The UK Labour Market Effects of Imports from China

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Abstract

We explore the worker-level impact of increased import penetration in UK manufacturing industries over the period 1997-2011. Our approach borrows the identification strategy of a corresponding analysis for the United States by Autor, Dorn, Hanson and Song (ADHS, 2013), which we extend in three main directions: we look at net as well as gross imports, thus separately examining the effects of increased intra-industry trade; we focus on import penetration from EU countries in addition to China; and we estimate worker-level outcomes separately by occupations. We find that import penetration from China had significantly negative effects on workers’ earnings and work hours in the affected industries. In contrast, increased imports from the EU are associated with positive worker-level outcomes, a fact that is largely explained by the effect that increased imports from the EU were mostly offset by increased same-industry exports to the EU. We also find that the adverse worker-level effects of increased imports from China are most pronounced among professional workers and managers and least pronounced among clerical staff and plant operators.
1 Introduction

Traditionally, the empirical evidence for detrimental wage effects from international trade has been sparse, with only a modest increase in the skilled-unskilled wage gap being found as a consequence of foreign outsourcing (Feenstra and Hanson, 1999). Skill biased technical change, on the other hand, has been shown to have a bigger impact on the US wage and earnings inequalities (Katz and Autor, 1999). So even though trade theory identifies that free trade with countries at any income level may affect individual worker outcomes such as domestic wages, earnings and employment evidence suggests that imports from developing economies were generally too small to have any major impact on US employment or wage inequality, especially during the period of rapid inequality growth that occurred during the 1980s and 1990s (Krugman, 2000).

More recently however, the growing importance of low-wage countries in the global economy has put new pressure on high-wage countries (e.g. Freeman, 1995; Feenstra, 2010), and this has provided a unique opportunity to examine the impact of international trade on worker adjustment. Most of the recent growth in global manufacturing output has come from China, as a consequence of its transition to a market-oriented economy. Indeed, Hanson (2012) reports that since 1990 China has accounted for more than 75% of the growth in manufacturing value added engendered by low- and middle-income economies. Moreover, China has dramatically improved its share of world manufacturing exports which has rapidly increased from around 2% in 1990 to 16% in 2011 (see Figure 1).

Until now, most of the recent research looking for detrimental employment and earnings effects in developed countries that might have occurred from increased imports from China has been undertaken for the US. This is mainly as a consequence of its trade imbalances with developing countries, like China, and the rise in the share of total US spending on low-income countries goods (see for example Bernard, Redding and Schott, 2006; Autor, Dorn and Hanson, 2013a). However, the spectacular Chinese export boom is expected to hit workers in the UK in a somewhat similarly disruptive way.

Of course the UK already has close trade ties with the European Union (henceforth the EU) which might also be expected to have had a sizable impact on its labour market. Trade theory predicts that trade with countries at any income level may affect domestic workers, yet the impact will depend on where imports originate (Bernard et al., 2006). Consequently, it is important to make the distinction between gross and net imports (or whether bilateral trade patterns are mainly in the form of inter- or intra-industry trade) in order to fully understand trade competition and its impact on worker’s career paths. The recent availability of new micro-level data, especially administrative data, enables researchers to better investigate the causal effect of enhanced trade competition on labour market outcomes at the individual level.

1 According to ADHS (2013), the share of U.S. total spending on Chinese goods rose from 0.6% in 1991 to 4.6% in 2007.
In this paper, we analyse the effect of exposure to increasing trade integration on UK manufacturing workers’ wages, employment and earnings. We focus on trade integration, mainly in the form of increased import competition from China (i.e., low-income countries) but also from (more similar countries like) the European Union. We use the econometric approach of ADHS by using, as a measure of trade exposure, the growth in UK imports from China, or the EU, over the period 1997 to 2011 that took place in a worker’s initial industry. Using individual-worker level panel data from the UK New Earnings Survey Panel Dataset (NESPD) we can analyse the medium- to long-run consequences of exposure to import competition on earnings, employment spells, hourly pay and hours worked of UK manufacturing workers.

We add three dimensions to the approach of ADHS. First, our data permit us to decompose total earnings into hours of work and hourly pay, hence allowing us to assess the relative contributions of each part in the adjustment process to trade shocks. Second, we contrast the impact of imports coming from China to those coming from the EU. We would expect a different impact on worker outcomes whether import competition stem from China or the EU. Third, and most importantly, unlike ADHS we are able to control for the worker’s occupation and evaluate import competition effects within occupational groups. One would expect workers employed in low-skill intensive occupations to exhibit declining earnings profiles as a consequence of trade compared to other workers within the same occupation; and not just workers relative to all workers across all occupations, which could be a consequence of skill biased technical change instead of pure trade effects. Indeed, within occupation groups, workers employed in industries that face higher subsequent exposure to import competition, say from China, would be expected to exhibit a worse earnings trajectory.  

Unfortunately, we do not observe individual education attainment in the NESPD, so we cannot directly capture skills of workers at the initial period. However, as it will be clear, we control for occupation at the 3-digit level and for a bunch of (pre-shock) individual observable characteristics. Thus, even though we cannot observe worker skills, we argue that we do control (somehow indirectly) for skill/ability in the best way we can.
Regarding UK trade exposure with China, we find that, on average, workers more exposed to import competition see a fall in cumulative earnings, a drop in cumulative wages and cumulative hours of work over the sample period from 1997 to 2011. The implied differential for a reduction in earnings over the 15 year sample period, between workers at the 75th percentile of industry trade exposure relative to workers at the 25th percentile is 37.2% of initial annual earnings. The drop in employment is equal to 15.3% of a year, which is equivalent to 56 days or 8 weeks lost during the 15-year sample period.

The trade competition impact differs across occupation groups, which highlights great heterogeneity in trade adjustment by job characteristics. Occupations such as managers, professionals, associate professionals and elementary production are most adversely affected by the rise in Chinese imports. Somewhat unexpected, we find that the adverse effects of increased imports from China are most pronounced among “white-collar” jobs. Interestingly, associate professionals experience the largest decline in wages, yet these are partly offset by a rise in hours of work.

Unlike China, increased imports from the EU are associated with positive earnings and employment, a fact that is largely explained by the fact that increased imports from the EU were mostly offset by increased same-industry exports to the EU, and that they might not substitute to UK domestic production, but are rather complements.

We begin in Section 2 by documenting some facts about UK bilateral trade patterns with China and with the EU. Section 3 then provide an overview of recent work, along with previous studies, analysing trade shocks on labour markets. Section 4 describes our empirical methodology to estimating the impact of exposure to trade competition, and documents facts about UK industry exposure to imports from China and the EU. The data used and the main estimating equation are discussed in Section 5, while Section 6 and Section 7 present the core results for the labour market effects of increased exposure to import competition from China and the European Union respectively. Section 8 concludes.

2 UK Bilateral Trade Patterns

We begin in this section by documenting UK bilateral trade patterns with China and with the EU. Figure 2, which plot values of imports from and exports to China for the UK, carries two main facts. First, the growth rate of UK imports from China is far bigger than the corresponding growth rate for exports. This first glimpse of evidence tells us that Chinese imports may put a bigger pressure on UK individual workers than the potential beneficial effects of export opportunity in China. Second, imports took off around 2001, when China joined the WTO suggesting (along with the first fact) that the Chinese export boom may be mainly driven by its internal-fostered transition to a market-oriented economy and by trade tariff reductions following WTO accession (something we cannot distinguish from this figure).
Figure 2: Trade between the UK and China, 1988-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries.

From the perspective of the UK, the rise of China in the world economy is expected to have similar qualitative impact on its domestic workers than in the US. Indeed, the UK bilateral trade relationships with China appear to be qualitatively similar to the US. (Figures A2 in the Appendix, which displays similar trends for both trade flow types). Note the magnitude differences between the UK and the US of both trade flow types roughly correspond to the US/UK population ratio (around 5). Thus, as in the US, we can think of UK industries having been confronted to a major rise in import competition from China without a counterbalancing rise in demand for UK exports.

Concerning the UK trade relationship with the EU, we can see in Figure 3 that imports from and exports to the EU have increased over time with much similar growth rates than the corresponding ones with China. We can see that trade with the EU happens to be more balanced and of a different nature than with China, which will matter for its impact on the

3 When looking in proportion rather than in volumes, we reach the same observations; the growth rate of the share of UK imports from China, relative to UK total imports, increases much more rapidly than the corresponding one for export share, with an inflexion point around 2001 (see Figure A1 in the Appendix), and that is qualitatively similar than for the US (see Figure A3).

4 Adding to the picture, we can observe the same declining path in the share of UK working age population employed in manufacturing industries as in the US. Figure A11 in the Appendix shows that the share of UK employment in manufacturing has fallen from 19% in 1994 to 10% in 2011.

5 Our definition of the European Union comprises the first 15 countries that entered before 2004 less the UK. The countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and Sweden.
labour market (more on this in section 7). This is where the distinction between gross and net imports (or whether bilateral trade patterns are mainly in the form of inter- or intra-industry trade) becomes crucial in understanding the trade competition impact on worker’s career paths.

Figure 3: Trade between the UK and the EU, 1988-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries. UK is omitted from the EU15.

