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Trade and Labour Market Adjustment

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Abstract

Trade and Labour Market Adjustment

While it is widely accepted that there are adjustment costs associated with the reallocation of resources in response to freer trade, in most models these costs are assumed to be very small. However, more recent evidence is casting doubt on this assumption. This paper develops a unique dataset based on harmonised labour force surveys for six economies, facilitating the comparison of short term labour market impacts from trade across countries. Data are reported at the individual worker level, allowing a comparison of impacts at both the industry and occupation levels. While the results of this empirical analysis at the industry level are very much in line with established research, the results at the occupation level are more varied. Overall, and as expected, impacts are generally larger for occupations than at the industry level. These results are consistent with modern trade theory which posits that an expanding export sector rewards mostly high skilled workers and that some workers may find it more difficult to switch occupations than to switch industries. Outcomes can also be explained in the context of labour market frictions and highlight the important role of labour market policy – as well as trade policy – in structural adjustment. Our results are consistent with sticky sector-specific human capital and information asymmetries, especially with respect to opportunities in different regions within the same country. A wide range of policies can be employed to address these labour market frictions to improve worker mobility and reduce adjustment costs. Further efforts to specify appropriate policies to accompany trade openness is warranted; doing so would go a long way towards improving employment outcomes and generating more inclusive growth.

Keywords: Labour market, adjustment, trade, offshoring, labour force surveys, micro data, panel analysis, occupation, duration, unemployment, trade policy, labour market policy.

JEL classification: F23, F16, F66, J08

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Executive Summary

Public debate surrounding trade and jobs is often based on the simplistic notion that exports expand markets and thereby create jobs in the domestic economy while imports represent a loss of domestic job opportunities. Off-shoring is often seen as large firms "exporting jobs overseas"; low wage, less developed economies benefit while developed economies lose jobs. These views are overly simplistic, for example taking no account of the role labour market policy plays in the adjustment process.

This project developed a unique dataset based on harmonised labour force surveys for six economies, facilitating the comparison of short term trade impacts across countries. Data are reported at the individual worker level, allowing a comparison of impacts at both the industry and occupation levels.

The results of this empirical analysis at the industry level are very much in line with established research. While there are some instances to the contrary, in the majority of cases higher export shares and off-shoring are associated with lower probability of unemployment and consistent wage premiums. Import penetration shows a tendency to increase slightly the probability of unemployment and put downward pressure on wages.

The results at the occupation level are more varied. Overall, and as expected, impacts are generally larger than at the industry level. In some cases, export shares are associated with slight increases in the probability of unemployment, in particular for medium skilled workers. Wage premiums associated with exports are smaller, and in some cases reversed. These results are consistent with modern trade theory which posits that an expanding export sector rewards mostly high skilled workers and that some workers may find it more difficult to switch occupations than to switch industries.

At the occupation level import penetration is shown to have little effect on the probability of unemployment, and in some cases even lowers it. Again, this is consistent with more recent evidence of the positive effects imports can have on firm performance. The evidence of wage premiums paid by importers to higher skilled workers also bears this out.

Finally, the impacts of off-shoring on unemployment are similar at both the industry and occupation levels and consistent with recent literature: off-shoring has little impact, and in some cases reduces slightly the probability of unemployment. There is, however, some evidence of downward pressure on wages.

There are also some counter-intuitive results at the occupation level. For example, for some countries, export share is associated with an increase in the probability of unemployment for high skilled workers. These outcomes can be explained in the context of labour market frictions and highlight the important role of labour market policy – as well as trade policy – in structural adjustment. Studies have shown that workers with higher skills or sector-specific human capital are often less willing to upgrade and/or change skills. Information asymmetries, especially with respect to opportunities in different regions within the same country, may also play a role. These inefficiencies, or frictions, create bottlenecks in the labour market, reducing mobility and increasing adjustment costs.

A wide range of policies can be employed to address these labour market frictions, improve worker mobility, and reduce adjustment costs. Further efforts to specify appropriate policies to accompany trade openness is warranted; doing so would go a long way towards improving employment outcomes and generating more inclusive growth.

I. Introduction

While it is widely accepted that there are adjustment costs associated with the reallocation of resources in response to freer trade, in most models of the welfare gains from trade, these costs are assumed away. And not without reason: an early review of the literature (Matusz and Tarr, 2000) concluded that adjustment costs were likely small in terms of the overall gains from liberalisation. Since then, additional studies have reached similar conclusions (Francois et al., 2011 and Porto and Hoekman, 2010), but there have been some notable exceptions (e.g. Cosar, 2011 and Autor et al., 2012). The lack of consensus is because the details of the adjustment process remain complex and the outcomes uneven. While overall impacts remain positive, the losses to those who do incur them – and the potential for more general economic inefficiencies to occur – is a social costs that deserves the attention of policy makers (Davidson et al., 1999 and OECD, 2007).

One of the factors complicating the measurement of adjustment costs is that the ultimate impact of trade on labour markets remains unclear. As the literature takes into account the increasingly interconnected global economy, the task of empirically identifying the mechanisms through which trade affects wages, employment and industry structure is commensurately more challenging. The measurement of the costs of labour market adjustment to trade liberalisation ultimately depends on a variety of factors including assumptions regarding the nature of firms (Melitz, 2003 and Egger and Kreickemeier, 2009); the type of labour employed and the underlying endowment base of a country (capital versus labour abundant) (Felbermayr et al., 2009); the ease of labour movement (i.e. labour market frictions and matching rates) (Davidson and Matusz, 2005, Helpman and Itskhoki, 2007); and the time horizon involved (Davidson and Matusz, 2010 and Tansel, 2004). The general conclusion is that over the long run unemployment is reduced by trade openness while wages rise. However, short and medium run responses are more complex.

In this paper we make a number of unique contributions to our understanding of how labour markets adjust to trade. First, we combine several individual country labour force surveys to obtain a harmonised, cross-sectional, time series dataset at the individual level. We then use this detail to go beyond traditional industry measures to develop outcomes across occupations for a variety of trade measures. This is particularly important to policy makers as they grapple with identifying the real drivers of labour market adjustment to ever-increasing economic ties among nations. If the majority of labour market adjustment takes place within industries rather than between, this may imply something about the mobility of resources and thus policies may want to focus on reducing labour market frictions. However, if the adjustment takes place between industries this could be an indication of a larger structural adjustment and polices may want to focus on broader areas of assistance. Further, finding evidence of trade impacts at the occupation level, when no significant effects were found at the industry level, provides policy makers with particular insights as to where adjustment assistance may be needed and most effectively applied. Thus, the structure of policy needs to shift along with the structure of change. Policymakers need to think of job markets in terms of fragmented tasks being supplied by the most efficient source. This shift in focus has implications for the way we analyse trade's impact on labour markets, as well as for the adjustment process itself, including where policy efforts should be placed – i.e. at the skill-set rather than at the industry level.

The paper proceeds as follows: section II discusses the expected labour market outcomes within the context of current theory and evidence. Section III outlines the data and methodology applied in this work with details of the dataset construction left to the Data and Technical Annexes. Section IV presents some trends in trade and labour market outcomes. Section V presents the regression results while Section VI outlines conclusions and policy recommendations.

II. Trade theory and resource allocation

Trade Models with Labour Market Frictions

Early empirical studies on the link between trade, income and unemployment were typically motivated by one of two trade models: the Heckscher-Ohlin model which predicts that countries export goods that use intensively the factor with which they are most abundantly endowed; and the Ricardian model which emphasises difference in technology as a foundation for trade. Over the 1980s and 1990s new patterns of trade, which did not fit with the predictions of these basic models, began to emerge. With these changes came a host of advancements in international trade theory, assisted by a growth in firm-level analysis. These models emphasised economies of scale (Krugman, 1979), productivity (Melitz, 2003), pro-competitive effects (Melitz and Ottaviano, 2008) and the complementarity between trade and global value chains (Ramondo and Rodriguez-Clare, 2008).

The Melitz (2003) model has emerged as the foundation for most recent work on trade. This model builds on the Helpman-Krugamn model of monopolistic competition, framing firm entry to an industry as being a function of productivity, introducing the concept of firm heterogeniety[1]. To evaluate the probability of entry to a market, a firm has to form strategies conditional on its potential productivity and thus decide the level of fixed costs it can bear (i.e. enough to enter just the domestic market, or to exceed the fixed costs of entry into both the domestic and export markets.). The lowest productivity firms exit, those with a certain threshold serve the domestic market only while those above a productivity threshold serve both the domestic market and export.

The emerging empirical work on trade and inequality with firm-level data indicates that firm heterogeneity indeed matters for the way wages and employment react to trade liberalization. Amiti and Davis (2011) show for Indonesia that trade liberalization raises wages of workers in globalised firms relative to workers in firms that are oriented towards the domestic market (wage premiums). Specifically, a 10 percentage point fall in export tariffs is found to lower wages by 3% in domestically-oriented firms and to raise wages in export-oriented firms by roughly the same amount. A 10 percentage point fall in import tariffs has no discernable effect on firms that do not import, but increases wages by up to 12% in firms that use imported inputs. Biscourp and Kramarz (2007) analyse the link between trade and employment for French manufacturing firms and find that importers of finished goods shed more jobs than importers of intermediate inputs, with the link being stronger for larger firms. Verhoogen (2008) shows for Mexican manufacturing plants that the 1994 peso crisis induced more productive firms to raise the wages of white-collar workers relative to the wages of blue-collar workers more than less-productive plants, and the relative wages of white-collar workers, increasing within-industry wage dispersion.

To understand the basic relationship between trade and unemployment, we need to include frictions that lead to unemployment in the first place. Frictions in the matching and searching process in the labour market can differ between sectors as well as between countries. Indeed, these cross-country differences in labour market frictions can be a source of comparative advantage and trade (Davidson, et al., 1999). Models of heterogeneous firms with labour market frictions have shown that a larger proportion of firms export in countries with small hiring costs (Helpman and Itskhoki, 2010). Helpman et al. (2011) show that if labour market frictions decline, a country can enjoy higher productivity but can also generate a relative negative productivity shock in its trade-partners. Thus, labour market frictions can

1 Other early works on incorporating firm heterogeneity into trade models include Bernard et al. (2003) and Yeaple (2005).

transmit between countries. This result shows that unilateral labour market reform may not always benefit trade partners, but coordinated reductions in labour market frictions can benefit every country.

