therefore these workers can lose the most if they

become unemployed and then have to move to a new firm with a lower level of seniority or where they are not as well matched. These results are in line with the findings from the displacement literature (see Raposo et al. (2019) for a study of job displacement in Portugal). The negative indirect effects on employment are observed for the two groups but are still stronger for older workers who, when leaving the firm, may take longer to find suitable matches. Unemployment benefits are also more generous in their duration (up to three years) for older workers, potentially prompting them to remain unemployed for a longer period and exacerbating the public cost of their non-employment, while reducing the individual income effects of the drop in earnings above. In all cases, we do not find significant direct effects.

Table 6: Heterogeneity: Workers Characteristics - IV estimates

	Cumulative Earnings		Cumulative Employment	
Panel A. Sample Median Age				
	Less 35 years old	More 35 years old	Less 35 years old	More 35 years old
$\Delta IPdir_j$	0.247 (0.892)	2.451 (1.760)	0.098 (0.668)	1.463 (1.367)
$\Delta IPind_j$	-0.892 (0.640)	-2.005** (0.808)	-0.865** (0.418)	-1.799** (0.748)
Panel B. Gender				
	Male	Female	Male	Female
$\Delta IPdir_j$	0.627 (0.848)	1.561 (1.821)	0.427 (0.625)	0.774 (1.136)
$\Delta IPind_j$	-0.748 (0.691)	-1.479*** (0.552)	-0.697 (0.568)	-1.054** (0.421)
Panel C. University Education				
	Non-Tertiary	Tertiary	Non-Tertiary	Tertiary
$\Delta IPdir_j$	1.091 (0.943)	0.260 (1.465)	0.549 (0.629)	0.018 (0.656)
$\Delta IPind_j$	-1.595** (0.739)	-0.577 (2.407)	-1.112** (0.458)	-1.083 (1.368)

Notes: Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. The variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1), and it is instrumented using the variable ΔIPO_j defined in Equation (3). The variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2). Given the large scale of the flows, the instrument variable is divided by 1000. All regressions include a constant and the vector of individual, firm, and sector controls from Column (6) of Table 5, when applicable. All controls are considered at the start-of-period level (1993). Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***).

We also investigate if women tend to suffer more or less than men from exogenous trade shocks. Despite the convergence of male and females observable attributes, Cardoso et al. (2016) show that the wage gender gap in Portugal, conditional on those workers' characteristics, amounts to 23 log points on average in the 1986-2008 period. In Panel B of Table 6, which divides the workers' sample between males and females, we find that the indirect effects on women are more negative than those on men, both for earnings and employment. This gender heterogeneity in the effects may result from the higher proportion of women employed in sectors that are more exposed to the competition from China, in particular competition in export markets. For instance, in the more labour-intensive manufacturing sectors of textiles, clothing and footwear, the proportion of female employees was around 68% in 1993.⁸

⁸When we exclude the sectors of textiles, clothing and footwear from the regressions, the estimated negative impact of Chinese indirect

The direct and indirect effects of increased competition from China are not statistically significant for university graduates, as can be inferred from Panel C of Table 6, which splits the workers' sample between those with and without tertiary education in 1993. Workers with higher schooling levels are likely to be able to move to different occupations, and therefore, to be less affected by negative international trade shocks. Moreover, they may also be better placed to take advantage from employment opportunities that follow from product upgrading, as schooling facilitates access to better paying firms and jobs (see Cardoso et al. (2018) for a detailed study of the sources of the returns to education in Portugal).

We next consider three distinct sample splits with respect to firms' characteristics: size, age and nationality of equity. Panel A of Table 7 displays the estimation results by size category of the employer firm in 1993.⁹ Small firms, defined as those that have an annual turnover not exceeding EUR 2 million, are not affected by the increased competition from China. One of the stylised facts of the export behaviour of individual firms is that exporters tend to be larger than domestic firms within the same industry (e.g., Bernard et al., 2007). Hence, given the higher probability of larger firms being exporters, it is natural that the effects of increased competition of Chinese products in third markets are concentrated in this category.