3 Literature Background

Mainly because of its trade imbalances with developing countries and the rise in the share of total US spending on low-income countries goods, the focus of the literature has been primarily on the US and on the adverse effect of increased import competition from low-income countries on workers’ employment and earnings. Low-income countries export growth in 1990 onwards is mainly due to China’s transition to a market-oriented economy. The main events that made China more open include a massive rural-to-urban migration of over 150 million workers (see Chen, Jin and Yue, 2010); the access of domestic industries to previously banned foreign technologies, capital goods and intermediate inputs (see Hsieh and

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6 As with China, UK bilateral trade patterns, in volumes, with the EU are qualitatively similar than those of the US with the EU (Figure A5 in the Appendix). Moreover, UK (and US) exports and imports shares with the EU are closely match as well but slightly declining over time (see Figure A4 for the UK and Figure A5 for the US in the Appendix). Note that the proportion of imports coming from the EU and exports going to the EU is 2 to 3 times bigger for the UK than for the US highlighting the relative importance of the EU as a key trading partner for the UK.
Klenow, 2009); the permission for multinational firms to operate in China (see Naughton, 2007, which is a great source of information about the Chinese economy and transition); and its accession the WTO in 2001.\footnote{For additional sources on the Chinese economy and transition, see for example Hanson (2012), Feenstra and Wei (2010), Harrison, McLaren and McMillan (2010), Hsieh and Ossa (2011) and Brandt, Van Biesbroeck and Zhang (2012).}

This has led to a number of papers investigating the impact of increased imports from China on labour markets. As already discussed, ADHS (2013) is the most similar to our study since they use individual worker data to look at the impact of exposure to import competition from China on cumulative earnings and employment of US workers over the period 1992 to 2007. They use individual-level administrative data for manufacturing industries. Their findings suggest that workers who were initially employed in manufacturing industries which experienced high subsequent import growth from China experienced lower cumulative earnings; are at greater risk of exiting the labour force and obtaining public disability benefits; spend less time employed with their initial employers; spend less time in their initial two digit industry; and spend more time employed elsewhere in manufacturing and outside manufacturing. Moreover, earnings losses are greater for workers with low initial wages; low initial tenure; low attachment to the labour force; and for those employed at larger firms with lower than industry-average wage levels. Trade competition in terms of exposure to import competition also induces substantial job churning among high-wage workers, yet they are better able than low-wage workers to move across employers with minimal earnings losses, and they are less likely to leave their initial employers during a mass layoff.

Dauth, Findeisen and Sudekum (2014) explore the impact of rising trade between Germany and China (and Eastern Europe) on employment in German local labour markets over the period 1988 to 2008. They exploit cross-regional differences in initial industry structures. They found regions that specialized in import-competing industries faced substantial job losses, both in manufacturing industries and in services. In contrast, regions specialized in export-competing industries gained jobs and displayed lower unemployment. Overall, they estimate that trade integration has caused some 493,000 additional jobs in the German economy. They also have a section discussing the impact of Chinese and Eastern European countries import and export competition on individual workers. They find that trade has a stabilizing effect on employment relationships (within regions, local industries and plants).

Bloom, Draca and Van Reenen (2011) examine the impact of firm exposure to Chinese import competition on patenting, IT, R&D and TFP using a panel of up to half a million firms over 1996-2007 across twelve European countries (Austria, Denmark, Finland, France, Germany, Ireland, Italy, Norway, Spain, Sweden, Switzerland and the UK). The identification strategy they use is related to the one we use here in the sense that in one of their specifications they use initial industry exposure to Chinese imports as an instrument for subsequent Chinese import growth.

One further strand of trade literature that looks at the impact of trade on wages takes a structural approach by estimating general equilibrium models. This literature generally
assumes perfect labour mobility across industries. Accordingly, labour market adjustments after (trade) shocks are very rapid (if not instantaneous) and thus changes in wages can be identified across (and not within) skill groups. A more recent approach to this modelling moves away from perfect worker mobility by introducing search frictions, costly firm entry and exit and industry-specific human capital. These works primarily explore the effects of trade liberalization on labour market dynamics and wage inequalities for developing countries. Our analysis is closely related to this branch of the trade literature, nonetheless the approach we take imposes less structure on the data. Another closely related strand of trade literature estimates the short- and medium-run impacts of trade exposure on wages, employment, firm dynamics, worker turnover and inequality at different levels of aggregation. Workers are assumed to face barriers to mobility across firms, occupations, industries or geographical regions. Thus, labour market adjustments to trade shocks are not immediate implying costly transitory effects. However, this approach does not permit the observation of effects which persist after the reallocation process has taken place (which we are able to do).

4 Industry Exposure to trade Competition

Following ADHS (2013), we use as a measure of trade exposure the change in the import penetration ratio for a UK industry over the period 1997 to 2011, controlling for the industry $j$ pre-shock domestic absorption (or size of the industry $j$ before the shock occurs). More specifically, we define the change in industry trade exposure as,

$$
\Delta I_{j,T} = \frac{\Delta M_{j,T}^{UK,C}}{Y_{j,96} + M_{j,96} - E_{j,96}},
$$

where $\Delta M_{j,T}^{UK,C}$ is the change in gross (net) imports between 1996 and 2011 from China or from the EU to the UK in industry $j$, whilst $Y_{j,96}$ is turnover, $M_{j,96}$ are imports and $E_{j,96}$ are exports for industry $j$ in 1996. The denominator represents UK initial industry $j$ absorption in 1996 (before the shock occurs). The idea is to capture the growth in UK gross (net) imports


9 See Helpman, Itskhoski, Muendler and Redding (2012), Coşar (2013), and Dix-Carneiro (2011) which use Brazilian data, whereas Coşar, Güner and Tybout (2011) uses data on Columbia. These works analyse firm dynamics and labour market responses after a certain type of trade liberalization.

10 Articles analysing trade shocks (i) at the plant level include Bernard, Jensen and Schott (2006) for the US, Verhoogen (2008) on Mexico, Amiti and Davis (2012) on Indonesia and Hummels, Jorgensen, Munch and Xiang (2011) using Danish data; (ii) at the industry level, see Goldberg and Pavcnick (2003), Artuc, Chandhuri and McLaren (2010), McLaren and Hakobyan (2010), Ebenstein, Harrison, McMillan and Phillips (2011), and Menzes-Filho and Muendler (2011); and (iii) at the regional level, see Autor, Dorn and Hanson (2013a) who look at the impact of rising import competition from China on employment in US local labour markets. See also Chiquiar (2008), Kovak (2011, 2013) and Topalova (2007, 2010) analyzing primarily labour market consequences of trade reforms in developing countries. See Brülhart, Carrère and Trionfetti (2012) who analyse regional wages and employment responses of trade liberalization in Austria following the fall of the Iron Curtain.
from China or from the EU that is exclusively accounted by domestic supply shocks within the UK partner country or changes in its trade cost structure.

We are concerned about estimating the causal effect of trade exposure on UK workers’ career path. More precisely, we are interested in isolating and estimating the causal effect of internal domestic factors within the partner economy that caused their exports to grow substantially. Our measure of industry trade exposure, as defined in (1), may be contaminated by domestic demand shocks to the UK economy that might influence import demand. Indeed, part of the observed changes in the import penetration ratio might be due to UK import demand shocks that have nothing to do with factors driving China’s export growth or the trade relationship patterns with the EU.

So, in order to capture internal supply shocks transmitted into UK imports on individual outcomes, we instrument $\Delta IP_{j,T}$ with:

$$\Delta IPO_{j,T} = \frac{\Delta M_{j,T}^{0,C}}{Y_{j,92} + M_{j,92} - E_{j,92}},$$

where $\Delta M_{j,T}^{0,C}$ is the change in imports between 1996 and 2011 from China (the EU) to non-UK high income countries in industry $j$, controlling for the (size of the) UK industry in which the worker was working in 1992, four years prior to the base period in (1).\textsuperscript{11} Consistent with the approach in ADHS (2013), we use 1992 instead of 1996 to account for the potential sorting of workers across industries in anticipation of future trade with China or with the EU.

The identification strategy relies on the idea that China’s export growth and EU trade patterns similarly affect other high income economies than the UK, provided that supply shocks come from within the partner country, and that domestic demand shocks are weakly correlated across high income countries. Therefore, constructing an industry measure of trade exposure in the UK by using the one of other high income countries identifies the supply-driven components of China’s export growth and EU trade patterns without any confounding effect of other shocks that simultaneously impact UK imports and workers’ outcomes (for example shocks originating from other common trade partners that are not China, the EU, the non-UK high income economies or the non-UK OECD countries used in the instruments).

The quality of the identification strategy could be altered if three important conditions are not fulfilled. First the explanatory power of the instruments must be high enough in order to avoid a weak instrument problem (we present the first stage F-Statistics in each table to show that this is not the case). Second, if product demand shocks are correlated across high-income economies, the IV estimates would be potentially correlated with unobserved components of product demand. If this is the case, our main estimators would tend to be biased toward zero and would not be exempt from domestic shocks. In other words, the effect of import exposure

\textsuperscript{11} Non-UK high income countries to instrument for UK import penetration ratio from China are Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain and Switzerland as in ADHS (2013). Non-UK OECD countries (Australia, Canada, Chile, Japan, Mexico, New Zealand, Republic of Korea, Switzerland and the US) are used to instrument for UK import penetration ratio from the EU.
on earnings, employment and wages would be weaker than it truly is. To address this concern, we will need to perform some robustness checks, but according to ADHS (2013) this does not consist of a serious threat (their estimation is based on a gravity-based model).

The last and potentially the most serious threat to the identification strategy may come from technological shocks affecting all high-income economies. If import growth from China (the EU) is predominantly due to some global technological shocks that push employment away from labour-intensive industries (i.e. industries in which China has a strong comparative advantage) or from more capital-intensive industries (i.e. some industries in which the EU has a comparative advantage), then we would not be able to identify and isolate pure trade competition effects. In our estimation, we will try to control for this by including a large set of initial-year industry and occupation characteristics. The novelty with respect to ADHS (2013) is that our data permit us to control for the worker’s occupation which will help us to discriminate between pure trade competition effects and pure technological effects. Nonetheless, recent evidences suggest that advances in technology (e.g. automation) are not the main drivers of rising import competition from low-income countries, and furthermore suggest that it is import competition from China that enhances innovation in high-income countries rather than the converse as shown by Bloom et al. (2011).