Beyond frictions, we can think of a worker being unemployed for two reasons. First she may simply not have marketable skills. Second, she may have skills, but her specific skill set may fall short of the hiring firm's established level and thus she will not be hired. In this framework, risk neutral workers are indifferent between working for a high or low productivity firm because, conditional on being employed, the expected wage is the same in all firms. However, Helpman et al. (2011) show that exporting firms will be more selective in their hiring than non-exporters. This has implications for both the level of unemployment (if this selectivity leads to less matching of suitable workers with employers) and wage differentials as long as not all firms export.[2]

Within this framework it can also be shown that trade affects wage distributions differently for workers with different skills. For lower skills, the conditional wage distribution is the same in autarky and in trade as they only marginally affect the threshold productivity for export (if at all). For high skills, the conditional wage distribution in the open economy dominates the distribution in the closed economy. However, for medium skilled workers, the conditional wage distribution in the open economy is dominated by that in a closed economy (Helpman et al., 2011). Thus medium skilled workers are the least fortunate when trade opens both in terms of wage gains and unemployment. This results from the fact that trade leads to a relatively greater loss of job opportunities for workers with intermediate ability in high-productivity firms which become exporters. The lowest productivity workers are not employed while the highest productivity workers are employed by high productivity firms in both closed and open economies. This implies that average wages and unemployment rates are negatively correlated in the cross-section. However, while medium skilled workers suffer a relative disadvantage, when an economy opens to trade the largest increase in unemployment generally takes place among workers with the lowest average wages (Helpman et al., 2011).

Thus we expect to see overall declines in unemployment with trade opening but this outcome will be influenced by the differences in labour market conditions among partner countries. Wages in general should rise but not necessarily consistently across skill levels. Finally the fortunes of medium-skilled workers may be worse off, especially with respect to higher skilled workers.

Labour Market Effects of Off-shoring

Disaggregated supply chains and off-shoring — broadly defined as the physical relocation of parts of the production process in a foreign country — play an increasingly important role in the trading system. Off-shoring has multiple effects on employment. While evidence suggests that the effects of off-shoring on employment are weaker than those stemming from import penetration (Biscourp and Kramarz, 2007; Ebenstein et al., 2012), they have attracted considerable attention because of the fear that this new form of international trade would lead to extensive job destruction.

From the perspective of an OECD country, sourcing in developing countries means that domestic production will become less labour-intensive, and employment in the OECD country will generally fall for any given level of output. Off-shoring, however, also raises

2 To the extent that wages change with trade, a general equilibrium analysis is required in order to assess the impact of trade on worker's expected income.

productivity, permitting lower prices that can lead to higher sales and profits. The additional hiring due to improved competitiveness appears to be sufficiently large to offset the job losses due to the fall in labour intensity (OECD, 2007; Hijzen and Swaim, 2007). A study of 17 OECD countries found that off-shoring has either no effect or a slight positive effect on sectoral employment (Hijzen and Swaim, 2007). Intra-industry off-shoring reduces the labour intensity of production but does not affect overall industry employment. This is because the productivity gains from such off-shoring are sufficiently large for the jobs created by higher sales to offset completely the jobs lost by relocating certain production stages to foreign production sites. Inter-industry off-shoring does not affect labour intensity, but may have a positive effect on overall industry employment.

Most of the empirical work investigating the impact of off-shoring on labour market outcomes has shown this effect to be small. Liu and Trefler (2008) look at the effect of US off-shoring of services to China and India between 1995 and 2005 and find negligible net effects on all variables of interest: *i*) changes in wages; *ii*) weeks spent unemployed as a share of weeks in the labour force; and *iii*) occupation and industry switching. Harrison and Mitchell (2011) show that the impact of US multinational activity on domestic manufacturing employment has been small. Indeed, certain types of off-shoring have even been shown to be complementary to domestic employment and job growth (Jensen et al., 2010, Stone and Bottini, 2012).

However, Ebenstein et al., (2012), looking at import competition and off-shoring on U.S. manufacturing employment, found the effect depends on the location of offshore activities: While a 10 percentage point increase in off-shoring to low-wage countries reduces employment in manufacturing by 0.2%, off-shoring to high-wage countries increases employment in manufacturing by 0.7%. Similarly, in their study of 89 Swedish industries in the period 1995-2000, Ekholm and Hakkala (2005) distinguish between off-shoring to low-income countries and off-shoring to high-income countries. The effect of the former depends on the educational attainment of workers (it is positive on highly educated ones, negative on workers with an intermediate level of education). The latter (the main type in Sweden‘s case) has no statistically significant effect.

Trade and Adjustment

If we think about how labour markets react to trade liberalisation over time, the usual assumption is that employment (and unemployment) are determined by macroeconomic forces, so that over the long run employment will be determined by supply and demand within the context of labour market institutions. While this is the neoclassical explanation of labour markets, there is another school of thought that postulates trade and trade policy changes can affect employment permanently. That is, when sectors are sufficiently heterogeneous, jobs may be created or destroyed with little or no adjustment in sectors not directly affected by the trade changes (Hoekman and Winters, 2005). These differences may stem from persistent asymmetries between traded and non-traded sectors in terms of sources of technological change and patterns of specialisation. Characterised by Myint (1958), Structuralists see trade (and opening the economy to trade) as providing access to a large global market allowing an economy to productively employ ‘surplus’ capacity thereby stimulating economic growth. While designed to explain the growth path of a natural resource rich economy, this logic can also explain that of a populous economy with large reservoirs of surplus labour such as China.

Neoclassical models proceed as if labour market adjustments take place instantaneously, assuming trade liberalisation happens in the long run. Structuralists, on the other hand, focus

on a time frame where full adjustment has not occurred and argue that this adjustment path is sufficiently long and painful that it should be a major driver of policy reform.

Despite the debate over the appropriate time horizon for labour market adjustment, there remains considerable consensus on, and concern over, the fact that trade harms certain groups of workers.[3] The structural change stemming from trade and investment liberalisation implies resource reallocation which may lead to short-run unemployment. Adjustment costs, however, depend on the efficiency of this reallocation process. Cosar (2011) shows that net absorption of labour in the exporting sector is slow in response to trade liberalisation and that there are large costs for displaced workers. Thus, the ultimate impact is dependent on the extent to which more productive firms, with more stringent hiring criteria, reduce the overall hiring rate. Therefore, labour market tightness can either remain the same or rise, leaving the net effect on unemployment ambiguous.

The adjustment process can entail many economic costs. There are losses in efficiencies due to prolonged joblessness or persistent reduction in earnings suggesting that the labour market may not be matching trade-displaced workers with employers who could make productive use of their skills (Kuhn, 2002, Jacobson et al., 1993). The ability to move to new jobs – both physically and with respect to skill – becomes paramount to minimising efficiency losses. Immobility can stem from asymmetric information, mismatched skill sets, geographic and cultural barriers as well as the quality of individual job search skills (OECD, 2005).

There may also be costs in terms of perceived inequities resulting from trade liberalisation. Even while studies have shown the benefits from trade outweigh the costs (especially over the long run) the high adjustment costs borne by a minority are often perceived to be more widespread, and thus larger, than they actually are. This leads to problems of perception and backlash against further opening to trade.[4]

Box 1 provides a summary of the various kinds of adjustment costs. The costs of adjustment to any change – trade induced or not – can be defined across those incurred at the private level (i.e. firms and individuals) and at the public level (i.e. governments). Within the private component we can break these into costs borne by major resource owners. Labour markets can incur little costs if transition to employment elsewhere is smooth, that is, if skills are readily matched, moving costs little or non-existent and firms willing to offer similar wages. However, if skills are obsolete or post-liberalisation wages lower, trade opening can incur real costs to the labour market.

3 While trade can affect certain classes of resources more generally (such as fixed capital investment), this paper focuses on labour markets.

4 See for example, McKinsey (2012) on common trade myths.

Box 1.1 Adjustment Cost Components

Social adjustment costs (aggregate)	Private adjustment costs	Labour	• Unemployment • Lower wage during transition • Obsolescence of skills • Training costs • Personal costs (e.g. mental suffering; not considered here) • Underutilized capital
		Capital	• Obsolete machines or buildings • Transition cost of shifting capital to other activities • Investments to become an exporter
	Public sector adjustment costs	• Lower tax revenue • Social safety net spending • Implementation costs of trade reform	

Source: Francois et al. (2011).

The approach to measuring labour market adjustment costs varies greatly. For example, some studies measure adjustment costs by the decrease in economic output associated with trade liberalisation, while others focus on losses in capital investment.[5] However, most focus on the impact trade liberalisation has on labour market reallocation in terms of how long it takes to find another job, if wages are affected, both in level and lost income. Finally there are studies that include social aspects such as mental distress or decline in local societies.[6] Labour should move more easily within industries than between industries (Greenaway et al., 1999 and Kletzer, 1996 for example). Haynes et al. (1999) shows that the likelihood of a displaced worker moving sectors relative to the likelihood of being re-employed in the original sector increased with the duration of the unemployment spell. Thus adjustment costs are assumed higher for movers than for stayers. Bruhlart (2000) used the rate of intra-industry job turnover as a proxy for labour market adjustment for Irish plants and found that trade had a consistently significant (positive) impact.

The OECD has visited this issue several times. A 2005 study found that the most important impact international trade and investment had on labour markets was to raise average wages. It has also induced shifts in the sectoral and occupation composition of employment but '… neither theory nor the historical record suggests that aggregate employment performance has been undermined by increased international economic integration.' (OECD, 2005, p. 25). Davidson and Matusz (2000) reach the same conclusion. However their model also provides evidence that globalisation leads to higher job turnover and a more unequal distribution of income.[7] And in a later study, having introduced labour market frictions, they argue that in such a market, trade shocks can lead to multiple equilibriums, warranting government intervention to provide a smooth adjustment path (Davison and Matusz, 2004).

5 See Matusz and Tar (2000) for a review of empirical studies on measuring trade adjustment.

6 See Baldwin et al. (1980) and Feenstra and Lewis (1994) for a discussion of different types of trade-induced adjustment costs.

7 Income inequality and trade is a major theme of inquiry in the general trade impact literature but is not the focus of this study. Some more recent contributions to the debate include Krugman (2008) and Autor et al. (2008).