Table 7: Heterogeneity: Firms Characteristics - IV estimates

	Cumulative Earnings		Cumulative Employment	
Panel A. Size				
	Small	Large	Small	Large
$\Delta IPdir_j$	1.6541 (1.781)	0.808 (1.028)	0.922 (0.867)	0.238 (0.759)
$\Delta IPind_j$	-0.585 (0.786)	-2.456** (0.981)	-0.361 (0.515)	-1.650** (0.690)
Panel B. Age				
	Less 5 years	More 5 years	Less 5 years	More 5 years
$\Delta IPdir_j$	-1.315 (1.806)	0.578 (1.302)	-0.556 (1.038)	0.049 (1.009)
$\Delta IPind_j$	0.729 (1.973)	-1.924** (0.871)	0.233 (0.992)	-1.246** (0.579)
Panel C. Origin of Equity				
	Domestic	Foreign	Domestic	Foreign
$\Delta IPdir_j$	0.665 (1.043)	1.410 (3.571)	0.823 (0.693)	0.317 (2.529)
$\Delta IPind_j$	-1.739** (0.744)	-1.782 (2.222)	-1.003** (0.446)	-1.734 (1.693)

Notes: Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. The variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1), and it is instrumented using the variable ΔIPO_j defined in Equation (3). The variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2). Given the large scale of the flows, the instrument variable is divided by 1000. All regressions include a constant and the vector of individual, firm, and sector controls from Column (6) of Table 5, when applicable. All controls are considered at the start-of-period level (1993). Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

competition becomes much more moderate or even non-significant.

⁹Portuguese firms are on average much smaller than those of other EU countries. Hence, in this partition of the sample by dimension of the firm, we used one of the official criterion for micro-firms included in the "Commission Recommendation 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises". According to this definition, a micro-firm is defined as a firm which employs fewer than 10 persons and whose annual turnover and/or annual balance-sheet total does not exceed EUR 2 million.

Panel B of Table 7 divides the sample of workers according to the age of the firm they were initially employed in 1993. The negative effect of increased trade exposure to China is mostly felt by individuals initially employed in firms with five or more years of activity. Given the traditional trade specialisation of Portugal based on exports of labour-intensive products, older exporters are more likely to be negatively affected by the increased competition of China in third markets. In fact, the higher competition from new low-cost players translated into strong losses for Portuguese producers in external markets for several years (Cabral and Esteves, 2006). In turn, this negative impact was at the genesis of a progressive change in the productive structure of Portuguese exports into higher quality products even in traditional sectors, like footwear.¹⁰

Finally, Panel C of Table 7 divides the sample between workers employed in domestic and foreign firms, defined as firms with at least 10% of foreign equity ownership in 1993. We find that individuals employed in foreign-owned firms do not appear to be affected by China's direct and indirect competition. [However, the sample of workers in foreign-owned firms is small, which can make it difficult to identify significant effects.](#) Foreign-owned firms, which are typically affiliates of foreign multinationals, may be more resilient to international trade shocks as they are likely to be part of global value chains. For instance, Martins and Yang (2015) present evidence that the wages of workers in affiliates of multinational firms around the world are influenced not only by the profitability of the affiliate itself but also by the profitability of the parent company.

5.3 Robustness Results

In this section, we present several robustness checks of our baseline results. We start by measuring the change in direct and indirect trade exposure to China using a gravity-based approach, which captures the differential changes in China's sectoral productivity and trade costs relative to Portugal. We proceed by including a measure of the increase in export opportunities for Portuguese firms arising from the integration of China in world markets; then we revise our measure of indirect trade exposure and express it in percentage changes. We also instrument our direct import penetration measure with a different set of countries, work through our analysis using a smaller sample of manufacturing workers, and use a distinct variable as a proxy of the initial size of an industry. Finally, we split the sample period in two. [With the exception of the OLS gravity-based results, the tables of this section include only the IV estimates \(the complete tables are included in Section 5 of the online Appendix\)](#)