4.1 The Anatomy of Gross Imports from China

As first evidence of huge variations in UK industry gross import exposure from China, Figure 4 shows the change in UK gross import values, in constant (2005) millions of British pounds, from China over 1996 to 2011 for 21 broad manufacturing sectors. On one hand, we can see that the biggest increases in imports are in sectors such as apparel (+£3280 million), toys and miscellaneous manufacturing (+£2803 million), TVs (+£2613 million), office machinery and computers (+£2536 million), electronics (+£2112 million), leather (+£1562 million) and textile (+£1357 million). These sectors are those that intensively use production workers (sectors in which China has a strong comparative advantage). On the other hand, in sectors such as tobacco (-£0.5 million), transport equipment (+£102 million), pulp, paper and paperboard (+£222 million), printing and publishing (+£292 million), and food (+£333 million) the increase in imports have been far more modest. Those sectors intensively use more natural resources or physical capital inputs.

Interestingly, we can see that the sectors that have exhibited high imports from China are very similar to those in the US (see Figure A7 in the Appendix). Indeed, the cross-country correlation coefficient between industry changes in gross imports from China to the UK and from China to the US is 0.785 (p-value of 0.000).
To shed more light on the apparent relationship between UK industry import exposure from China and the share of production workers employed, we plot in Figure 5 on the horizontal axis the growth of industry import penetration from China from 1996 to 2011 and on the vertical axis the share of production workers in total industry employment in 1996. Each point on the graph represents a single (5-digit) industry, whereas each label corresponds to one of the corresponding 21 broad manufacturing sectors. Focusing first on the broad sectors, the evidence suggests that sectors with the biggest increase in import exposure from 1996 to 2011 tend to be those that were initially (i.e. in 1996) intensive in the use of production workers. Accordingly, sectoral patterns of import growth are broadly consistent with China’s comparative advantage in sectors that use intensively production workers (Amiti and Freund, 2010).

However, differences in factor intensity cannot be the entire story. Figure 5 shows a large variation in the change in import penetration within the broad manufacturing sectors (which tend to be quite similar in terms of production worker intensity use). In the empirical analysis, we will include controls for eight broad manufacturing sectors, leading to an identification of the effect of trade competition on medium- to long-run outcomes among industries with similar skill-intensity requirement in production. ADHS (2013) provide similar evidence for the US between 1991 and 2007. In their study, they also identify sectors intensive in the use of production worker as being exposed to high import growth from China (pp10-11).
Figure 5: Growth in Trade Exposure from China and the Share of UK Production Workers

Notes: For 166 consistently defined manufacturing industries. The sub-sectors are labelled at the two digit. Import penetration is constructed using imports and exports from Comtrade and turnover from the Annual Business Inquiry. The share of production workers is taken from the 1995/6 Quarterly Labour Force Survey.

4.2 The Anatomy of Gross Imports from the European Union

Along with the emergence of China, the UK’s close trade ties with the EU are expected to have a sizable impact on the dynamics of its labour market. Figure 6 replicates Figure 4 but using import growth from the EU (instead of China). This shows a totally different pattern. The change in gross import values from the EU to the UK is high in sectors such as chemicals (+£11107 million), food products (+£6720 million), motor vehicles (+£5296 million) and metals (+£5296 million), whereas sectors such as office machinery (-£3229 million), TVs (-£1456 million), pulp, paper and paperboard (-£694 million) and textiles (-£619 million) experienced a negative change in gross import values from the EU.

Again, UK industry trade patterns with the EU look similar to those in the US (see Figure A8 in the Appendix) with a cross-country correlation coefficient between industry changes in gross imports from the EU to the UK and from the EU to the US equals to 0.865 (p-value of 0.000). These figures imply that the sectors that experienced high growth in gross imports from the EU differ to those that faced high imports from China in terms of the intensity of their use of production workers. Indeed, this observation is confirmed by Figure 7, which replicates Figure 5 with the growth of gross import penetration ratio coming from the EU (instead of China) on the horizontal axis. Industries with the biggest increase in import exposure from 1996 to 2011 tended to be those that were initially (i.e. in 1996) not that intensive in the use of production workers, but more intensive in the use of capital or natural resources.
Figure 6: The Change in Imports from the EU to the UK, 1996-2011

Figure 7: Growth in Trade Exposure from the EU and the Share of UK Production Workers

Notes: For 166 consistently defined manufacturing industries. The sub-sectors are labelled at the two digit. Import penetration is constructed using imports and exports from Comtrade and turnover from the Annual Business Inquiry. The share of production workers is taken from the 1995/6 Quarterly Labour Force Survey. To make the figure comparable with figure 8, import penetration from the EU 15 for the manufacture of essential oils (2463) is 0.990 but set to 0.8, also precious metal production (2741) is set to 0.8 but is actually 2.26. The correlation coefficient between UK import penetration from China and Europe is 0.264 with a p-value of 0.001.
5 Empirical Methodology and Data

5.1 Data sources

Our primary source of data are taken from the New Earnings Survey Panel Dataset (NESPD) which is a one percent random sample of UK workers who have the same last two digits in their National Insurance number. This data set is made available by the Office for National Statistics (ONS) and began in 1975. The NESPD follows workers throughout their working life collecting information on their earnings, number of hours worked, place of work, age, gender, industry and occupation of employment. More importantly, the NESPD picks up workers after an unemployment spell. Thus if they leave employment they leave the survey but when they re-enter employment again they re-enter the survey.

Following ADHS (2013), we select a sample of workers with high labour market attachment. This consists of full-time workers age 22 to 64, who were born between 1947 and 1975, with non-zero earnings in 1992-1994 and 1995-1997. Most of our estimations for the impact of trade exposure on worker’s career outcomes are based on workers observed between 1997 and 2011. We use data from pre-sample years in order to construct control variables and perform robustness checks (which we discuss in more detail later). We use five main worker outcomes over the sample period: cumulative earnings, the number of years with positive earnings, cumulative earnings per year in years with non-zero earnings, cumulative hourly pay and cumulative hours of work.

Our International bilateral trade data are taken from the United Nations Commodity Trade Statistics Database (UN Comtrade). We use detailed bilateral commodity imports and exports flows from 1988 to 2011 for most partner countries. Product values are classified according to the SITC revision 3 at the 5-digit level in current US dollars. To concord these data to 5-digit UKSIC 1992 industries, we constructed a crosswalk table that maps any 5-digit SITC product to at least one 5-digit UKSIC 1992 industry (see the Appendix section 9.2 for more details). Trade flows were converted into constant (2005) GBP using historical exchange rates and the UK Consumer Price Index (CPI).

5.2 Estimating Equation

Again following ADHS (2013), we estimate the effect of trade exposure on individual worker outcomes with the following specification:

\[ E_{ij,t} = \beta_0 + \beta_1 \Delta IP_{j,t} + \beta_2 IP_{j,96} + X'_{ij,96} \beta_3 + Z'_{j,96} \beta_4 + \epsilon_{ij,t}, \]  

(3)

where \( E_{ij,t} \) is one of the five main worker outcomes between 1997 and 2011 for worker \( i \) in industry \( j \). \( \Delta IP_{j,t} \) is the change in gross (net) import penetration from China (the EU) over the period 1996 to 2011 in industry \( j \) as defined in (1). \( IP_{j,96} \) is import penetration in 1996 in

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12 Historical yearly GBP/USD exchange rates are provided by oanda.com. UK CPI is taken from the World Bank.
industry $j$; $X_{ij,96}$ is a vector of worker characteristics in 1996; and $Z_{ij,96}$ is a vector of industry/occupation controls in 1996.

The vector of worker characteristics include the worker’s birth year, gender, indicators for the size of the primary firm (4 dummies), indicators for job tenure at the initial firm (4 dummies) in 1996, mean log annual earnings over 1990 to 1996 (also interacted with age) and the change in log earnings over the period 1990 to 1996.

The vector of industry/occupation controls include the industry net capital stock, the industry share of production workers, the industry average log wage, the industry share of imported intermediate inputs in total intermediate consumption, the industry share of IT equipment in total domestic output, the industry share of computer equipment in total domestic output, import penetration by countries other than China (the EU), eight sub-sector dummies and three digit occupation dummies (more details to follow). All of our controls are measured for 1996. Standard errors are clustered at the 3-digit industry level.

Following ADHS (2013) we model the cumulative shock due to trade exposure as a function of import penetration ratio in 1996 (the initial condition) plus the subsequent growth in import penetration ratio over 1996 to 2011 (the average annual change). The biggest challenge in estimating equation (3) is that industries that face increasing import competition might be exposed to other shocks that could be wrongly attributed to trade. To control for such confounding factors, we include a large set of industry and occupation (initial-year) controls observed in 1996. Our main specification includes the industry net capital stock, the industry share of IT equipment in total domestic output, the industry share of computer equipment in total domestic output and the industry share of production workers in employment, all of which might indicate the degree of industry exposure to technical change (Doms, Dunne, and Troske, 1997; Autor, Katz, and Krueger, 1998). Moreover, the specification includes the industry share of imported intermediate inputs in total intermediate consumption (as in Feenstra and Hanson, 1999) and import penetration by countries other than China (the EU) in order to capture overall industry exposure to trade in final goods and offshoring. Finally, we also include the industry average log wage, eight sub-sector dummies and three digit occupation dummies.