However, it is important to keep in mind that trade is only one of many drivers of job turnover and structural change. Indeed, this difficulty of attributing trade's impacts has spawned the vast literature on the subject we see today. As for adjustment costs, OECD provided evidence that these may be higher for trade-displaced workers than for other job losers (OECD, 2005). It found that in the United States and Europe, workers displaced from jobs in industries facing the most intense international competition are slower to become re-employed and experience larger wage losses once re-employed. However, mitigating this causal link is the finding that these displaced workers also tended to be older, less educated with higher tenure – all factors associated with above-average re-employment difficulties and larger earnings losses following re-employment. The report concluded that the best policy advice was for governments to provide training and job search assistance to facilitate the inevitable (and not detrimental) structural changes associated with changing trade patterns.

Another cost associated with trade induced change is the potential for increased job insecurity (Rodrik, 1997). However, Hill et al. (2008) found that job security had not changed greatly in OECD countries between 1995 and 2005, a period of rapid changes in global trade. The study also found no significant impact of import penetration on labour demand. However, it concluded that the exact nature of the relationship between off-shoring, productivity and labour demand depends on the policy environment with slowly-adjusting labour markets slightly worse off.[8] Particularly, services off-shoring was found to be negatively related to employment when employment protection and entry barriers were high.

More recently, Francois et al. (2011) found that adjustment costs were often skewed and could, as a consequence, be very substantial for some individuals. Consistent with previous studies they found aggregate adjustment costs to be significantly smaller than long term benefits of trade liberalisation. They also argue there is no strong evidence that trade induced unemployment is different than unemployment caused by other shocks. However, they find that labour markets tend to bear the majority of the trade-induced costs and the more rigid the market, the larger the costs.

The variety of empirical outcomes, and the sensitivities to assumptions underlying functional forms, creates a dilemma for policymakers. It becomes difficult to formulate an appropriate response, or lack thereof, to accommodate the labour market adjustment process without a clear empirical message from the literature. Egger and Kreickemeier (2009) discussing the various conflicts that arise in these circumstances, find that in trade liberalisation, both wage inequality and unemployment rates increase, along with a simultaneous increase in firm profits in the near term. This introduces, at least in the short run, distributional conflicts: higher average profits and higher unemployment associated with globalisation as well as the conflict between workers employed versus those who lose their jobs. Those who stay benefit from the gains from trade while those newly unemployed don't.

In sum, there is broad agreement that, in the aggregate and in the long run, trade leads to growth which provides job opportunities and better wages. What is also generally accepted is that these benefits do not accrue to all workers, and perhaps not even to the majority of affected workers in the short-run. However, what the discussion above highlights is the continued uncertainty surrounding the exact nature of the impact of trade on labour markets. The exact private costs borne as a result of globalisation - both in terms of data and

8 There is evidence that both very flexible and very sluggish labour market regimes gain more from trade liberalisation than those with 'moderate' regimes (Davidson, 2000). This is because costs are minimised in rapidly adjusting markets while returns tend to equalise more slowly in very sluggish markets.

measurement – are subject to debate. Empirically differentiating, for example, increased job insecurity due to openness and that due to technological change and indeed, the interaction between the two, is a challenge researchers have long faced. Complicating these interactions is the fact that private costs play into the level of social costs when pressure from private costs leads to policies which increase social costs – such as erecting new barriers to trade.

III. Methodology and data

Method applied[9]

In the literature that links global economic activity and labour demand, a typical approach is to examine the effects of trade on wages using measures of import penetration and off-shoring across industries. But these measures capture the impact of those remaining in the industry. Those that move between industries may suffer significant adjustment costs through declines in real wages. Indeed, Ebenstein, et al. (2012) find significant effects of import competition of employment reallocation, indicating that much of the negative effects of globalisation operate through downward pressure on wages of workers who leave manufacturing to take jobs in agriculture and services. As it is difficult to accurately identify these effects at the industry level, research is turning to individual-based analysis.

Evidence suggests that individual analysis, like firm-level analysis, may provide new and significant insights into labour market effects of trade. As Ebenstein et al. (2012) argue that researchers have been looking for a link to globalisation in the wrong place and that analysis at the *occupation* level provides more insights into these relationships as well as being more in keeping with the theoretical literature's emphasis on tasks. Recent work by Lanz et al. (2011) also provides evidence of the importance of looking at a more detailed occupation-based level. They found, using data on tasks rather than jobs, that certain services off-shoring was positively related to the demand for related tasks in the domestic economy.

The approach taken in this work builds the work on Ebenstein et al. (2012) and Lanz et al. (2011) adapting the empirical approach applied in OECD (2005), Liu and Trefler (2008) and Gorg and Gorlich (2011). Our work, however, departs from these studies in several important ways. We combine data across several economies, broadening the focus of the analysis. We know from the theoretical work of Helpman et al. (2011) and others that labour market frictions in one country can affect the outcomes in a trading pattern's domestic economy. By looking to see if the patterns observed individually hold in a cross-country setting, we are attempting to gain insight into the generalisability of reported findings. We also examine several measures of 'adjustment' including wages, unemployment and duration of unemployment, contrasting outcomes across three measures of 'trade': imports, exports and off-shoring.[10] Finally, we examine the impact across different types of labour. Again, the work by Helpman and others indicates that we should observe a detrimental impact on medium skilled workers *vis-a-vis* other skill levels, from all of our trade variables – including exports.

The paper hopes to provide unique insights to the interactions of trade and labour market outcomes. As noted, the adjustment process can be seen as a combination of private and social costs. For the purposes of this report, we focus our empirical work on private labour

9 Details of the methodology are in Annex 4, Technical Annex.

10 As this paper is focusing on adjustment to trade variables, we chose to look at unemployment rather than employment.

market adjustment costs of unemployment and wage changes (as defined in Box 1), and will address social costs in a qualitative sense.

Data[11]

In order to conduct the above analysis, we constructed a harmonised dataset of Labour Force Surveys (LFS) from six economies: four OECD (Canada, Israel, the United Kingdom (UK) and the United States (US)) and two non-OECD (Brazil and South Africa). The LFS were largely harmonised based on the Canadian survey. The years covered are 2003 to 2008, inclusive.[12] Industry level output and trade variables were taken from the OECD STAN database and available input-output tables. Industry classification was harmonised to 43 sectors and occupations were classified to 47 major groupings, the details of which are contained in the Data Annex. The Data Annex also includes various descriptive statistics of the underlying data.

There are many advantages to harmonising LFS across countries. First and foremost, such a dataset allows improved comparisons across countries. Second, empirical work of a cross-country nature has been conducted at the industry level and is not, therefore, micro-based. However, much of the new evidence being produced in the trade field shows the importance of micro data, especially firm and individual-level information (Redding, 2010). Also, because we are examining issues which are inherently cross-country (i.e. trade) it is relevant to look across trading nations.[13] We gain greater insight into the generalisability of other studies by looking across countries, placed on common footing. However, we do lose some detail that focusing on a single country can provide. However, this paper is designed to supplement existing evidence and provide additional insights for developing a policy framework. Thus, it gains by providing perspective not found in other studies.

IV. Trends in trade variables by industry and occupation

Occupational trends by industry grouping

Before we turn to examining trends in import penetration, exports and off-shoring, we look at how the distribution of occupations across sectors has changed over the time period under review. Figure A1.1 shows the sector share of employment for the 9 major occupations for 2003, 2005 and 2008 for the six economies under review. The fact that services dominate employment for almost all of the occupations is readily apparent. Even the majority of plant and machinery operators are, by 2008, employed in the services sector. The exception are those employed in the primary skilled occupation (such as fishing or hunting). We see that for each occupational classification the share of employment in manufacturing has declined. Both primary and services gained an average 10% and 3% respectively, between 2003 and 2008 across all occupations. The lower skilled occupations saw the largest gains in services and the largest declines in manufacturing.

11 Details of the underlying data are included in Annex 3, Data Annex. Countries were chosen based on consistency of reporting over the sample period, inclusion of certain key variables and consistency across countries.

12 Not all variables are available for all countries and years. See Annex 3, Data Annex for details of data coverage.

13 Another approach would be to examine effect by matched trade partners. However, data constraints do not allow us to follow this approach.

The declines in manufacturing are relatively even across occupations while the growth in services is not (Figure A1.2). For example, in manufacturing managers and professionals fell roughly 10% between 2003 and 2008 while plant and machinery and elementary workers fell on average 15%. The average growth for the same two higher skilled occupation for services was 1.5% while for the two lower-skilled occupations grew over 11%. This implies a general decline in opportunities in the manufacturing sector while job opportunities in the services sector may be biased toward lower skills. Primary industries – including mining – saw significant growth in both higher skilled occupations (e.g. over 19% for managers) and lower skilled (e.g. 19% for plant and machinery operators).

Trends by individual sectors and occupation[14]

We now examine how our measures of trade related to both broad industry categories (Table A1.1) and occupation (Table A1.2). Turning first to industry trends we see that for the overall sample, average import penetration and off-shoring were highest in the manufacturing sector while primary saw the largest average export share. This is being driven by the large export shares for this sector reported in Israel and the relatively large share in South Africa. However, for most economies manufacturing has the highest participation rates in the trade measures examined.

Average import penetration increased between 2003 and 2006 for the total sample. But the details behind this increase are mixed. For most economies, import penetration in the primary sector increased. For Israel and South Africa it declined, leading to an overall decline for the sample. Average import penetration for manufacturing increased but Brazil experienced a decline while South Africa did not change. Import penetration of services, while small, increased between the two periods, driven entirely by increases in the United Kingdom and United States. All other economies experienced declines with the exception of Israel whose shares were too small to report.

Export shares fell overall for the six economies between 2003 and 2006 stemming from declines in Israel, South Africa and the United Kingdom and this in turn is being driven by declines in average export shares of the primary sector for these three economies. Export shares in manufacturing increased and this increase came across the board. Services' export shares, however, fell for these six economies as a whole between 2003 and 2006. We see that only the United States experienced an increase in its average export share of services.

The largest increase for the sample came in off-shoring. Overall, average off-shoring increased over 35% with substantial gains in all three sectors, but especially in primary industries and composition of our dataset which includes several major primary sector producers. South Africa is the only economy reporting a decline in off-shoring in the primary industry between 2003 and 2006.[15] While overall average off-shoring in manufacturing shows an increase, this comes entirely from increases in the United States and United Kingdom. Services also show an overall increase in the average value for off-shoring but here the increase is more generally shared. Indeed, only Brazil shows a decline in services off-shoring.