First, we adopt an alternative identification strategy that imposes weaker assumptions in measuring the direct and indirect import competition from China, based on gravity equations. Section 4 of the online Appendix describes in detail the procedures used to construct these

¹⁰Since 2009, Portuguese exports have recorded gains in export market shares in almost every year.

measures of trade exposure, which follow the strategy of Autor et al. (2013) and Dauth et al. (2014). Intuitively, instead of using actual changes in Chinese exports as in Equations (1) and (2), we use gravity residuals to capture the rising productivity and increasing market accessibility of China relative to Portugal and the implied differential change of Portugal's attractiveness relative to China from the perspective of third countries. The gravity approach neutralises import demand shocks in the destination markets, thereby isolating supply and trade-cost driven changes in Chinese export performance, which are precisely the components of China's export growth that we want to capture.

Table 8 shows the results of this alternative specification, which is estimated by OLS, as the gravity approach sterilises the confounding effects of possible unobservable shocks. As in our baseline regression, the impact of increased Chinese import penetration on the Portuguese domestic market is statistically non-significant, while the effect of higher competition of Chinese products in the main destination markets of Portuguese exports is negative and significant. To compare the economic magnitudes of these estimates with those of our baseline regression, we consider a manufacturing worker at the 75th percentile of the distribution of the gravity-based measure of indirect import competition (39.724) and a similar worker at the 25th percentile of the same distribution (0.530). Using the estimates of Table 8, the worker who experiences a stronger rise in indirect trade exposure has a relative reduction in cumulative wages of 17.6% ($-0.448 * (39.724 - 0.530)$) of the base wage over the outcome period (9.4% differential decline in years of employment). These magnitudes are consistent but more conservative than those obtained with our baseline results, because the rise in gravity residuals captures only the exogenous differential increase in competitiveness and accessibility of China, and should be interpreted as a conservative estimate of the impact of Chinese competition on the Portuguese labour market. Nevertheless, the fact that our gravity and baseline estimates lead to consistently negative economic effects of China's indirect competition in third markets suggests that correlated import demand shocks across countries are not driving our main results and, hence, adds further confidence to their causal interpretation.

Second, we test a different impact channel of the integration of China in international trade: the increased export opportunities for Portuguese firms that may follow from the higher demand for imports from China. The measure of the direct export opportunities in each Portuguese industry j that we propose is defined as:

$$\Delta EO_{j,\tau} = \frac{\Delta X_{j,\tau}^{prt \rightarrow chn}}{WB_{j,93}}, \quad (6)$$

where $\Delta X_{j,\tau}^{prt \rightarrow chn}$ is the change in Portuguese exports of industry j to China over the period 1993-2008.

Table 8: Robustness: Gravity-based Measures - OLS estimates

	Cumulative Earnings		Cumulative Employment	
	(1)	(2)	(3)	(4)
$\Delta IPGdir_j$	-0.040 (0.099)	0.249 (0.196)	-0.070 (0.079)	0.084 (0.124)
$\Delta IPGind_j$		-0.448** (0.204)		-0.239** (0.107)

Notes: N= 602,073. Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. The variable $IPGdir_j$ is the gravity-based measure of direct import competition defined in Equation (6) of the online Appendix, computed using the average change of the residuals for each industry j across 82 destination countries between 1993 and 2008, based on the estimation of a gravity model of trade for China and Portugal. The variable $IPGind_j$ is the gravity-based measure of indirect import competition defined in Equation (7) of the online Appendix, computed using the change of the residuals for each industry j and country C of the EU14 between 1993 and 2008, based on the estimation of a gravity model of trade for China and Portugal. See Section 4 of the online Appendix for a detailed description of these variables. All regressions include a constant and the vector of individual, firm, and sector controls from Column (6) of Table 5. All controls are considered at the start-of-period level (1993). Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