Implicitly our analysis compares workers with similar individual characteristics, similar initial earnings, similar initial experience on the job, similar initial employer size, who are initially employed in similar occupation and with similar average industry characteristics, some of whom work in industries that face subsequent increases in trade competition and some of whom do not.
6 The Labour Market Effect of Increased Exposure to Import Competition from China

6.1 Baseline Results

Table 1 presents our estimates for the relationship between UK gross import exposure from China and cumulative earnings over 1997 to 2011. Initially we restrict the sample to full time workers (as noted in section 5.1). We regress cumulative earnings on the change in gross import penetration from China and a full set of birth-year dummies to account for life-cycle variations in earnings. Column 1 provides the OLS estimates and column 2 the 2SLS estimates using the variable defined in equation (2) as our instrument. In both columns, we find a negative and statistically significant relationship between the change in gross import penetration and cumulative earnings over 1997 to 2011. Thus, higher exposure to gross import competition from China (based on a worker’s initial industry) is related to lower cumulative earnings over the subsequent 15 years.

In order to quantify our results we compare a manufacturing worker at the 75\textsuperscript{th} percentile of the change in trade exposure with a manufacturing worker at the 25\textsuperscript{th} percentile. The value of the change in gross import penetration from China is 0.26 percentage points at the 25\textsuperscript{th} percentile and is 5.51 percentage points at the 75\textsuperscript{th} percentile. So using column 1, the implied differential for a reduction in earnings over the 15 year sample period, between workers at the 75\textsuperscript{th} percentile relative to the 25\textsuperscript{th} percentile is 52.2\% of initial annual earnings.\textsuperscript{13} Using the 2SLS estimates from column 2, the implied differential increases slightly to 55.7\% of initial annual earnings.\textsuperscript{14} The 2SLS estimate is similar to the OLS estimate suggesting that the potential positive correlation between UK industry import demand shocks and UK industry labour demand is not that severe.

In the three subsequent columns, we add controls for whether the worker is female (column 3), the size of the worker’s initial firm and the worker’s work experience at the initial firm (column 4). We also add controls for the worker’s earnings histories (column 5) including their mean log annual earnings and the change in their log earnings over the period 1990 to 1996. Overall, the inclusions of those controls have little impact on the estimates and on the implied earnings differentials, except for the inclusion of the gender dummy.

In order to control for cross-industry heterogeneity in exposure to other shocks that might be confounded with import shocks, we add an extensive list of industry and occupation-level control variables in the four subsequent columns. Column 6 includes the initial gross import penetration from China and from all other countries except China to account for overall industry exposure to trade in final goods. In column 7, we add initial industry controls such as average industry log wage, industry net capital stock, industry share of IT equipment in total domestic output, industry share of computer equipment in total domestic output and industry share of production workers in employment, all of which might indicate the degree of

\textsuperscript{13} The computation is $9.938 \times (5.51 - 0.26) = 52.17$.

\textsuperscript{14} The computation is $10.607 \times (5.51 - 0.26) = 55.69$. 

industry exposure to technical change (Doms et al., 1997; Autor et al., 1998). Moreover, column 7 includes the industry share of imported intermediate inputs in total intermediate consumption (as in Feenstra and Hanson, 1999) which (roughly) which controls for industry exposure to offshoring. Column 8 adds three-digit level occupation dummies and thus in this column we are comparing the outcomes of manufacturing workers who are initially working in different jobs within the same occupation. Finally, column 9 adds dummies for eight manufacturing sub-sectors, so that we are comparing outcomes for manufacturing workers who are initially working in different industries within the same sub-sector. This is our preferred specification and provides an estimate of -7.08 which is strongly significant. The first stage is also strong and demonstrates an F-statistic of 59.81 supporting the use of Chinese imports to other high income countries as an instrument for Chinese imports to the UK.

From column 9 the implied differential for a reduction in earnings over the 15 year sample period, between workers at the 75th percentile relative to the 25th percentile is 37.2%. This is very similar to that found by ADHS (2013) even though our estimate compares workers within three digit occupation. For the US, ADHS (2013) find an implied differential for a reduction in earnings over 16 years, between workers at the 75th percentile relative to the 25th percentile of around 46%.

As an alternative labour market outcome measure we use the number of years (between 1997 and 2011) that workers have experienced non-zero earnings. The intention here is to roughly capture the extensive margin of employment. If an individual works a single day in a year, they will have non-zero earnings in that year. Consequently, any periods of unemployment that are less than a year in duration are unobserved. The specifications in columns 1 to 9 of Table 2 are directly comparable to those in Table 1. Again, we find a strongly significantly negative relationship between the change in gross import exposure and years of non-zero earnings. Again column 9 is our preferred specification and this implies that Chinese import exposure reduces subsequent employment. The employment differential for a manufacturing worker at the 75th percentile of import exposure relative to a worker at the 25th percentile is 15.3% of a year, which is 56 days or 8 weeks during the 15-year sample period.

In Table 3, we further consider three additional outcome measures, namely cumulative earnings per year, cumulative hourly pay (which captures the intensive margin of gross annual earnings) and cumulative hours of work (i.e. cumulative number of hours employed, which better captures the extensive margin of gross annual earnings). We also now consider changes in net import penetration (rather than gross import penetration) from China in the

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15 The inclusion of the industry dummies in column 9 does substantially change the estimates. The coefficient on the change in gross import penetration from China in column 9 is roughly 30% lower than that in column 8 suggesting, that even controlling for input intensity use, a lot of variation remains. Also the coefficient on the change in import exposure from column 9 is smaller than that from column 2 whereas ADHS (2013) find the converse. This suggests that conditional on our demographic measures, workers with lower potential earnings are initially employed in industries that experienced higher subsequent import exposure.

16 If we use Chinese imports to the EU as an instrument we obtain a first stage F-Statistic of 17.10 (0.0001) with a parameter estimate (standard error) on the change of Chinese imports to the UK of -7.09 (3.09).

17 The computation is 2.904*(5.51-0.26) = 15.25.
lower panel. Focusing first on the upper panel, we can see that increased gross import exposure has a negative and significant impact on cumulative earnings per year (column 3), on cumulative hourly pay (column 4) and on cumulative hours of work (column 5), with a bigger magnitude on the cumulative wage than on cumulative hours of work. Indeed, the implied reduction in total wage earnings for a manufacturing worker at the 75th percentile of import exposure relative to a worker at the 25th percentile is 48% of initial total wage (in 1996), whereas the fall in employment is 27.6% of the total number of hours worked in 1996. This suggests that adjustment is more severe at the intensive margin relative to the extensive margin. To account for the potential new export opportunities that China’s economic opening might offer (which might temper some of the loss incurred by gross import competition), the lower panel shows that for net imports each point estimate is larger (in absolute value). This suggests that what really hurts UK manufacturing workers is the difference in the nature of imports and exports.

In order to explore the dynamics within our observed period, we again follow ADHS (2013) by plotting the estimated impact of gross import exposure on specific worker outcomes by year for the years 1993 through 2011 using our preferred specification. The upper panel in Figure 8 illustrates the estimated impact of gross import exposure on worker earnings per year on average. As expected, the trade effects are zero before the trade shock in 1996. But thereafter trade exposure has an adverse effect on earnings in every year between 1996 and 2011, although this does exhibit some degree of convergence after approximately eight years. The second panel provides the results for the probability of having non-zero earnings in each year. This suggests a similar pattern to earnings loss which again starts to converge back to zero after around eight years. This is contrary to the findings for the US. Figure 3 in ADHS (2013) shows accelerating decline of earnings and employment after 2001. The third panel provides earnings losses for a sub-sample of workers who never exhibit zero earnings. For these workers, relative earnings continue to decline, with no signs of convergence.

Figure 9 plots hourly pay by year (upper panel) and hours of work by year (lower panel). For both we can see that rising imports from China adversely affect annual wages and employment for the entire sample period, with wages suffering slightly more than employment. Interestingly, both wages and employment seem to stabilize from 2000 onwards.

### 6.2 Results by One-Digit Occupation

One advantage that the NESPD has over the data used in ADHS (2013) is that it contains information on the occupations of workers. So we are able to look at trade exposure effects separately by occupation. Table 4 provides estimates for gross import exposure from China on our five main worker outcome measures (as per the upper panel of Table 3) estimated separately by one-digit occupation. In order to maintain sensible sample sizes it was necessary to combine personal service occupations, sales and customer service and elementary occupations into one composite group. This provides seven one-digit occupation groups for managers, professionals, associate professionals, clerical/secretarial, skilled trades, plant/machine operators and personal/sales/elementary occupations. In column 1 increased
trade exposure adversely affects the cumulative earnings of managers, professionals, associate professionals and plant operators. The largest is for associate professionals, leading to an implied reduction in earnings of more than 160% of initial earnings for a worker at the 75th percentile of import exposure relative to a worker at the 25th percentile.

In column 4, the adverse effect on hourly wages is more severe for the three top occupation groups (managers, professionals and associate professionals) relative to less “skill-oriented” occupations (clerical, skilled trades, plant operators and elementary occupations). Again, associate professionals experience the biggest reduction in cumulative wages, with an implied differential of over 200% of total wage in 1996. However, as seen in column 5, this group’s hours of work increase in response to rising trade competition from China, offsetting part of the loss in wages. The findings suggest that associate professionals earned less and worked more. It could be that their wages initially fell in response to increased import competition, but then employment adjusted to offset some of the loss incurred. However, if both margins drop simultaneously then the rise in employment is not an offsetting process stemming from the fall in wages, but instead is driven directly by rising Chinese competition. These results are consistent with those found in the US since Autor, Dorn and Hanson (2013b) also find large negative effects from Chinese trade competition on US non-production jobs. In this paper they explore the effects of technology and trade on employment in US local labour markets and find that Chinese import competition has an adverse employment effect on non-production workers (alongside a less surprising negative employment effect on production workers).18

Again we can plot the estimated impact of gross import exposure on specific worker outcomes by year for each occupation group, although we can only look at earnings and non-zero probabilities as a consequence of smaller sample sizes. The upper panel in Figure 10 supports the findings of Table 4 since trade exposure has the largest adverse effect on earnings for managers, professionals, associate professionals and elementary jobs. The lower panel shows that the decline in earnings is partly due to a rise in zero-earnings years for each occupation group, with machine operators being the only exception. Interestingly, both the earnings and the probability of being in employment never fully converge for professionals, associate professionals and elementary workers. This is not the case for managers whose earnings and employment likelihood seem to converge to zero in 2011.