In our sample we observe a dominance of manufacturing in average trade values. Shares of primary sector are more volatile but that is in keeping with the nature of these industries. Services, while small, show a fairly consistent rise between the two time periods, in some

14 This analysis is based on a comparison of the years 2003 and 2006 as all trade variables were consistently available for all countries for these years.

15 We cannot say for Israel as there are no values reported for off-shoring in 2003.

cases substantial. Thus in terms of absolute influence, manufacturing still holds sway, but we see evidence of a rise (albeit small) in services activity on the international stage.

Table A1.2 presents the degree to which each occupation is 'exposed' to trade by providing values for average off-shoring, import penetration and export share by occupation. For example, managers work in industries that on average have a 26.3% import penetration rate and this level of exposure changed little between 2003 and 2006 (to 27%). The Table brings to light some of the differences between analyses at the industry versus occupation level. First we see that the extent of trade exposure, as measured by average values for import penetration, export shares and off-shoring, are more uniform across the categories of occupation than they were across the various industry groupings. Particularly see how off-shoring affects all occupations whereas off-shoring values tended to vary across sectors. Thus, we can see that in order to capture the truly pervasive effects of globalisation on a country's labour force, measuring such effects at the individual, in this case, occupation, level provides important information to policy makers.

That does not mean, however, that certain occupations do not stand out in terms of their exposure to trade. Service workers tend to have smaller shares across all three measures. This may be changing as average values for off-shoring for service workers almost doubled between 2003 and 2006. While we see increases for all occupations (with the exception of a slight decrease for primary workers) for average import penetration, the greater gains were in lower skill occupations. Import penetration tends to be highest for occupations in Israel and the United Kingdom.

Export share averages are also fairly consistent across occupations, but we see more evidence of a bias in lower skilled occupations. While most occupations experienced a decline in average export share between 2003 and 2006, craft workers saw a significant increase.

Craft workers appear to be relatively highly exposed to off-shoring as well. They had the highest average value, along with plant and machinery operators, in 2003 but their increase in 2006 was much greater. Craft workers increased their exposure to off-shoring by 64% while plant and machinery occupations grew by 20%. All occupations saw significant increases in their off-shoring exposure, especially service workers who saw the average value of off-shoring increase 90%. This is consistent with the relatively large growth rates we saw in the services sector above. Primary workers also saw large increases with the average rate increasing over 70%, also reflecting the increases in off-shoring in the primary sector, the major employment sector for these workers.

No one occupation stands out as being particularly exposed to trade variables, with the possible exception of plant and machinery operators or craft workers, both of which are categorised as a relatively low skilled level. However, surprisingly, low skilled occupations do not dominate the field. High values for trade exposure are also seen in higher skilled professional and technical occupations.

From the discussion above we know that most workers are employed in services sectors, yet most trade exposure – as measured by average shares of import penetration, exports and off-shoring - can be found in the manufacturing sector. Thus even though the shares can be relatively high for each occupation, they actually affect only a small fraction of workers in our sample. Another insight is that while the theory suggests that medium skilled workers will tend to experience the largest increases in unemployment and wage declines with trade expansion, we do not observe these occupations being particularly exposed to trade pressures.

Evidence of labour market adjustment

Table A1.3 presents the changes in the distribution of the duration of time period reported for unemployed persons for each survey year for those countries reporting this information.[16] Many of the shares experienced little change over the time period under review. Canada experienced fairly stable shares across each of the 4 categories. Both Israel and the United Kingdom show a slight shift toward longer period of unemployment. Israel's shift occurred mainly from medium term periods to durations of over one year while for the United Kingdom the shift in shares was from the share of those unemployed for less than 3 months to those unemployed between 6 and 12 months. The United States experienced just the opposite – an increase in the share of those unemployed less than 3 months and a decrease in the share of those unemployed over one year. Thus for North America this appears to be a period of stability and perhaps even a small improvement for those unemployed while for the United Kingdom and Israel we see a slight deterioration in the position of the unemployed.

Adjustment Trends and Trade: Transition Matrices

We further investigate the changes in labour outcomes across time periods by calculating transition or probability matrices. These matrices tell us the probability of transitioning from one state to another.

$$p_{eu} = Pr\{I_t = u \mid I_{t-1} = e\}$$

In our data this translates to the probability of an individual (I) being in a state of unemployment (u) at time t given this individual was employed (e) in $t-1$.We apply this to our employment data to give us an indication of movement from employment to unemployment or unemployment to employment over our sample period.[17] The results are shown in Table A1.4.[18] We see that for our entire sample, the probability of staying employed from one period to another is quite high – almost 95%. Indeed, the probability of moving from unemployment to employment over a year is also quite high, just over 93%. This is consistent with what is often implied by findings in the literature (e.g. Shrimer, 2008). While it certainly depends on many factors (including education, age, industry, etc.) most unemployed find work within a year.[19]

We then examine how these probabilities differ by our globalisation characteristics, dividing our sample into those industries with above average trade value and those below. We found that for those working in industries with above-average off-shoring values, a higher percentage were still unemployed after one year than those working in industries with average or below average values for off-shoring (12.5% versus 7.35%). However the probability of staying employed was higher in high off-shoring industries as well. A possible

16 Only the four OECD countries reported detailed data on duration of unemployment. See Data Annex for details.

17 Given we do not observe an individual moving from employment to unemployment (or the other way) over time, we created groups based on individual characteristics of age, sex, education and country. We ran several iterations with different random assignment to groups to ensure our results were robust to group assignment.

18 We present the results for the pooled data sample as individual country results were largely the same.

19 For example in the United States, in 2007 less than 3% of the unemployed who found work had been jobless for more than one year, more or less a trend since 1994. However, more recent evidence implies that this trend may be changing. In 2010, 11% of transitions from unemployment to employment exceeded one year (US BLS 2011).

explanation is that those industries which have higher than average off-shoring also are more efficient and thus have less of a tendency to shed those workers they keep.

We see a different pattern for those working in industries with higher than average import penetration and higher than average export shares. There is a lower probability of remaining unemployed after one year for these groups: just over a 2 percentage points lower in probability of remaining unemployed after a year if you work for a high import industry, and 3 percentage points if your industry has a high export share. In addition, the probability of moving from employment to unemployment is lower for relatively high importing industries but a bit higher for high exporting industries. The export outcome is consistent with Helpman et al. (2011) when he argues that fewer matchings occur for exporting firms. While the outcome for imports may seem surprising, if we associate those industries with high imports with increases in efficiency and competitiveness (which recent studies such as Bas and Strauss-Kahn (2010) have shown) we would expect employment prospects in these industries to improve.

Based on the data presented there is some evidence that workers are moving out of manufacturing and into services and primary industries, but it does not appear that wages are motivating this move.[20] It also appears that labour markets are adjusting to measures of trade rather well. We do not observe longer periods of unemployment associated with high imports nor do we see import penetration or export shares associated with an above-average probability of moving to unemployment. There is some evidence of off-shoring leading to higher unemployment but there also appear to be good prospects for staying employed. To more systematically investigate these implications, we perform various regression analysis relating trade impacts to the changes in employment, wages and duration.

V. Regression results

Unemployment

In the first set of regressions, we examine the basic relationship between trade and unemployment and break it down by skill level for our sample of countries over the 2003 to 2008 time period as outlined in equations 1a and 1b.[21] In Table A2.1, the first column presents the results for industry measures and the second for the occupation-specified results for each country with the available information.[22] Impacts are overall very small, and uniformly larger in the occupation-specified equations.

In general the impact of trade on unemployment is, as reported elsewhere, mixed. However, the majority of cases show that export share, as measured across industries, is associated with a decline in the probability of unemployment. When we look at how export share affects unemployment of particular occupations we see the majority of outcomes are either negative (i.e. lowering the probability of unemployment) or have no net effect. This is an indication that it may be easier for some occupations to switch industries when faced with potential employment pressure.

20 We would like to track the movement of individuals into and out of different sector employment but this information was not available in the LFS.

21 We report values by skill categories based on the ILO classification. See Data Annex for details

22 No industry was reported for unemployed in the UK LFS therefore the UK was not included in this part of the analysis.

Measured across industries imports generally are associated with an increase in the probability of unemployment though again, the results are varied. We see more evidence of a negative impact on the probability of unemployment when we look at how import penetration affects particular occupations. Finally off-shoring is as often associated with a positive influence on being unemployed as it is with a negative one. And this is consistent across both industry and occupation measures. This is most likely a reflection of the diversity shown in recent off-shoring activity. As noted in the literature review, off-shoring has evolved away from a simple replacement of relatively expensive domestic labour to a complex system in support of global value chains. Its impact on domestic unemployment, therefore, will depend on the trade-off between productivity gains and replacement of certain stages of production offshore.

Individual Country Results

For Brazil, export share is associated with an increase in the probability of unemployment for the very low and the medium-high (skill 3) skilled but a decrease for low-medium (skill 2) skilled workers. The result for high skilled workers is not significant. While we expect to see less productive workers potentially worse off with an expansion of more productive exporting firms, this usually wouldn't apply to higher skilled workers. However, Muendler (2011) does find evidence of an increase in unemployment in Brazil with an expansion of trade. When we measure at the occupation-specific export share, this outcome is reversed. Here all occupations experience a reduction in the probability of unemployment and this reduction increases with the skill level (with respect to the outcomes for low skill). Thus, for occupations, export shares are associated with a decrease in the probability of becoming unemployed and this effect is weakest for skill levels 2 and 3, a result more consistent with trade model predictions.

Looking at imports we see a positive impact on the probability of being unemployed for the lowest skilled workers (1 and 2) but fall in the probability for skill level 3 while the highest skilled workers do not appear to be significantly affected by imports. At the occupation, we see an increase in the probability of unemployment for all skill levels, although the net effect for skill level 2, with respect to low skilled workers, is negligible. Finally, off-shoring is generally associated with a decrease in the probability of being unemployed for occupation-specified results and this effect is strongest for the lowest skilled workers. High-skilled workers may actually experience an increase in the probability of unemployment associated with off-shoring.

Thus for Brazil, trade's affect, as measured through the occupation specification, is consistent with what predicted by most trade models. That is, exports are generally associated with a decrease in the probability of being unemployed and imports associated with an increase. This result is similar to what is reported in Fajnzylber and Fernandes (2004) who found that international experience (exporting and importing) was associated with stronger demand for skilled labour. The outcomes for the various skill categories show a greater impact on medium skilled workers – whether it be fewer gains or greater losses. The outcome for off-shoring is also consistent with recent literature that shows that many, often lower-skilled occupations, are complementary to off-shoring (e.g. Lanz et al., 2011).