In the following regression table, we use also a measure of net direct import penetration, including both Portuguese imports from China and Chinese imports from Portugal. This measure allows us to take into account some of the potentially positive labour market effects of China's emergence in terms of increased Portuguese exports to China, possibly offsetting some of the effect of China's higher import penetration. This net measure is:

$$\Delta NIPdir_{j,\tau} = \Delta IPdir_{j,\tau} - \Delta EO_{j,\tau}, \quad (7)$$

We instrument them as follows:

$$\Delta EOO_{j,\tau} = \frac{\Delta X_{j,\tau}^{O \rightarrow chn}}{WB_{j,91}}, \quad (8)$$

$$\Delta NIPO_{j,\tau} = \Delta IPO_{j,\tau} - \Delta EOO_{j,\tau}, \quad (9)$$

where $\Delta IPO_{j,\tau}$ is defined in Equation (3) and $X_j^{O \rightarrow chn}$ are the exports of the same seven selected countries to China in industry j .

Table 9 includes the IV estimation results of three different specifications: export opportunities of Equation (6) and indirect effects of competition in third markets of Equation (2); export opportunities, direct import penetration of Equation (1) and indirect effects; net import penetration of Equation (7), which adjusts the direct effect of import competition with the impact of exports to China, and indirect effects. The estimates of Table 9 shows that our results are robust to these new specifications. We find that impact of increased export opportunities to China is positive but statistically non-significant. While the direct effects of Chinese import penetration, even in the broader definition of Equation (7), are still statistically non-significant, the indirect effects remain significantly negative in all regressions and with coefficients similar to those of our baseline results.

Table 9: Robustness: Export Opportunities, Net Direct Effects and Indirect Effects - IV estimates

	Cumulative Earnings			Cumulative Employment		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔEO_j	3.693 (6.080)	3.768 (6.941)		0.648 (4.635)	0.684 (5.080)	
$\Delta IPdir_j$		1.072 (0.917)			0.521 (0.609)	
ΔNIP_j			0.841 (0.864)			0.464 (0.572)
$\Delta IPind_j$	-1.525** (0.638)	-1.737** (0.713)	-1.602** (0.725)	-1.062*** (0.402)	-1.165** (0.460)	-1.132** (0.443)

Notes: N= 602, 073. Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. The variable ΔEO_j is the measure of export opportunities defined in Equation (6), and it is instrumented using the variable ΔEOO_j defined in Equation (8). The variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1), and it is instrumented using the variable ΔIPO_j defined in Equation (3). The variable ΔNIP_j is the direct net import penetration of Equation (7) that considers both direct import penetration from China and export opportunities to China, and it is instrumented using the variable $\Delta NIPO_j$ defined in Equation (9). The variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2). Given the large scale of the flows, the instrument variables are divided by 1000. All regressions include a constant and the vector of individual, firm, and sector controls from Column (6) of Table 5. All controls are considered at the start-of-period level (1993). Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

Third, we examine a distinct measure of workers' indirect exposure to trade with China. This alternative measure of indirect competition from China is computed as the change in exports of China to each of the EU14 countries by industry j , as a percentage of total imports of each individual market in 1993, weighted by the share of each EU14 country in total Portuguese exports of each industry in 1993:

$$\Delta IPind2_{j,\tau} = \sum_{C=1}^{14} v_{j,93}^{prtC} \left(\frac{\Delta M_{j,\tau}^{chn \rightarrow C}}{M_{j,93}^{\rightarrow C}} * 100 \right), \quad \text{with} \quad v_{j,93}^{prtC} = \frac{X_{j,93}^{prt \rightarrow C}}{X_{j,93}^{prt \rightarrow}}$$
 (10)