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18 See their Table 4 on page 20.
Table 1: Gross Imports from China and Cumulative Earnings 1997-2011 for Full Time Workers: OLS and 2SLS Estimates

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>(ΔChina Imports)/UK Consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.889)</td>
<td>(3.232)</td>
</tr>
<tr>
<td>(China Imports_96)/UK Consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>96</em></td>
<td>-9.171*</td>
<td>-10.603*</td>
</tr>
<tr>
<td>(Non-China Imports_96)/UK Consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>96</em></td>
<td>1.167**</td>
<td>1.408*</td>
</tr>
<tr>
<td></td>
<td>(0.704)</td>
<td>(0.724)</td>
</tr>
</tbody>
</table>

Birth Year Dummies  Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  |
Gender               Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  |
Firm Size & Job Tenure Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  |
Earnings History        Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  |
Industry Controls        Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  |
Three Digit Occupation Dummies |   |       |       |       |       |       |       |       |       |
8 Sub-Sector Dummies     | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  | Yes  |

Difference for the change in IP at the 75th relative to the 25th percentile
-0.522 | -0.557 | -0.450 | -0.439 | -0.489 | -0.547 | -0.515 | -0.558 | -0.372

Notes: For a sample of 16,573 workers age 22-64 and born between 1947 and 1975, with non-zero earnings in 1992-1994 and 1995-1997. All regressions include a constant and birth dummies. Where * (**) denotes statistically significant at the 5 (10) percent level. Robust standard errors are clustered on start of period 3 digit industry. Using change in trade exposure from China with respect to the Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain and Switzerland over the period 1996-2011 (with initial absorption in 1992) as an instrument for the change in trade exposure from China with respect to the UK over the period 1996-2011. The mean (standard deviation) of (ΔChina Imports)/UK Consumption_96 is 0.0578 (0.0927), whilst the median is 0.0222, the value at the 25th percentile is 0.0026 and the 75th percentile is 0.0551. The F-Statistics (P-Values) for the statistical significance of the instrument in the first stage range from 31.14 (0.000) for the first column to 59.81 (0.000) in the final column.
Table 2: Gross Imports from China and Years of Non-Zero Earnings 1997-2011 for Full Time Workers: OLS and 2SLS Estimates

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>(ΔChina Imports)/UK Consumption\textsubscript{96}</td>
<td>-4.815*</td>
<td>-5.523*</td>
</tr>
<tr>
<td></td>
<td>(1.303)</td>
<td>(1.583)</td>
</tr>
<tr>
<td>(China Imports\textsubscript{96})/UK Consumption\textsubscript{96}</td>
<td>-2.259</td>
<td>-4.038*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Non-China Imports\textsubscript{96})/UK Consumption\textsubscript{96}</td>
<td>0.224</td>
<td>0.493</td>
</tr>
<tr>
<td>Birth Year Dummies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Gender</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm Size &amp; Job Tenure</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Earnings History</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three Digit Occupation Dummies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>8 Sub-Sector Dummies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference for the change in IP at the 75\textsuperscript{th} relative to the 25\textsuperscript{th} percentile</td>
<td>-0.253</td>
<td>-0.290</td>
</tr>
</tbody>
</table>

Notes: For a sample of 16,573 workers age 22-64 and born between 1947 and 1975, with non-zero earnings in 1992-1994 and 1995-1997. All regressions include a constant and birth dummies. Where * (**) denotes statistically significant at the 5 (10) percent level. Robust standard errors are clustered on start of period 3 digit industry. Using change in trade exposure from China with respect to the Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain and Switzerland over the period 1996-2011 (with initial absorption in 1992) as an instrument for the change in trade exposure from China with respect to the UK over the period 1996-2011. The mean (standard deviation) of (ΔChina Imports)/UK Consumption\textsubscript{96} is 0.0578 (0.0927), whilst the median is 0.0222, the value at the 25th percentile is 0.0026 and the 75th percentile is 0.0551.
Table 3: Gross and Net Imports from China 1997-2011 for Full Time Workers: 2SLS Estimates for Various Labour Market Outcomes.

<table>
<thead>
<tr>
<th></th>
<th>Cumulative Annual Earnings (1)</th>
<th>Years of Non-Zero Earnings (2)</th>
<th>Cumulative Annual Earnings/Year (3)</th>
<th>Cumulative Hourly Pay (4)</th>
<th>Cumulative Hours of Work (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross Imports:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ΔChina Imports)/UK Consumption&lt;sub&gt;96&lt;/sub&gt;</td>
<td>-7.079* (2.919)</td>
<td>-2.904* (1.209)</td>
<td>-1.601* (0.606)</td>
<td>-9.144* (3.601)</td>
<td>-5.256* (2.115)</td>
</tr>
<tr>
<td>Differential for the change in IP at the 75th relative to the 25th Percentile</td>
<td>-0.372</td>
<td>-0.153</td>
<td>-0.084</td>
<td>-0.480</td>
<td>-0.276</td>
</tr>
<tr>
<td><strong>Net Imports:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ΔChina Net Imports)/UK Consumption&lt;sub&gt;96&lt;/sub&gt;</td>
<td>-8.940* (3.563)</td>
<td>-3.961* (1.467)</td>
<td>-2.045* (0.730)</td>
<td>-13.110* (4.627)</td>
<td>-8.577* (2.384)</td>
</tr>
<tr>
<td>Differential for the change in IP at the 75th relative to the 25th Percentile</td>
<td>-0.423</td>
<td>-0.187</td>
<td>-0.097</td>
<td>-0.620</td>
<td>-0.406</td>
</tr>
</tbody>
</table>

Notes: For a sample of 16,573 workers age 22-64 and born between 1947 and 1975, with non-zero earnings in 1992-1994 and 1995-1997. All regressions include a constant and birth dummies. Where * (**) denotes statistically significant at the 5 (10) percent level. Robust standard errors are clustered on start of period 3 digit industry. Using change in trade exposure from China with respect to the Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain and Switzerland over the period 1996-2011 (with initial absorption in 1992) as an instrument for the change in trade exposure from China with respect to the UK over the period 1996-2011. The mean (standard deviation) of (ΔChina Imports)/UK Consumption<sub>96</sub> is 0.0578 (0.0927), whilst the median is 0.0222, the value at the 25th percentile is 0.0026 and the 75th percentile is 0.0551. The mean (standard deviation) of (ΔChina Net Imports)/UK Consumption<sub>96</sub> is 0.0468 (0.0966), whilst the median is 0.0121, the value at the 25th percentile is 0.0007 and the 75th percentile is 0.0480. The F-Statistics (P-Values) for the statistical significance of the instrument in the first stage for net imports is 18.52 (0.000).
Table 4: Gross Imports from China 1997-2011 for Full Time Workers: 2SLS Estimates by One Digit Occupation.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>N</th>
<th>F-Stat</th>
<th>Cumulative Annual Earnings</th>
<th>Years of Non-Zero Earnings</th>
<th>Cumulative Earnings/Year</th>
<th>Annual Hourly Pay</th>
<th>Cumulative Hours of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>2189</td>
<td>47.74 (0.000)</td>
<td>-10.588* (4.987)</td>
<td>-6.679* (2.212)</td>
<td>-2.769* (1.126)</td>
<td>-21.935* (7.766)</td>
<td>-12.336* (4.086)</td>
</tr>
<tr>
<td>Professionals</td>
<td>942</td>
<td>47.41 (0.000)</td>
<td>-31.366* (12.118)</td>
<td>-7.725* (3.354)</td>
<td>-4.502* (2.119)</td>
<td>-19.521** (11.138)</td>
<td>-10.511* (5.174)</td>
</tr>
<tr>
<td>Associate Professionals</td>
<td>920</td>
<td>32.56 (0.000)</td>
<td>-30.604** (16.362)</td>
<td>-13.625* (4.735)</td>
<td>-5.736* (2.544)</td>
<td>-39.548* (14.765)</td>
<td>18.947* (7.368)</td>
</tr>
<tr>
<td>Clerical/Secretarial</td>
<td>1729</td>
<td>26.54 (0.000)</td>
<td>-6.641 (7.325)</td>
<td>-4.625** (2.727)</td>
<td>-2.642* (1.190)</td>
<td>-6.928 (6.524)</td>
<td>-6.099** (3.124)</td>
</tr>
<tr>
<td>Skilled Trades</td>
<td>4026</td>
<td>20.06 (0.000)</td>
<td>-8.891 (5.519)</td>
<td>-4.283* (2.013)</td>
<td>-1.866* (0.866)</td>
<td>-8.253 (7.772)</td>
<td>-2.710 (4.126)</td>
</tr>
<tr>
<td>Plant/Machine Operators</td>
<td>5592</td>
<td>74.95 (0.000)</td>
<td>-8.885* (3.981)</td>
<td>-0.843 (1.516)</td>
<td>-0.665 (0.675)</td>
<td>-6.431 (4.453)</td>
<td>-3.887 (2.754)</td>
</tr>
<tr>
<td>Personal/Sales/Elementary Occupations</td>
<td>1175</td>
<td>6.54 (0.000)</td>
<td>31.592 (22.279)</td>
<td>-9.728** (5.004)</td>
<td>-7.244** (4.051)</td>
<td>24.415 (19.398)</td>
<td>-18.122** (10.228)</td>
</tr>
</tbody>
</table>

Notes: See Table 3. The differential for the change in IP at the 75th relative to the 25th percentile are in square brackets.
Figure 8: Year-by-Year Regression Results for Main Outcomes, 1993-2011
Figure 9: Year-by-Year Regression Results for Additional Outcomes, 1993-2011
Figure 10: Year-by-Year Regression Results for Main Outcomes by One-Digit Occupation, 1993-2011

Earnings by Year

Prob Earnings > 0

7 The Labour Market Effect of Increased Exposure to Import Competition from the European Union

In this section we explore the nature of trade with China and compare that to trade with the EU. Figure 11 shows that UK bilateral trade patterns with China are mainly in the form of *inter*-industry trade, whereas Figure 12 shows that UK bilateral trade relationships with the EU are mainly in the form of *intra*-industry trade. This makes the EU an interesting point of reference, given that overall trade has increased in a similar way to that with China. This is also the case for the US (as shown in Figures A9 and A10 in the Appendix).