Turning to the results for Canada, exporting industries tend to be associated with a lower probability of unemployment across skill levels, with little net impact on skill level 2. When measured through occupation, we see the same outcomes for skill levels 1 and 2 but little net effect on skill level 3 and a slight positive impact for skill level 4. This finding could be due to market frictions. As Helpman et al. (2011) argued, if there are problems matching available opportunities with the right skills, unemployment could result, even for skilled

workers. Indeed, recent evidence from the European Union shows an increase in both the vacancy rate and unemployment rates among many EU members, indicating a skills mismatch between workers and employers (Europa, 2012).

Looking at imports we see an increase in the probability of unemployment for the lowest and highest skilled workers while medium skilled workers, especially skill level 2, fare a bit better. At the occupation level, low skilled workers continue to be at increased risk for unemployment but this is reduced for higher skilled workers and only reversed for the very high skilled workers. Thus for Canada occupation specific results show imports and off-shoring can actually reduce potential exposure to unemployment while exporting firms seem to leave high skilled workers the most vulnerable. Off-shoring actually may lead to small but significant declines in the probability of being unemployed for all workers with the exception of skill level 3. As we know, off-shoring can lead to both an increase in demand for some types of labour through complementarity effects and a decrease in others through substitution (Stone and Bottini, 2012). The results presented here provide some evidence of a slight dominance of the complementarity effect for Canada.

When we look to Israel, we see that the probability of being unemployed associated with exporting firms increases for most workers with the exception of skill level 3, an outcome at odds with what is implied in Helpman et al. (2012). However, if medium skilled workers are highly mobile, it could be exporting firms have an incentive to make additional efforts to keep these workers. This outcome is even stronger at the occupational level. Here, while low skilled workers see declines, other workers, particularly skill 3, see an increase in the probability of unemployment with respect to their low skill counterparts. Import penetration appears to be associated with lower probability of unemployment for skill levels 1 and 2 but an increase for skill level 3 while skill level 4 is not significant. At the occupation level we see just the opposite: an increase in the probability of low skilled workers but a decreased probability for higher skilled worker. Again, this implies a complementarity in demand for labour. If firms that import are more dynamic and productive then one would expect there to be a positive association with labour demand. There has been evidence in both the United States (Bernard et al., 2007) and in developing countries (Seker, 2012) that importing firms tend to employ more workers than firms that o not trade at all. This outcome is similar to what is observed for Canada. For off-shoring there is a reduction in the probability of being unemployed for low skilled workers but an increase for higher skilled. The same trend can be observed at the occupation level, however here the highest increase in probability is for skill level 3.

Overall, Israel's results at the occupation level, similar to Canada, show that exports are associated with potential increases in unemployment while imports may actually help reduce it. Again, the export result may be a function of market frictions which lead to a greater number of mismatches between available workers and those exporting firms looking to fill positions. Off-shoring outcomes are long more traditional lines with a slight increase in the probability of unemployment for medium skilled workers.

South Africa's results follow a pattern similar to Israel and Brazil. There is a small, positive association between export share and the probability of unemployment for low skilled workers, with this trend reversing itself for higher skilled workers.[23] This pattern completely reverses itself at the occupation level – low skilled workers show a reduction in the probability of unemployment while higher skilled workers seem to experience an increase. For imports there is an increase in low skilled worker's probability of unemployment but this decreases over skill levels. Finally off-shoring shows a consistently

23 The results for skill level 4 were omitted due to collinearity.

negative outcome across skill levels for industry-based outcomes. For the occupation-specified equations, we see a decrease for low skill with an increase in probability for higher skills. This, as stated above, is consistent with a greater impact on medium skilled workers.

Overall for South Africa, similar to Israel and Brazil, greater export shares are generally associated with a reduction in the probability of unemployment for low skilled workers but increases for higher skill levels while imports improve the prospects of higher skilled workers.

For the United States we see that the probability of unemployment at the low skill level falls with export share, but that decline reverses itself for higher skilled workers, with a slightly larger effect for skill level 3. This same negative impact was found in Ebenstein et al. (2012) who argued that export growth was labour-saving for many educational categories. Using an occupation specification we observe the same trend but now the highest skilled workers (skill 4) experience the largest increase in the probability of being unemployed. Again, this may be due to a worker mismatch or to greater volatility in exporting sectors. We know that exporting firms tend to face greater volatility in their sales (e.g. Vannoorenberghe, 2012) and that globalisation increases the volatility of employment (Buch and Pierdzioch, 2009). This may, in turn lead to greater volatility in hiring.

Similar to the industry results observed for Canada and Brazil, import penetration increases the probability of unemployment for low skilled workers but lowers it for higher skills in the United States. However, unlike Brazil, we see this trend completely reverse in the occupation outcomes. Here, imports reduce the chances of unemployment for all skill levels with lowest and the highest skill levels experiencing the greatest declines. In the industry-specified results for off-shoring, low skilled workers appear worse-off with respect to employment prospects while skill level 3 is relatively unaffected. At the occupation level, low skill workers also see an increase in the probability of unemployment, but now skill levels 2 and 3 are neutral (with respect to low skill) and skill level 4 experiences a net increase.

Overall we see potentially more precarious employment associated with more open markets for high skilled workers in the United States and Canada. We did see evidence of this is in the employment trends presented in Figure A1.2 where the growth in employment opportunities appeared to be greater for lower skilled workers. Exporting measured along occupation rather than industry dimensions, shows an increase in the probability of unemployment, with respect to their low skilled counterparts. Cosar (2011) finds that increases in human capital can often exacerbate negative outcomes of search frictions leading to slower adjustment. In contrast Ebenstein et al. (2012) find a negative association for workers with less than a college degree and is at odds with what is predicted in the literature (i.e. higher productivity workers gain more with exporters). But we also know from a review of the literature on trade (e.g. Davidson and Matusz, 2000) that the ultimate impact of trade on employment is a function of many factors, including market volatility. Imports, on the other hand, show a strong decline for these same workers while off-shoring shows little net impact.

Across the five countries we see similar patterns emerging. Exports, as predicted by more recent trade theory, are not always associated with rising employment. Indeed, all countries show an increase in the probability of unemployment as skill levels rise. This outcome is consistent with models of trade with labour market frictions. What this work shows that hasn't always been predicted is the potential positive impact imports can have on employment. For Brazil, Canada, Israel and South Africa, imports increase the probability of unemployment for low skilled workers but this diminishes as skill levels increase, even

reversing for high skilled workers. For the United States we see a decrease in probability of unemployment across all skill levels. Like imports we see a positive impact for off-shoring, implying a complementary relationship with certain types of labour demand for all countries but the United States. These outcomes are quite consistent with modern trade patterns. One of the major insights gained through the study of GVCs is the fact that imports can be as important a source of growth as exports. Our results provide empirical support for this contention.

The difference in outcomes between industry and occupation also has something to tell us. Overall for unemployment we see industry and occupation giving us two different but complementary pictures of trade impacts. Industry level appears to be capturing broader trends; a potential lack of matching with respect to exporting firms and substitution and replacement with respect to imports. However, occupation level seems to pick-up the improved opportunities available in exports markets for those with the matching skills and potentially more productive workers. Imports appear to be about industry expansion and efficiency and improvements in prospects for individual workers. However, at the occupation specification we also see a relatively greater (negative) impact on medium skilled workers for both imports and off-shoring, something predicted from trade theory.

Wages[24]

Turning to wage impacts (Table A2.2) we see that exports have a positive impact on wages at the industry level and that this increases, generally, with skill. This is consistent with much of the reported evidence of a wage premium paid by exporters. We also find that, across industries, import penetration generally puts downward pressure on wages. As discussed above, the effect of off-shoring on wages has generally been shown to be mixed. We find a consistent positive association between off-shoring and wages measured across industries. This outcome provides support for the contention that off-shoring raises productivity and this is reflected in higher wages.

When measured across occupations, we see that all three trade measures – exports, imports and off-shoring – tend to have a much smaller impact on the wages. This outcome is in contrast with the larger, more negative results reported for the United States in Ebenstein et al. (2012) and seems to indicate that occupations experience less wage impact from trade than industries. However, Ebenstein et al. explain their results in terms of occupational switching where our results may be capturing occupational tenure. It has been shown that time in an occupation has a more significant influence on wages than time in an industry. Thus our results may be measuring the ability of workers to maintain employment in a certain occupation rather than employment in a certain industry. This has implications for policy makers if, as Artuc et al. (2010) and Trefler and Zhui (2011) argue, increases in trade and off-shoring will lead to greater occupational shifting and this shifting has high costs.

Individual Country Results

In Brazil, export share at the industry level has a positive influence on wages but this effect diminishes as skill level increases. At the occupation level, we see just the opposite, a negative influence on lower skilled workers but a premium on higher skilled workers with the highest being on skill level 4.This is consistent with the argument that exporting firms increase demand for high skilled workers *vis-a-vis* other workers.

24 Israel did not report wages and South Africa only reported wages in bands so these two countries are not included in this part of the analysis.

For imports we see a wage premium for low skilled workers measured at the industry level but it diminishes across skill where it would appear import competition asserts greatest pressure on skill level 2 wages. For occupations, we see a consistent downward pressure on wages across the board, with the exception of skill level 3 workers. Off-shoring has the same pattern: increases in wages for industry specification but downward pressure when we move to occupation-based results. This result is similar to that observed by Ebenstein et al. (2012) for the United States. Thus for Brazil when measuring outcomes across occupations we see wage premiums paid to higher skilled workers in exporting firms and relatively lower wages to those working in firms with higher import penetration. We also see downward pressure on wages in off-shoring industries. However, skill level 3 appears to receive a small wage premium in both imports and off-shoring. A possible explanation is the mobility of medium-skilled workers relative to other workers. Gathmann and Schonberg (2010) show that, in Germany, medium skilled workers spend on average 1 year less with a particular firm than other workers. While low skilled workers were shown to be the most mobile overall, exporting firms may not be as willing to pay a wage premium to keep these presumably less productive workers on staff.

Canada industry outcomes for wages also show a wage premium for low skilled workers in exporting firms but this premium diminishes for skill level 2 before increasing for skill levels 3 and 4. This evidence of wage premium is fairly standard in the literature. At the occupation level there is a similar story with wages taking a small hit for lower skills and a premium elsewhere.