where $v_{j,93}^{prtC}$ is the share of each EU14 country C in total Portuguese exports of each industry j in 1993. $X_{j,93}^{prt \rightarrow C} = M_{j,93}^{prt \rightarrow C}$ of Equation (2) are Portuguese exports of each industry j to each country C of the EU14 and $X_{j,93}^{prt \rightarrow}$ are the total Portuguese exports of industry j in 1993. This weight is then multiplied by the percentage change of export share of China in each individual industry-country market from 1993 to 2008, where $\Delta M_{j,\tau}^{chn \rightarrow C}$ is the change in imports from China of industry j by country C of the EU14 from 1993 to 2008 and $M_{j,93}^{\rightarrow C}$ are total imports of that country at the industry-level in 1993. Intuitively, a gain of export share of China in a given industry of a given EU14 country will represent a greater increase in competition from China, the higher the relevance of that individual market in total Portuguese exports in the baseline year. Compared to the original specification of the indirect effect, here we consider the changes of China exports in each industry of each EU14 country as a percentage of the respective industry-country total imports in 1993 (not changes in Chinese imports normalised by the size of the Portuguese industry); and we weight each individual market in terms of its importance in Portuguese exports of that industry in 1993 (not using weights in imports of the EU14 country).

Panel A of Table 10 reports the estimated effects, which are consistent with the main results

from Column (6) of Table 5. In particular, the effects on earnings and employment of the increased competition from China in the main Portuguese export markets are significantly negative, while the impacts of direct import competition are not statistically significant. To compare these estimates with our baseline results, consider a worker who faces a rise in indirect import exposure at the 75th percentile (44.980 in this alternative metric) and compare to a worker with indirect import competition at the 25th percentile (6.452). The coefficient estimates imply that the former earns 38.5% ($-0.999 * (44.980 - 6.452)$) less than the latter over the period (drop of 23.9% in terms of years of employment), because of the stronger increase in indirect trade exposure. In this sense, given the greater magnitude of these effects, our baseline results can be seen as a conservative estimate of the impact of stronger Chinese competition in Portuguese export markets.

Table 10: Robustness: Alternative Measures of Import Competition - IV estimates

	Cumulative Earnings	Cumulative Employment
Panel A. Different Measure of Indirect Effects		
$\Delta IPdir_j$	1.001 (0.766)	0.447 (0.506)
$\Delta IPind2_j$	-0.999*** (0.293)	-0.621*** (0.180)
Panel B. Different Instrument Group of Countries		
$\Delta IPdir_j$	0.608 (0.776)	0.337 (0.557)
$\Delta IPind_j$	-1.573** (0.715)	-1.116** (0.441)
Panel C. Only within Manufacturing		
$\Delta IPdir_j$	0.594 (0.805)	0.242 (0.559)
$\Delta IPind_j$	-1.031* (0.554)	-0.823** (0.378)
Panel D. Different Normalisation - Turnover		
$\Delta IPTdir_j$	-0.216 (0.740)	-0.414 (0.496)
$\Delta IPTind_j$	-1.535** (0.610)	-0.933*** (0.345)

Notes: N= 602,073 in all panels, except in Panel C (only manufacturing industry) where N= 283,272. Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. In Panels A and C, the variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1), and it is instrumented using the variable ΔIPO_j defined in Equation (3). In Panels B and C, the variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2). In Panel A, the variable $\Delta IPind2_j$ is the measure of indirect import competition from China defined in Equation (10). In Panel B, the variable $\Delta IPdir_j$ is instrumented with the variable $\Delta IPoecd_j$, which uses imports of selected fifteen OECD non-EU14 countries from China. In Panel D, the variable $\Delta IPTdir_j$ is the measure of direct import penetration, instrumented using the variable $\Delta IPTO_j$, and the variable $\Delta IPTind_j$ refers to the measure of indirect import competition from China. The numerators of these three variables are same as the variables defined in Equation (1), Equation (3) and Equation (2), respectively, but $\Delta IPTdir_j$ and $\Delta IPTind_j$ use total turnover of industry j in 1993 as a normalisation factor and $\Delta IPTO_j$ uses total turnover of industry j in 1991 in the denominator. Given the large scale of the flows, the instrument variables are divided by 1000. All regressions include a constant and the vector of individual, firm, and sector controls from Column (6) of Table 5. All controls are considered at the start-of-period level (1993). Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