Figure 11: The Nature of Trade between the UK and China, 1988-2012

In order to compare the impact of import penetration from China with that from the EU we estimate our preferred specification for all five of our outcome variables further conditioning on the change in import penetration from the EU (over 1996 to 2011) and the import penetration from the EU in 1996. This is analogous to Table 3 where we look at gross imports in the upper panel and net imports in the lower panel. The upper panel in Table 5 shows that the impact of gross Chinese imports on all labour market outcomes is still negative and significant. However, these estimates are slightly lower than those in Table 3. Moreover, increased gross imports from the EU are associated with positive worker-level outcomes in all columns, although the estimates are not statistically significant for non-zero earnings (column 2), cumulative annual earnings per year (column 3) and cumulative hourly pay (column 5).

The estimates in the lower panel show that the adverse effect of net import competition from China is larger than for gross imports, confirming that UK industries have been exposed to a major rise in imports from China without a counterbalancing rise in demand for UK exports. Net import growth from the EU now implies negative exposure shocks, though these are
largely not statistically different from zero. Overall, the findings suggest that imports from the EU might not be a substitute to domestic production, but instead are complements.\footnote{We use the change in trade exposure from the EU with respect to non-UK OECD countries (i.e. Australia, Canada, Chile, Japan, Mexico, New Zealand, Republic of Korea, Switzerland and the US) as an instrument for the change in trade exposure from the EU with respect to the UK See Table A1 in the Appendix for which we use as an instrument the change in trade exposure from the EU with respect to Denmark. We find similar results.}

Figure 12: The Nature of Trade between the UK and the EU, 1988-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries. The EU 15 consists of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and Sweden.
Table 5: Imports from China, the EU and Cumulative Earnings and Hours 1997-2011 for Full Time Workers: 2SLS Estimates

<table>
<thead>
<tr>
<th></th>
<th>Cumulative Annual Earnings</th>
<th>Years of Non-Zero Earnings</th>
<th>Cumulative Annual Earnings/Year</th>
<th>Cumulative Hourly Pay</th>
<th>Cumulative Hours of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross Imports:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ΔChina Imports)/UK Consumption&lt;sub&gt;96&lt;/sub&gt;</td>
<td>-6.728* (2.552)</td>
<td>-2.744* (1.103)</td>
<td>-1.551* (0.542)</td>
<td>-6.930* (3.326)</td>
<td>-4.365* (1.728)</td>
</tr>
<tr>
<td>(ΔEU Imports)/UK Consumption&lt;sub&gt;96&lt;/sub&gt;</td>
<td>3.495* (1.334)</td>
<td>1.159 (0.467)</td>
<td>0.797 (0.251)</td>
<td>2.708 (1.333)</td>
<td>1.915** (0.745)</td>
</tr>
<tr>
<td>(China Imports&lt;sub&gt;96&lt;/sub&gt;/UK Consumption&lt;sub&gt;96&lt;/sub&gt;)</td>
<td>0.705 (4.758)</td>
<td>0.533 (1.858)</td>
<td>-0.143 (0.979)</td>
<td>-6.512 (12.178)</td>
<td>-2.022 (3.212)</td>
</tr>
<tr>
<td>(EU Imports&lt;sub&gt;96&lt;/sub&gt;/UK Consumption&lt;sub&gt;96&lt;/sub&gt;)</td>
<td>3.276 (2.011)</td>
<td>1.182 (0.790)</td>
<td>0.685** (0.397)</td>
<td>6.585 (4.561)</td>
<td>3.267* (1.393)</td>
</tr>
<tr>
<td>(Non-China Imports&lt;sub&gt;96&lt;/sub&gt;/UK Consumption&lt;sub&gt;96&lt;/sub&gt;)</td>
<td>-1.271 (1.072)</td>
<td>-0.575 (0.398)</td>
<td>-0.168 (0.222)</td>
<td>-2.430** (1.413)</td>
<td>-1.248* (0.619)</td>
</tr>
<tr>
<td><strong>Net Imports:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ΔChina Net Imports)/UK Consumption&lt;sub&gt;96&lt;/sub&gt;</td>
<td>-7.215** (4.255)</td>
<td>-3.557* (1.483)</td>
<td>-1.825** (0.967)</td>
<td>-10.239* (3.940)</td>
<td>-8.222* (2.137)</td>
</tr>
<tr>
<td>(ΔEU Net Imports)/UK Consumption&lt;sub&gt;96&lt;/sub&gt;</td>
<td>-6.020 (7.165)</td>
<td>-2.017 (2.463)</td>
<td>-1.488 (1.967)</td>
<td>-1.542 (6.005)</td>
<td>-0.374 (4.014)</td>
</tr>
<tr>
<td>(China Net Imports&lt;sub&gt;96&lt;/sub&gt;/UK Consumption&lt;sub&gt;96&lt;/sub&gt;)</td>
<td>8.473 (6.929)</td>
<td>3.511 (2.662)</td>
<td>2.161 (1.698)</td>
<td>11.540 (8.429)</td>
<td>5.395 (4.815)</td>
</tr>
<tr>
<td>(EU Net Imports&lt;sub&gt;96&lt;/sub&gt;/UK Consumption&lt;sub&gt;96&lt;/sub&gt;)</td>
<td>-2.386 (3.356)</td>
<td>1.079 (1.333)</td>
<td>-0.921 (0.851)</td>
<td>3.279 (6.144)</td>
<td>0.249 (2.463)</td>
</tr>
<tr>
<td>(Non-China Net Imports&lt;sub&gt;96&lt;/sub&gt;/UK Consumption&lt;sub&gt;96&lt;/sub&gt;)</td>
<td>0.256 (1.299)</td>
<td>0.318 (0.444)</td>
<td>0.128 (0.324)</td>
<td>0.698 (1.316)</td>
<td>0.799 (0.751)</td>
</tr>
</tbody>
</table>

Notes: For a sample of 16,570 workers age 22-64 and born between 1947 and 1975, with non-zero earnings in 1992-1994 and 1995-1997. All regressions include a constant and birth dummies. Where * (**) denotes statistically significant at the 5 (10) percent level. Robust standard errors are clustered on start of period 3 digit industry. Using change in trade exposure from China with respect to the Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain and Switzerland over the period 1996-2011 (with initial absorption in 1992) as an instrument for the change in trade exposure from China with respect to the UK over the period 1996-2011. Using change in trade exposure from the EU with respect to the Other OECD countries (Australia, Canada, Chile, Japan, Mexico, New Zealand, Republic of Korea, Switzerland and the US) over the period 1996-2011 (with initial absorption in 1992) as an instrument for the change in trade exposure from the EU with respect to the UK over the period 1996-2011. The F-Statistics (P-Values) for the statistical significance of the instrument in the first stage are 31.12 (0.000) and 16.93 (0.000) for China and EU gross imports respectively, whilst they are 9.99 (0.000) and 4.90 (0.009) for China and EU net imports.
8 Conclusion

The emergence of low and middle-income countries in the global economic landscape, mainly driven by China’s transition to a market-oriented economy, has revived academic interest in the effects of trade competition on worker adjustment. China is an economy that converges toward the global technology frontier in response to major changes in domestic policy. Using a unique longitudinal dataset of individual worker characteristics for the UK over an extended period of time, we exploit this recent surge in exports from low and middle-income countries to analyse how UK manufacturing workers adjust to trade competition.

The UK’s close trade ties with the EU had a sizable impact on its labour market. Indeed, as trade theory predicts, trade with countries of any income level may affect domestic workers, although the impact largely depends on the nature of trade and where the imports originate from. We provide unique evidence that the effects of import competition from the EU did not have an adverse effect on the labour market outcomes of UK workers, and moreover may even have had a complementary effect. This is largely a consequence of that nature of trade being *intra* rather than *inter*-industry. Conversely trade exposure from China has led to lower cumulative earnings and hours of work between 1997 and 2011. The implied differential for a reduction in earnings over the 15 year sample period, between workers at the 75th percentile of industry trade exposure relative to workers at the 25th percentile is 37.2% of initial annual earnings. Employment is lower by 15.3% a year, which is equivalent to 56 days or 8 weeks lost over the full 15-year sample period.

The impact of trade competition differs across occupation groups, which highlights the great heterogeneity in trade adjustment by job characteristics. Occupations such as managers, professionals, associate professionals and elementary production are most adversely affected by the rise in Chinese imports. Somewhat unexpectedly we find that the adverse effects of increased imports from China are most pronounced among “white-collar” jobs, with associate professionals experiencing the largest decline in wage trajectories, though these are partly offset by a subsequent increases in hours of work.
9 References


10 Appendix

10.1 Extra Figures and Tables

Figure A1: The Proportion of Total Trade between the UK and China, 1988-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries.

Figure A2: Trade between the US and China, 1989-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries.
Figure A3: The Proportion of Total Trade between the US and China, 1989-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries.