For Canadian workers engaged by firms with high import penetration, the results are, again, fairly standard showing downward pressure on wages for all workers, the most on skill levels 1 and 3. At the occupation level, however, these results are largely reversed. There is evidence of a wage premium for all workers that is falling over subsequent skill levels, completely disappearing for skill level 4. For off-shoring we also see wage premiums paid but at a declining rate. There is little qualitative difference in the industry and occupation results for off-shoring.

Thus we find some evidence in Canada, in line with employment, of positive labour market outcomes associated with imports and off-shoring. This could be explained by improving productivity due to increases in efficiency through imports/off-shoring giving firms a greater ability to pay wage premiums. Both Van Biesebroeck (2008) for developed economies and Seker (2012) for developing, find evidence of wage premiums paid by importing firms.

Similar to both Canada and Brazil, the United Kingdom shows exporting firms pay a wage premium to low skill workers that declines relatively for skill levels 2 and 3 but increases for highly skilled workers. At the occupation level, however, we see the opposite where the largest gains are among medium skilled workers while low and high skilled workers actually experience a decline.

For imports we see wage declines across skills with the smallest decline in skill level 2. For the UK occupation-specified equations, however, there is evidence of a wage premium for all levels but 3. Again, if medium skilled jobs are more mobile, we may be seeing evidence of the flip side of that effect. Skill level 3 may include tasks that are easily off-shored or embodied in imports. Thus while expanding exporting firms may pay premiums when these workers are needed, importing firms may exert downward pressure as a consequence of the possibility of substitution overseas. Indeed, off-shoring shows the largest negative outcomes for skill level 3 wages.

The potential for medium skilled workers to be made worse-off by globalisation with respect to their low and high skilled colleagues is highlighted by the UK results. The United Kingdom shows different wage impacts on medium skilled workers as a result of exports, imports and off-shoring. However, while imports and off-shoring are associated with negative impacts on wages, exporters appear to pay premiums. The overall impact for these workers depends on employment effects which we are unable to investigate with this data. However, if medium skilled workers are more mobile and command a wage premium *vis-a-vis* other skill levels, if could be this will offset the negative impact from off-shoring and import competition.

For the United States there is evidence of a wage premium paid by exporters for workers in skill levels 1 and 4 with less in 2 and actual declines for skill level 3. At the occupation level we still observe a premium for skill level 1, less so for skill level 2 and losses for skill level 3. However we now also see downward pressure on wages for the highest skilled workers. These workers also experienced the highest probability of unemployment.

Import penetration at the industry level shows a fairly consistent negative impact except on skill level 3. For occupation we see that import penetration continues to put downward pressure on wages for lower skilled workers (1 and 2) but we now see premiums for both skill levels 3 and 4. Like Ebenstein et al. (2012) we see differences in outcomes at the industry versus occupation level, but unlike that paper, it isn't all bad news. Indeed, we find evidence of small wage premiums paid for higher skilled workers working in high import penetration sectors. For off-shoring we again see gains but these are diminishing across skill levels while for occupation-based measures we see negative outcomes skill levels 1 and 3 but gains for high skilled workers. Like the United Kingdom, skill level 3 experiences the largest negative impact from off-shoring but unlike the United Kingdom, these workers appear to gain premiums, with respect to low skilled workers, in importing sectors.

Overall, the results for wages across countries are more diverse than we found for unemployment. Concentrating on occupation-specified outcomes, we see some common trends however. For example, we find evidence of wage premium being paid by exporters, however, the impact varies widely by skill and country. In Brazil and Canada premiums appear to be paid only to high skilled workers while the United States see relatively bigger gains going to lower skills and the United Kingdom to medium skilled workers only. Canadian importers appear to pay a premium to all workers with the exception of high skilled workers while Brazil only pays a premium to skill level 3. Higher skilled workers (skill levels 3 and 4) appear to gain small premium in importing industries in the United States as do skill levels 1 and 4 in the United Kingdom. Finally, off-shoring is even more of a mixed bag however the losses to medium skilled workers, relative to other workers, appear to be pervasive across countries.

The difference between industry and occupation for trade again, are pronounced. As with unemployment, occupation-based measures tend to be larger and this is seen to the greatest extent in the United States, a result that was also found in Ebenstein et al. (2012). Off-shoring, long considered more of an 'occupation' phenomenon then exports or imports ironically shows little difference between the results at the industry level and those at the occupation level. It could be for exactly that reason, the off-shoring measured at the industry level is still very much an occupation driven outcome.

Comparing the two sets of results, there is a greater variety in outcomes along skill level for the occupation-based results, which is more in keeping with trade theory. For example, consistent wage premiums found for exporters in the United Kingdom and Canada, turn to losses for certain skill levels when measured along occupation lines. For imports as well we see that losses measured along industry lines turn to premiums when we look at occupations.

Finally for off-shoring, 3 of 4 economies show average premiums gained along industry lines are actually losses for certain occupations.

Generally the occupation results were more differentiated than the industry-specified outcomes. This is as expected if trade impacts are better measured at the individual/occupational level. We see a richer story and this additional information can be of great value to policy makers. For instance, we see greater impacts on medium skilled workers and being measured at occupation could imply that changing occupations could have more serious consequences than changing industries. The implied role of labour market frictions, long discussed in the labour market context, highlights to need to consider complementary policies outside the traditional 'trade policy' realm to adequately address the adjustments to today's trade trends. Improving information flows across both industry and geographic dimensions is another important policy implication from this work.

Duration[25]

The results for the regressions using the duration variable are reported in Table A2.3. As stated above, these are not based on traditional duration or hazard models but are an exercise in examining the probability of a marginal change in the duration of unemployment with respect to our trade variables. Again these are measured over industry averages and at the occupation level.[26]

We see that the duration of unemployment does not appear to be significantly associated with export share at any of the duration intervals when measured at the industry level. This implies that while the probability of being unemployed is associated with export share, how long one is unemployed does not differ for those working in exporting firms. However, for individual occupations it does appear to matter. Here, the probability of being unemployed for less than 3 months appears to be reduced with an increasing export share, but to increase for all other duration categories. This is consistent with the trend identified in our data set of moving from shorter periods of unemployment to longer periods. The fact that duration is higher for exporters is also consistent with our argument that difficulty in matching is driving the results for unemployment. If indeed the probability of being unemployed is higher with respect to export share and that this is driven by an inability of firms to find appropriate workers (or workers appropriate firms) it would make sense there would also be a negative (i.e. increasing) impact on duration. This is consistent with Ebenstein et al. (2012), who argue that it is more difficult to change occupations than it is to change industries.

We see a similar pattern for imports. Import penetration is not significantly associated with any duration level measured at the industry level but is significant at the occupation level. Here, unemployment durations of less than three months appear to be positively associated with imports. However, longer periods of unemployment are negatively associated with imports. This again, would be consistent with the idea that importing firms are expanding market share and creating more employment opportunities.

Finally, as with both our unemployment and wage equations, the results for off-shoring across industry- and occupation-based measures are more consistent. Here, we see that off-shoring, like imports, has a positive impact on the probability of experiencing a unemployment spell of less than 3 months but reduces the probability of longer term

25 As noted earlier, the duration analysis presented is based on a pooled of three OECD economies (Canada, Israel and the United States). Industry information is not available for UK unemployed.

26 Given the nature of the exercise we do not report breakdowns for skill levels.

unemployment. An explanation could be that firms who offshore or import experience an increased demand for workers and thus more easily matched with available workers. In addition, complementarity between off-shoring activity and labour demand may increase employment in an economy (Stone and Bottini, 2012). Reductions in periods of unemployment spells are consistent with this outcome. Increases in such spells associated with exporters is consistent with the idea of an expansion of highly productive firms and the chance that matching between those available for work and those hiring is not complete, potentially making it more difficult to find work and thus expand unemployment duration.

The results imply that adjustment of labour markets to trade may be prolonged. But interestingly, this adjustment may be more from exports than imports or off-shoring. Thus, it is the normal, and most would argue healthy, structural change through which trade affects labour markets and not necessarily as replacement.

VI. Conclusions and policy implication

Overall we see no consistent evidence of a large or systematically difficult adjustment process with respect to trade, as measured by changes in unemployment or duration, and wage reductions. We do see incidence of impacts on all three but these occur both to the benefit and detriment of workers. Indeed, many of the negative impacts – in the form of prolonged unemployment or lower wages – were as likely to take place in relation to export share, a major driver of economic growth. Therefore, it would appear that these labour market adjustments are a function of structural change to which trade can contribute. Indeed, many of the import measures, long considered a driver of job loss and wage declines, were as often a positive influence on these labour market outcomes as not.

However, like many previous studies, we do find some indication of divergent paths for certain types of individuals which may lead to a social divide between those benefiting from increase opportunities from trade and those not. While we do not measure income or other types of inequality, we can infer some impacts from our results. One implication is that these effects could be greatest in export markets where competition for high productivity workers may lead to a two-tiered labour market: those with the necessary skills to command wage premiums and those without who not only command no premium but more often end up unemployed – possibly for longer spells.

The potential costs of these diverging opportunities may lead to greater social costs in the form of increased assistance for longer periods of time, and a greater need for training and skill matching. Indeed, our results imply a role for policy in the process of job matching be it through skill acquisition or improved information regarding job opportunities. There is often a disincentive for experienced workers to invest in new skills. Thus targeted subsidies that reward mobility by facilitating not only the reallocation process, but faster formation of necessary skills during the adjustment process, may go a long way in reducing labour market impacts. To maintain popular support for open markets, it is important not to let the positive experiences of those who do remain employed eclipse the very real pressures on those who don’t.

From a policy perspective, the results presented here add credibility to the argument that the industry-based model is not providing a complete picture. In the analysis, we see a more varied and interesting story come out of the occupation-specified results. In addition these insights are often more consistent with modern trade theory. Therefore, we would argue they provide credible and important insights for policy makers. The industry story falls with the more generalised approach that exports are ‘good’ for the economy (in terms of lower probability of unemployment and higher wages) and imports are ‘bad’ for contributing to

lower wages and unemployment. The occupation information shows that imports can actually be associated with higher wages and a lower probability of unemployment. This can explain some of the conflicting results we see coming out of the theoretical literature (Egger and Kreickemeier, 2009).