Fourth, we test the sensitivity of the baseline results with respect to the construction of the instrumental variable by changing the countries that are included in the instrument group. We use a set of fifteen OECD non-EU14 countries.¹¹ Panel B of Table 10 shows that the results are basically unchanged when using this alternative IV, thus suggesting that our findings are

¹¹ We only considered non-EU14 countries that are OECD members in our sample period: Australia, Canada, Czech Republic, Hungary, Iceland, Japan, Mexico, New Zealand, Norway, Poland, Slovakia, South Korea, Switzerland, Turkey, and the United States.

robust to the choice of the instrument group.

Following Autor et al. (2014), our baseline regressions are based on the full sample of 602,073 workers employed in 1991 and 1993 in manufacturing and non-manufacturing sectors. This sample includes individuals working in the 83 manufacturing industries that were exposed to competition from China, as well as workers employed in non-manufacturing sectors, which have zero trade exposure. Instead of using all private sector workers, we now focus on a more homogeneous group of workers and perform the same analysis as before but only for the 283,272 individuals employed in the manufacturing industry in 1991 and 1993. The estimation results are presented in Panel C of Table 10. Even if the statistical significance decreases, the results are very similar, with the effects of direct import competition from China remaining statistically non-significant. Using these estimates to perform the same comparison of an individual initially employed in an industry at the 75th percentile of the Chinese indirect trade competition with a worker employed in an initial industry at the 25th percentile of the same distribution, the implied relative reduction in cumulative wage earning is 15.6% (12.5% drop of years of employment). These values are smaller than the ones obtained in our baseline regressions that use a bigger and more heterogeneous sample of workers and, hence, can be seen as a low benchmark of our results.

As described in Section 3.1, to normalise the changes in sectoral trade flows with China, our baseline results use the total wage bill of a given domestic industry as a proxy of the initial industry size. Even if due to data unavailability we can not compute the domestic absorption of each industry in 1993, we test a distinct normalisation of trade exposure to China: the total turnover of each industry in 1993 (1991 in the case of the instrumental variable).¹² Panel D of Table 10 shows that using turnover to capture the initial relative dimension of domestic industries does not have a significant impact in our results. We still find no evidence of a negative direct effect of increased imports from China and the impact of Chinese competition in export markets continues to be significant and negative. In economic terms, the magnitude of the results is very similar to the one obtained with the baseline estimates of Table 5. Using turnover as the normalisation factor, the values of the 25th and 75th percentiles of the distribution of indirect import exposure to China in third markets are 0.487 and 18.039, respectively. Comparing individuals initially employed in industries at the 75th and 25th percentiles of the distribution of the measure of Chinese competition in export markets, the estimates show that the individual in the more affected industry earns 26.9% ($-1.535 * (18.039 - 0.487)$) less when compared to a worker at the 25th percentile (reduction of 16.4% in terms of years of employment).

Finally, we consider two different sub-periods for the trade shock variables, 1993-2000 and 2000-2008, still focusing on the same worker-level outcomes of the main sample of workers

¹²More precisely, we used total turnover of industry j in 1993 and 1991 divided by 100 so that the values of the estimated parameters are more similar to the baseline regressions.

employed in 1991 and 1993. The estimates in Table 11 show that the negative impacts of increased competition from China in exports markets are concentrated in most recent sub-period, while the direct effect of imports from China continues to be non-significant in both sub-periods. These results are consistent with the distribution of the trade shock over time. For each trade shock variable considered, around 75% of the average increase occurred from 2000 to 2008, when China’s international trade accelerated strongly following its accession to the WTO.