Figure A4: The Proportion of Total Trade between the UK and EU15, 1988-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries. UK is omitted from the EU15
Figure A5: Trade between the US and the EU, 1989-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries. EU15 contains UK

Figure A6: The Proportion of Total Trade between the US and the EU, 1988-2012

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries. EU15 contains UK
Figure A7: The Change in Imports from China to the US, 1996-2011

Figure A8: The Change in Imports from the EU to the US, 1996-2011
Figure A9: The Nature of Trade between the US and China, 1989-2012.

Figure A10: The Nature of Trade between the US and the EU, 1989-2012.

Notes: Using data from Comtrade for 166 consistently defined manufacturing industries. The EU 15 consists of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.
Figure A11: The share of manufacturing employment in UK, 1994-2011

Table A1: Imports from China and the EU and Cumulative Earnings and Hours 1997-2011 for Full Time Workers: 2SLS

<table>
<thead>
<tr>
<th>Gross Imports:</th>
<th>Cumulative Annual Earnings</th>
<th>Years of Non-Zero Earnings</th>
<th>Cumulative Annual Earnings/Year</th>
<th>Cumulative Hourly Pay</th>
<th>Cumulative Hours of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ΔChina Imports)/UK Consumption_{96}</td>
<td>-6.751* (2.544)</td>
<td>-2.743* (1.097)</td>
<td>-1.531* (0.543)</td>
<td>-6.952* (3.358)</td>
<td>-4.404* (1.692)</td>
</tr>
<tr>
<td>(ΔEU Imports)/UK Consumption_{96}</td>
<td>3.728* (1.857)</td>
<td>1.155 (0.759)</td>
<td>0.591 (0.359)</td>
<td>2.928 (2.596)</td>
<td>2.302** (1.388)</td>
</tr>
<tr>
<td>(China Imports_{96})/UK Consumption_{96}</td>
<td>0.995 (4.644)</td>
<td>0.528 (1.781)</td>
<td>0.400 (0.979)</td>
<td>-6.237 (12.877)</td>
<td>-1.538 (3.270)</td>
</tr>
<tr>
<td>(EU Imports_{96})/UK Consumption_{96}</td>
<td>3.395 (2.196)</td>
<td>1.179 (0.866)</td>
<td>0.579 (0.408)</td>
<td>6.698 (4.349)</td>
<td>3.466* (1.557)</td>
</tr>
<tr>
<td>(Non-China Imports_{96})/UK_{96}</td>
<td>1.321 (1.129)</td>
<td>-0.574 (0.402)</td>
<td>-0.124 (0.199)</td>
<td>2.477** (1.302)</td>
<td>-1.331* (0.663)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Net Imports:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(ΔEU Net Imports)/UK Consumption_{96}</td>
<td>-0.538 (8.303)</td>
<td>1.443 (3.213)</td>
<td>-0.704 (2.043)</td>
<td>17.216 (14.812)</td>
<td>2.875 (6.647)</td>
</tr>
<tr>
<td>(China Net Imports_{96})/UK Consumption_{96}</td>
<td>5.141 (6.298)</td>
<td>1.408 (2.531)</td>
<td>1.685 (1.403)</td>
<td>0.147 (10.245)</td>
<td>3.422 (4.810)</td>
</tr>
<tr>
<td>(EU Net Imports_{96})/UK Consumption_{96}</td>
<td>0.062 (4.337)</td>
<td>0.467 (1.752)</td>
<td>-0.571 (0.984)</td>
<td>11.654 (10.132)</td>
<td>1.699 (3.421)</td>
</tr>
<tr>
<td>(Non-China Net Imports_{96})/UK_{96}</td>
<td>0.818 (1.314)</td>
<td>0.672 (0.535)</td>
<td>0.208 (0.331)</td>
<td>2.623 (2.106)</td>
<td>1.133 (1.091)</td>
</tr>
</tbody>
</table>

Notes: For a sample of 16,570 workers age 22-64 and born between 1947 and 1975, with non-zero earnings in 1992-1994 and 1995-1997. All regressions include a constant and birth dummies. Where * (**) denotes statistically significant at the 5 (10) percent level. Robust standard errors are clustered on start of period 3 digit industry. Using change in trade exposure from China with respect to the Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain and Switzerland over the period 1996-2011 (with initial absorption in 1992) as an instrument for the change in trade exposure from China with respect to the UK over the period 1996-2011. Using change in trade exposure from the EU with respect to the Denmark over the period 1996-2011 (with initial absorption in 1992) as an instrument for the change in trade exposure from the EU with respect to the UK over the period 1996-2011. The F-Statistics (P-Values) for the statistical significance of the instrument in the first stage are 28.08 (0.000) and 11.11 (0.000) for China and EU gross imports respectively, whilst they are 9.25 (0.000) and 2.34 (0.099) for China and EU net imports.
<table>
<thead>
<tr>
<th>Table A2: Descriptive Statistics.</th>
<th>Main Sample</th>
<th>Sample for China and EU Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trade Exposure 1997-2011</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>((\Delta \text{China Imports})/\text{UK Consumption}_{96})</td>
<td>0.0578 (0.0927)</td>
<td>0.0578 (0.0922)</td>
</tr>
<tr>
<td>P10 - P90 Interval</td>
<td>[0.0067, 0.1861]</td>
<td>[0.0067, 0.1861]</td>
</tr>
<tr>
<td>P25 - P75 Interval</td>
<td>[0.0026, 0.0551]</td>
<td>[0.0026, 0.0551]</td>
</tr>
<tr>
<td>((\Delta \text{EU Imports})/\text{UK Consumption}_{96})</td>
<td>0.0505 (0.2029)</td>
<td></td>
</tr>
<tr>
<td>P10 - P90 Interval</td>
<td>[-0.0600, 0.1682]</td>
<td></td>
</tr>
<tr>
<td>P25 - P75 Interval</td>
<td>[-0.0003, 0.0893]</td>
<td></td>
</tr>
<tr>
<td>((\text{China Imports}<em>{96})/\text{UK Consumption}</em>{96})</td>
<td>0.0062 (0.0647)</td>
<td>0.0062 (0.0647)</td>
</tr>
<tr>
<td>((\text{EU Imports}<em>{96})/\text{UK Consumption}</em>{96})</td>
<td>0.1938 (0.2895)</td>
<td></td>
</tr>
<tr>
<td>((\text{Non-China Imports}<em>{96})/\text{UK}</em>{96})</td>
<td>0.3451 (0.4766)</td>
<td>0.3451 (0.4766)</td>
</tr>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative Annual Earnings</td>
<td>12.863 (12.787)</td>
<td>12.863 (12.787)</td>
</tr>
<tr>
<td>Years of Non-Zero Earnings</td>
<td>6.598 (4.603)</td>
<td>6.598 (4.603)</td>
</tr>
<tr>
<td>Cumulative Annual Earnings/Year</td>
<td>3.308 (2.423)</td>
<td>3.308 (2.423)</td>
</tr>
<tr>
<td>Cumulative Hourly Pay</td>
<td>15.746 (22.133)</td>
<td>15.746 (22.133)</td>
</tr>
<tr>
<td>Cumulative Hours of Work</td>
<td>9.563 (9.032)</td>
<td>9.562 (9.032)</td>
</tr>
<tr>
<td><strong>Worker Characteristics</strong></td>
<td></td>
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</tr>
<tr>
<td>Female</td>
<td>0.244 (0.429)</td>
<td>0.244 (0.429)</td>
</tr>
<tr>
<td>Age</td>
<td>36.34 (7.475)</td>
<td>36.34 (7.475)</td>
</tr>
<tr>
<td>Employees in Firm 1-99</td>
<td>0.2514 (0.4338)</td>
<td>0.2512 (0.4337)</td>
</tr>
<tr>
<td>Employees in Firm 100-499</td>
<td>0.2679 (0.4429)</td>
<td>0.2680 (0.4429)</td>
</tr>
<tr>
<td>Employees in Firm 500-999</td>
<td>0.1243 (0.3299)</td>
<td>0.1243 (0.3299)</td>
</tr>
<tr>
<td>Employees in Firm &gt; 500</td>
<td>0.3564 (0.4789)</td>
<td>0.3564 (0.4789)</td>
</tr>
<tr>
<td>Job Tenure 0-1 year</td>
<td>0.0575 (0.2330)</td>
<td>0.0575 (0.2330)</td>
</tr>
<tr>
<td>Job Tenure 2-5 years</td>
<td>0.3602 (0.4801)</td>
<td>0.3602 (0.4801)</td>
</tr>
<tr>
<td>Job Tenure 6-10 years</td>
<td>0.4779 (0.4995)</td>
<td>0.4779 (0.4995)</td>
</tr>
<tr>
<td>Job Tenure &gt; 11 years</td>
<td>0.1043 (0.3056)</td>
<td>0.1043 (0.3056)</td>
</tr>
<tr>
<td>Average log wages 1990-1996</td>
<td>7.975 (1.967)</td>
<td>7.975 (1.967)</td>
</tr>
<tr>
<td>N</td>
<td>16573</td>
<td>16570</td>
</tr>
</tbody>
</table>
10.2 Mapping trade products to industries: from SITC revision 3 to UKSIC 1992 revision

The aim is to carry out extensive analysis using trade data classified by the UK Standard Industrial Classification, revised in 1992 (UKSIC(92)) at the finest, five-digit level of disaggregation.

To perform such a correspondence, we used one existing official (administrative) concordance table that matches 8-digit Combined Nomenclature 2002 codes (CN 2002) with 6-digit Classification of Products by Activity 2002 codes (CPA 2002), with 6-digit Harmonized System 2002 (HS 2002) and also with 5-digit SITC rev3 (SITC3) codes. Therefore, CN 2002, and at a lesser extend HS 2002, serve as “proxy” classifications that linked SITC3 to UKSIC(92). Indeed, CPA 2002 is identical to NACE 1.0, on which UKSIC(92) is built. Therefore, CPA 2002 and UKSIC(92) are identical up to the 4-digit level (with some exceptions).