For policy makers the results of this study provide added incentive to move the debate about trade to a different level. The desire to cast trade in terms of 'good and bad' does not do the issue justice, nor does it lead to the kinds of policy formulation needed to equip economic actors with the necessary skills, both technologically as well as psychologically. Coping with globalisation is not going to get any easier as companies in emerging economies continue to rise up the technology ladder and participate in GVCs in ever-expanding ways. Investment in high productivity processes overseas can erode the productivity edge of domestic workers and lead to greater unemployment even with expanding export levels (as this work implies).

Concentration should not be placed on tariffs and other types of trade distorting measures but rather on ensuring equal access abroad and safety nets at home. If the data in this study are right, duration of unemployment could possibly increase for some workers. Anecdotal evidence suggests that workers may change occupations, and not just industries, several times in their working life times. Thus governments need to educate workers to constantly upgrade skills, to look for new opportunities, and to adjust expectations so that being unemployed for some period of time may be part of most lifetime work experiences. Dynamic markets – trade induced or not – mean periods of adjustment. Trade policies must not hinder this process.

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Annex 1
Tables and Charts

Figure A1.1. Sector share of occupational employment

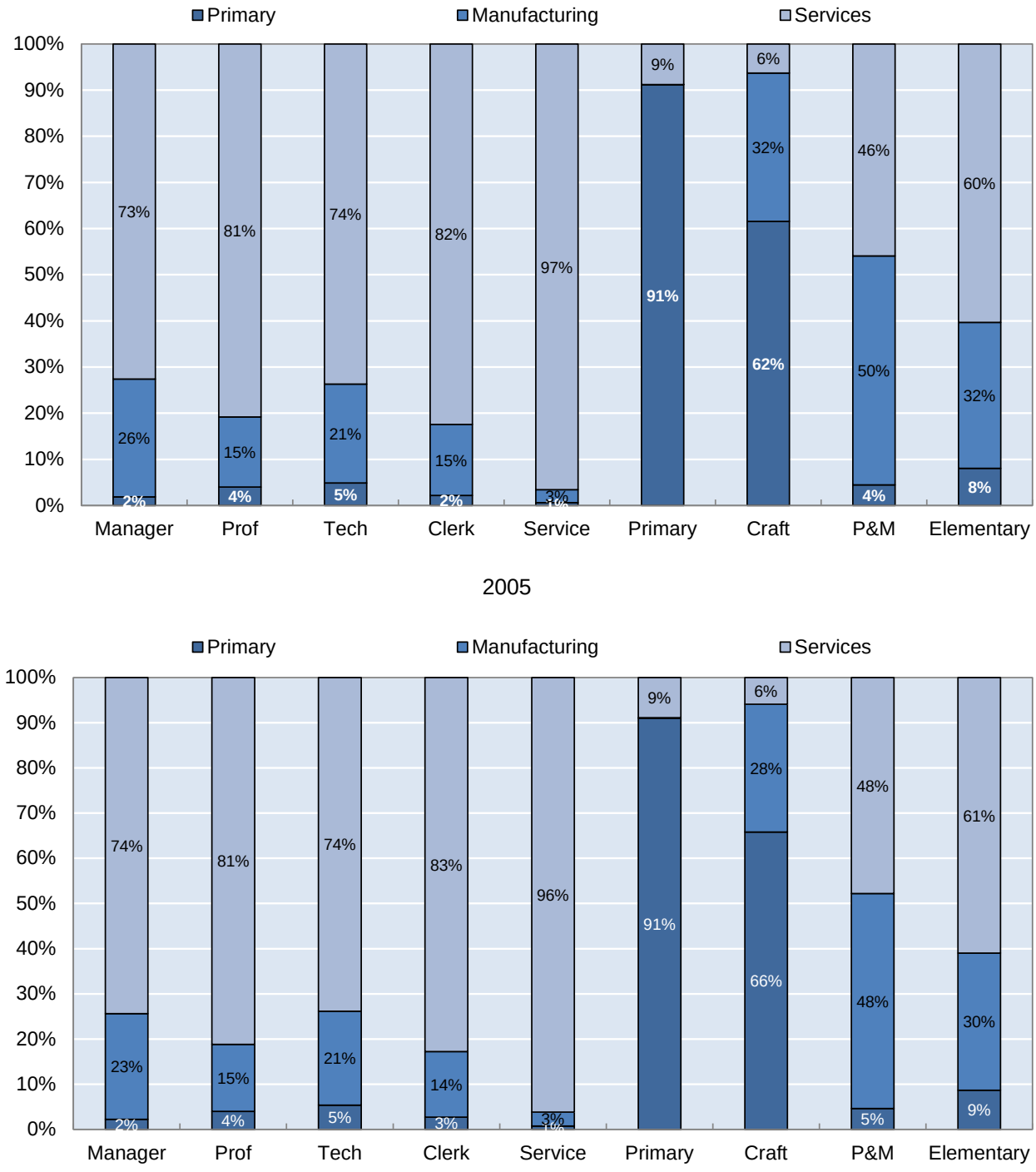
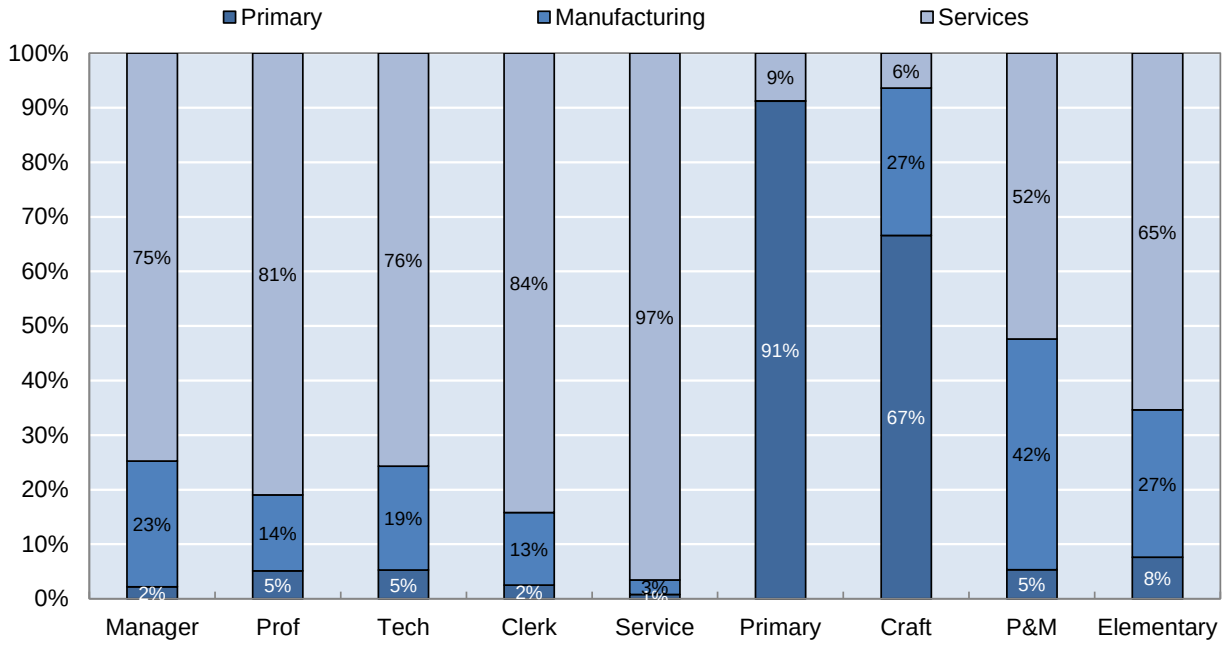


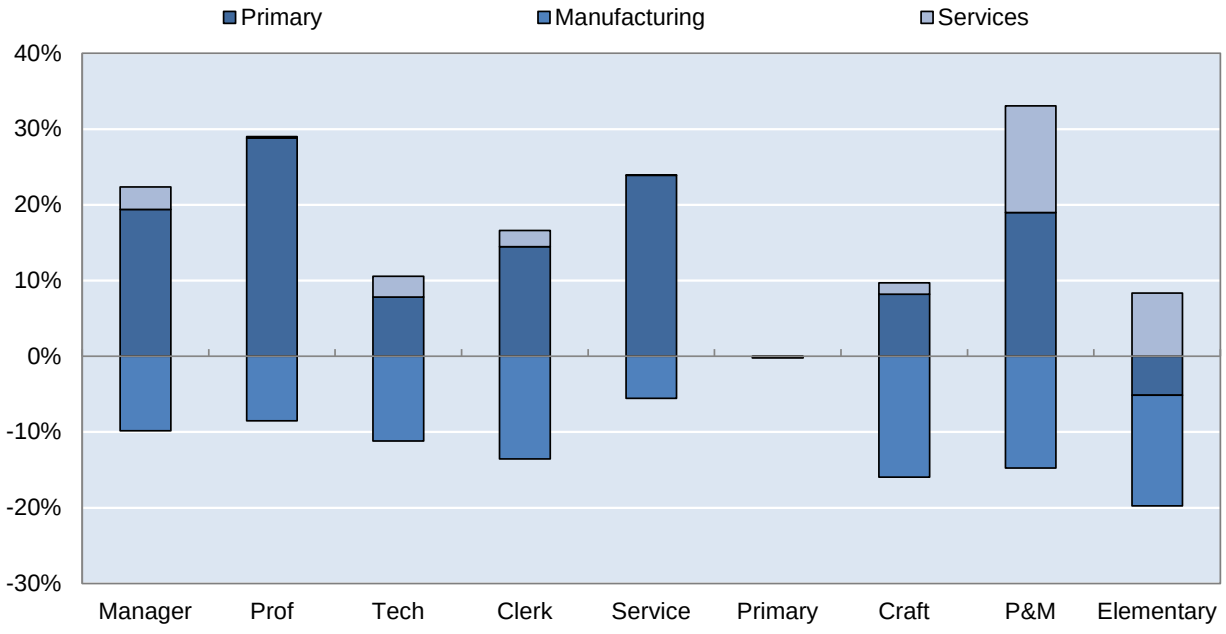
Figure A1.1. Sector share of occupational employment (‘cont)

2008



Source: Authors’ calculations. Note: Simple averages for the six sample economies: Brazil, Canada, Israel, South Africa, United Kingdom and United States.