Table 11: Robustness: Time Periods - IV estimates

	Cumulative Earnings		Cumulative Employment	
	1993-2000	2000-2008	1993-2000	2000-2008
$\Delta IPdir_j$	-0.015 (16.967)	1.317 (0.924)	0.471 (13.801)	0.661 (0.570)
$\Delta IPind_j$	-1.278 (0.977)	-3.212*** (0.806)	-1.079 (0.771)	-2.152*** (0.416)

Notes: N= 602,073. Dependent variables: 100 x Cumulative earnings (1994-2008), normalised by average earnings in 1991 and 1993; 100 x Cumulative years of full-time employment in the private sector. The values of each trade exposure variable for the two sub-periods sum to respective trade exposure variable for the full period used in the baseline regressions of Table 5. The variable $\Delta IPdir_j$ is the direct import penetration defined in Equation (1) and the variable $\Delta IPind_j$ refers to the measure of indirect import competition from China defined in Equation (2). The variable ΔIPO_j is the instrument of the variable $\Delta IPdir_j$, which is defined in Equation (3) and uses imports of selected countries from China. Given the large scale of the flows, the instrument variable is divided by 1000. All regressions include a constant and the vector of individual, firm, and sector controls from Column (6) of Table 5. All controls are considered at the start-of-period level (1993). Standard errors in parenthesis are clustered at the industry level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%***).

6 Concluding Remarks

Recent decades have been characterised by a strong growth of international trade. The integration of emerging and developing economies in world trade and the rise of global value chains has dramatically changed the organisation of world production, potentially leading to deep and lasting economic impacts as well as in other social and political domains. Given that China’s sudden ascent as a major economic power is arguably one of the most important causes and consequences of these developments, a number of studies have examined the (direct) effects from China’s increased competition on labour markets worldwide. However, the indirect effects (‘collateral damage’) of increased competition with China in third-country export markets have largely been overlooked so far, especially when considering worker-level data. This is an important research gap given the increasing relevance of China’s exports, as they become more sophisticated and may have wider indirect effects around the world.

In this paper, we examine these two, direct and indirect, effects simultaneously. Using information on international trade across countries and industries over a long period of time (1993-2008) we propose different measures of these trade shocks. We match them with comprehensive employer-employee panel data from Portugal, linking each worker back in 1993 to the shocks that his or her initial industry was subject to until the end of the next decade.

We then assess how cumulative wage earnings and years of employment over the 1994-2008 period are affected by these measures of trade exposure.

Our findings show that countries can indeed be affected in various ways by the emergence of China as a dominant player in the global market for manufactured goods. In contrast to evidence for other countries, we find that an increase in direct import penetration from China does not necessarily significantly decrease individuals' wage earnings and years of employment. In contrast, our results indicate that the indirect dimension associated with increased competition in third-country markets driven by China's exports can generate significant negative labour market effects. More specifically, for Portugal, we find that a rise, from the bottom to the top quartile, of an industry's exposure to Chinese indirect import competition in a group of 14 EU countries is associated to a drop of 25% in worker's cumulative wages and a 17.4% reduction in employment years.

The negative labour-market effects of increased trade exposure to China are robust to a number of tests but are also heterogeneous across individuals. The impact falls disproportionately on older workers, females and workers without tertiary education. Moreover, the negative effects are also stronger for individuals working in larger, older and domestic-owned firms. Hence, this paper not only supports the view that trade integration generates losers in the labour market but also contributes to the identification of those most affected, which is essential for public policies aiming at supporting workers more hurt by globalisation.

Overall, our findings contribute to a better understanding of the effects of the 'China shock', not only in Portugal but also in other countries with significant shares of their workforce employed in relatively labour-intensive manufacturing exporting firms. This indirect effect is also increasingly relevant as more and more industries around the world become exposed to the increasing range and quality of China's exports. Of course, as China's emergence led to the important indirect import penetration effects that we examine here, it may also have contributed to relevant indirect export opportunities, namely by selling intermediate goods to firms in third countries that then export final goods to China. This is a topic that we leave for future research.

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