This CN-HS-CPA-SITC concordance table was built by EuroStat by putting in correspondence several existing official tables. The concordances were created by electronic means and have not been thoroughly checked or validated by any organization or working party. As a consequence no guarantee can be given as to their full reliability. However, it is a valuable starting point and it serves as an input file which forms the skeleton of the SITC3-UKSIC(92) concordance.

The strategy is then based on two steps. The first step is to build a correspondence table going from SITC3, at five-digit, to CPA 2002, at 6-digit using information from CN-SITC3, CN-CPA, HS-SITC3 and HS-CPA tables. Some SITC3 products couldn’t be fairly allocated to a single 6-digit CPA code, so some SITC3 products are matched to a 5-digit CPA code. In cases where it was needed to improve the appropriateness and precision of the allocation, we also used an additional table that linked 8-digit (and not 6-digit as before) HS 2002 codes to 6-digit CPA codes.

The second step involves converting those 6-digit CPA codes to 5-digit UKSIC(92) activities. With few exceptions, CPA 2002 and UKSIC(92) are identical up to the fourth digit. As a consequence, and again with few exceptions, 6-digit CPA codes within any fourth digit, are embedded, by construction, within the corresponding UKSIC(92) 4-digit activity. From that, we can allocate the vast majority of 6-digit CPA codes to 5-digit UKSIC(92) activities (see below for the list of exceptions).

The result gives us 3121 SITC Rev 3 codes each with a given 5-digit UKSIC(92); 283 sectors in total, among which 251 are manufacturing sectors. The remaining 32 sectors are mainly comprised into “Mining and Quarrying”.
10.2.1 Limitations

No SITC products are left unmatched but two exceptions; SITC codes 91100 (postal packages not classified according to kind) and 93100 (special transactions and commodities not classified according to kind) have no corresponding codes with CPA 2002 or even with different revisions of HS and CN classifications. Therefore, those codes have a corresponding SIC missing code represented by “.” in the concordance table.

Unfortunately, not every UKSIC(92) manufacturing sectors are matched. Indeed, the list below shows the ones that are not.

- 17.13: preparation and spinning of worsted-type fibres;
- 17.23: worsted-type weaving;
- 22.21: printing of newspaper;
- 22.23: bookbinding and finishing;
- 22.25: Other activities related to printing;
- 22.3: reproduction of recorded media;
- 27.35: Other first processing of iron and steel not elsewhere classified; production of non-ECSC ferro-alloys;
- 27.5: casting of metals;
- 28.4: forging, pressing, stamping and roll forming of metal; powder metallurgy;
- 28.5: treatment and coating of metals; general mechanical engineering;
- 33.3: industrial process control equipment;
- 37: recycling.

The main reason for the non-matching (except for codes 17.13, 17.23 and 27.35) is that the corresponding CPA codes (thus identical to UKSIC(92)) have been found to have no match at all with any HS or CN classification, since they mainly consist of related services linked to the corresponding activities (see the CPA 2002 structure). For codes 17.13 and 17.23, the reason is that the SITC3 classification does not distinguish between worsted-type fibres and other fibres made with other techniques. For code 27.35, we decided to allocate those to code 27.10; we did that as a matter of consistency across the different correspondence and correlation tables built. To be more precise, 27.35 no longer exists in UKSIC(2003), it is allocated into 27.10. Therefore in the correspondence table matching sectors from UKSIC(2003) to UKSIC(1992), 27.35 cannot be matched since it is incorporated into 27.10 in UKSIC(2003).

Moreover, 10 4-digit UKSIC(92) manufacturing sectors couldn’t be broken further down into their fifth digit because of the SITC3 classification nature. Those sectors are:

- 15.13: production of meat and poultry meat products;
- 15.93: manufacture of wines;
- 15.94: manufacture of cider and other fruit wines;
- 23.20: manufacture of refined petroleum products;
- 24.30: manufacture of paints, varnishes and similar coatings, printing ink and mastics;
- 25.23: manufacture of builders’ ware of plastic;
- 29.12: manufacture of pumps and compressors;
- 33.20: manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment;
- 33.30: industrial process control equipment;
- 36.50: games and toys.

Finally, two pairs of 4-digit UKSIC(92) sectors have to be grouped together, again because of the SITC3 classification nature, it was impossible to distinguish them one from the other. Those sectors are:

- 15.81 and 15.82 grouped together into code number 15.81 in the table;
- 26.63 and 26.64 grouped together into code number 26.63 in the table.
10.3 Mapping industries consistently: from UKSIC 2007 revision to UKSIC 1992 revision

Since UKSIC has been updated twice since the 1992 version, we need to work with one consistent industry classification for all available years. The aim is to concord industries classified according to the 2007 or 2003 UKSIC versions into the 1992 UKSIC version. The classification has been revised in 2003 and 2007 (and one minor revision in 1997). The 2003 revision was not a full-scale change, so its structure is still tightly linked to the 1992 revision. In 2007, however, the structure of the classification has been revised in depth leading to major changes. So, we proceed first by mapping UKSIC 2007 industry codes to UKSIC 2003 ones and then we map UKSIC 2003 industry codes to corresponding UKSIC 1992 codes.

10.3.1 From UKSIC 2007 to UKSIC 2003

The crosswalk table is heavily built on the one provided by the Inter-Departmental Business Register (IDBR) from ONS. The ONS last update was done in December 2009 and no further updates are expected.

The table is a weighted correlation table that maps any UKSIC(2007) code to at least one corresponding UKSIC(2003) code at the 5-digit level. The weighted correlation table shows the level of change that might be expected at UKSIC level in employment data, turnover data (see the section “limitations”) and the number of businesses in percentage format following implementation of UKSIC(2007).

The table is based on data taken from the IDBR, which contains information on VAT traders and PAYE employers in a statistical register comprising of over 2 million enterprises. This dataset relates to a snapshot of VAT and/or PAYE registered businesses on the IDBR, taken in December 2009.

Some minor modifications have been made to the original IDBR table. Indeed, some UKSIC(2007) industries are absent from the original table and, thus, have been included in the current table. Those industries are:

- 01150: Growing of tobacco;
- 01230: Growing of citrus fruits;
- 01260: Growing of oleaginous fruits;
- 01280: Growing of spices, aromatic, drug and pharmaceutical crops;
- 05200: Mining of lignite;
- 07210: Mining of uranium and thorium ores;
- 10810: Manufacture of sugar;
- 17110: Manufacture of pulp;
- 24460: Processing of nuclear fuel;
- 64110: Central banking;
- 84210: Foreign affairs;
- 84230: Justice and judicial activities;
• 84240: Public order and safety activities;
• 84300: Compulsory social security activities;
• 97000: Activities of households as employers of domestic personnel;
• 98100: Undifferentiated goods-producing activities of private households for own use;
• 98200: Undifferentiated service-producing activities of private households for own use;
• 99000: Activities of extraterritorial organisations and bodies.

Part of those sectors include some in which UK does not produce anything (i.e. mining of uranium and thorium ores, growing of oleaginous fruits) and some that were apparently protected by ONS (so the weights were not computed). In order to find at least one corresponding UKSIC(2003) match, we double-checked our priors with a raw correspondence table provided by Eurostat and a UKSIC(2007) detailed alphabetical index, provided by ONS, for which corresponding UKSIC(2003) codes were provided (without weights, so it is a m-to-m correspondence table).

For example, for 16 out of the 18 above-mentioned industries, we could identify a 1-to-1 match, therefore having a 100% weight in the table. For the other two (codes 01260 and 01280), there is more than 1 plausible match, thus we had to weight them according to their corresponding UKSIC(2003) “frequency” matches. To be more specific, let us introduce an example on how the correspondence is presented in the alphabetical index. The example is for UKSIC(2007) code number 01280 (Growing of spices, aromatic, drug and pharmaceutical crops):

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01280</td>
<td>01110: Pharmaceutical crops growing</td>
</tr>
<tr>
<td>01280</td>
<td>01110: Plants used chiefly in pharmacy or for insecticidal, fungicidal or similar purposes</td>
</tr>
<tr>
<td>01280</td>
<td>01110: Drug and narcotic crops growing</td>
</tr>
<tr>
<td>01280</td>
<td>01110: Hop cones growing</td>
</tr>
<tr>
<td>01280</td>
<td>01120: Pepper growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Spice crops growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Vanilla growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Anise growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Aromatic crops growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Badian growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Basil growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Bay growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Chilli growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Chillies and peppers capsicum sop. growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Cinnamon growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Clove growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Coriander growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Ginger growing</td>
</tr>
<tr>
<td>01280</td>
<td>01139: Nutmeg, mace and cardamoms growing</td>
</tr>
</tbody>
</table>
So, UKSIC(2007) code number 01280 matches 14 times with UKSIC(2003) code number 01139, 4 times with 01110 and once with 01120. Accordingly, the weights are respectively 14/19, 4/19 and 1/19 in the table.

Turnover data weights for some industries were not provided by IDBR. Those industries are UKSIC(2007) codes 64201, 64202, 64203 and 64204. Since those industries are not from manufacturing and account for a small fraction of the industry total in many respects, I’ve taken the arithmetic mean of the two other weights to approximate them. Noteworthy, correlations between any two weighting scheme are more than 98%.

10.3.2 From UKSIC 2003 to UKSIC 1992

The 2003 revision was not a major change; accordingly both classification structures at each level of disaggregation are tightly linked. The changes and modifications made to the 2003 revision are listed and available in an ONS PDF-format file. Therefore, we directly applied those changes without any further modification except one.

UKSIC(1992) code number 27350 no longer exists in the UKSIC(2003) revision; this code is included into code number 27100. Therefore, it should be noted that 27350 is absent from the UKSIC(1992) classification in the table and integrated into code number 27100 as in the 2003 revision.

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