Figure A1.2. Change in sectoral share of occupational employment between 2003 and 2008



Source: Authors’ calculations. Note: Simple averages for the six sample economies: Brazil, Canada, Israel, South Africa, United Kingdom and United States.

Table A1.1. Trade values by Broad Industry Classification

Country	Year	Indicator	Total	Primary	Manufacturing	Services
Total	2003	Import penetration mean	20.33	26.73	32.25	2.01
		Import penetration Std Dev	12.45	15.60	18.87	4.30
		Export share mean	26.07	46.95	28.66	2.61
		Export share Std Dev	18.70	36.34	17.27	4.97
		Offshoring mean	14.95	13.54	27.29	4.01
		Offshoring Std Dev	8.92	8.13	15.67	3.71
	2006	Import penetration mean	20.67	26.14	34.06	2.15
		Import penetration Std Dev	12.50	15.39	19.92	3.31
		Export share mean	25.14	42.03	31.35	2.46
		Export share Std Dev	17.80	30.88	19.89	3.94
		Offshoring mean	20.27	24.18	31.92	4.70
		Offshoring Std Dev	10.18	12.31	16.17	3.10
Brazil	2003	Import penetration mean	7.51	5.94	12.78	3.81
		Import penetration Std Dev	7.84	6.22	10.94	6.37
		Export share mean	7.67	8.73	10.01	4.29
		Export share Std Dev	7.15	9.70	6.75	5.00
		Offshoring mean	7.69	6.32	11.91	4.85
		Offshoring Std Dev	7.67	6.82	10.06	6.12
	2006	Import penetration mean	7.88	8.46	12.49	2.67
		Import penetration Std Dev	8.44	10.91	10.86	3.55
		Export share mean	11.50	15.19	15.42	3.88
		Export share Std Dev	6.99	8.47	8.25	4.25
		Offshoring mean	7.06	7.54	11.14	2.51
		Offshoring Std Dev	8.37	9.68	10.04	5.38
Canada	2003	Import penetration mean	20.03	18.22	41.20	0.69
		Import penetration Std Dev	10.04	4.47	24.79	0.87
		Export share mean	26.04	28.78	44.60	4.76
		Export share Std Dev	10.98	12.55	20.39 ..	
		Offshoring mean	21.44	14.47	42.28	7.58
		Offshoring Std Dev	13.27	12.42	22.73	4.65
	2006	Import penetration mean	20.97	19.49	42.80	0.61
		Import penetration Std Dev	10.12	4.83	24.71	0.84
		Export share mean	26.92	32.89	46.09	1.79
		Export share Std Dev	11.36	10.33	22.19	1.57
		Offshoring mean	21.08	16.64	38.58	8.00
		Offshoring Std Dev	10.32	10.04	19.76	1.17
Israel	2003	Import penetration mean	43.50	82.86	47.64	0.00
		Import penetration Std Dev	27.59	59.06	23.72	..
		Export share mean	77.24	189.14	42.57	0.00
		Export share Std Dev	60.89	157.56	25.11	..
		Offshoring mean	..	..	..	..
		Offshoring Std Dev	..	..	..	..
	2006	Import penetration mean	41.62	73.58	51.29	..
		Import penetration Std Dev	26.93	53.11	27.69	..
		Export share mean	68.37	158.76	46.35	..
		Export share Std Dev	54.32	134.69	28.27	..
		Offshoring mean	42.90	67.31	53.91	7.48
		Offshoring Std Dev	19.19	33.06	24.51	..

Table A1.1. Trade values by Broad Industry Classification (cont.)

Country	Year	Indicator	Total	Primary	Manufacturing	Services
South Africa	2003	Import penetration mean	14.52	15.47	21.17	6.91
		Import penetration Std Dev	11.74	9.65	15.89	9.69
		Export share mean	16.54	27.56	15.94	6.13
		Export share Std Dev	14.01	19.52	12.77	9.75
		Offshoring mean	11.72	10.37	21.65	3.13
		Offshoring Std Dev	9.30	8.49	15.73	3.68
	2006	Import penetration mean	12.86	10.94	21.15	6.50
		Import penetration Std Dev	10.59	6.77	16.52	8.47
		Export share mean	13.80	18.69	16.52	6.20
		Export share Std Dev	14.70	15.62	18.83	9.67
		Offshoring mean	10.75	9.43	19.31	3.52
		Offshoring Std Dev	8.27	5.80	13.62	5.40
United Kingdom	2003	Import penetration mean	24.71	27.59	46.19	0.35
		Import penetration Std Dev	9.61	6.41	22.41	..
		Export share mean	19.11	15.90	41.09	0.34
		Export share Std Dev	13.56	15.94	24.72	..
		Offshoring mean	22.47	24.34	38.88	4.20
		Offshoring Std Dev	7.82	5.24	18.21	..
	2006	Import penetration mean	26.90	31.97	48.14	0.59
		Import penetration Std Dev	9.96	7.92	21.97	..
		Export share mean	18.87	14.27	42.21	0.15
		Export share Std Dev	12.74	13.23	24.99	..
		Offshoring mean	26.95	31.06	43.40	6.38
		Offshoring Std Dev	7.52	5.61	16.95	..
United States	2003	Import penetration mean	11.70	10.29	24.55	0.28
		Import penetration Std Dev	7.86	7.81	15.49	0.28
		Export share mean	9.83	11.59	17.74	0.16
		Export share Std Dev	5.60	2.74	13.89	0.17
		Offshoring mean	11.40	12.18	21.74	0.27
		Offshoring Std Dev	6.57	7.69	11.62	0.41
	2006	Import penetration mean	13.76	12.43	28.48	0.37
		Import penetration Std Dev	8.98	8.78	17.77	0.38
		Export share mean	11.40	12.38	21.54	0.28
		Export share Std Dev	6.69	2.95	16.82	0.29
		Offshoring mean	12.86	13.10	25.18	0.30
		Offshoring Std Dev	7.41	9.67	12.12	0.45

Source: Authors' calculations.

Table A1.2. Trade values by occupation

Country	Year	Indicator	(1)Manager	(2)Prof	(3)Tech	(4)Clerk	(5)Service	(6)Primary	(7)Craft	(8)P&M	(9)Elementary
Total	2003	Import penetration mean	26.28	27.23	26.88	25.65	18.65	22.56	29.83	29.16	27.68
		Import penetration Std Dev	20.14	19.66	20.04	21.23	15.66	16.33	20.78	20.18	19.72
		Export share mean	27.41	29.51	28.54	30.94	27.66	34.65	43.37	29.91	33.25
		Export share Std Dev	24.34	24.84	25.34	31.45	30.29	37.25	46.02	26.69	31.16
		Offshoring mean	14.46	14.07	14.64	11.92	9.34	12.04	19.14	19.64	16.59
		Offshoring Std Dev	14.12	11.66	13.48	11.61	7.26	5.64	12.56	15.37	13.76
	2006	Import penetration mean	26.98	28.22	28.23	26.09	18.69	22.11	34.20	29.13	29.56
		Import penetration Std Dev	20.09	19.25	18.62	20.47	14.88	14.81	16.90	19.67	20.35
		Export share mean	26.72	28.21	27.93	28.35	22.20	33.23	52.42	28.96	34.24
		Export share Std Dev	24.18	24.88	24.40	29.17	26.61	32.68	34.71	25.53	29.50
		Offshoring mean	20.88	20.82	22.66	19.00	17.75	20.66	31.46	23.89	24.21
		Offshoring Std Dev	15.33	12.93	14.34	13.72	10.16	10.27	15.08	16.45	15.75
Brazil	2003	Import penetration mean	6.00	2.04	5.77	4.23	3.27	2.67	2.67	5.10	6.49
		Import penetration Std Dev	8.24	4.40	8.32	8.02	4.12	..	..	9.67	8.21
		Export share mean	6.14	2.48	5.39	4.60	4.01	3.62	3.62	4.22	7.98
		Export share Std Dev	5.80	5.02	6.06	5.19	3.20	..	..	7.05	5.57
		Offshoring mean	6.44	3.70	6.92	4.87	4.26	3.08	3.08	5.73	6.55
		Offshoring Std Dev	7.57	5.02	7.68	7.34	4.14	..	..	9.02	8.01
	2006	Import penetration mean	5.15	2.04	4.44	3.63	1.47	2.58	2.58	5.19	5.55
		Import penetration Std Dev	5.87	2.93	6.57	4.55	3.71	..	..	9.48	6.99
		Export share mean	6.67	2.83	5.00	4.71	3.82	10.62	10.62	5.81	14.76
		Export share Std Dev	6.31	5.87	6.13	5.13	3.86	..	..	8.84	7.34
		Offshoring mean	4.47	1.74	4.42	3.42	1.47	2.91	2.91	5.36	4.95
		Offshoring Std Dev	7.95	3.02	7.59	4.73	3.54	..	..	7.89	7.41
Canada	2003	Import penetration mean	30.81	28.06	30.45	26.72	4.13	15.49	21.06	33.79	26.11
		Import penetration Std Dev	27.09	30.04	27.51	26.31	12.02	0.74	5.10	26.91	19.20
		Export share mean	41.98	44.31	40.75	38.39	35.15	21.22	36.75	43.81	36.09
		Export share Std Dev	21.02	23.40	20.37	21.35	19.33	0.14	14.11	21.80	17.85
		Offshoring mean	15.79	14.83	16.21	11.96	8.75	7.46	22.48	27.80	21.38
		Offshoring Std Dev	20.05	17.69	18.99	15.53	7.33	1.77	13.71	24.42	18.10
	2006	Import penetration mean	31.96	29.63	31.16	27.09	4.54	15.91	22.95	34.23	27.79
		Import penetration Std Dev	27.62	31.54	28.07	26.56	12.39	1.07	4.73	26.83	19.05
		Export share mean	35.22	34.53	35.05	30.71	6.10	25.23	40.06	38.46	35.55
		Export share Std Dev	26.87	32.14	26.84	25.77	13.46	1.45	10.32	25.46	18.34
		Offshoring mean	15.54	14.69	15.90	12.05	8.23	9.22	23.86	24.57	19.74
		Offshoring Std Dev	16.83	15.49	16.39	12.63	4.32	0.62	9.55	20.48	15.64
Israel	2003	Import penetration mean	47.26	55.93	55.50	57.73	57.98	58.70	75.32	50.19	56.87
		Import penetration Std Dev	30.12	27.92	31.68	41.78	43.98	56.32	58.36	34.17	40.93
		Export share mean	52.56	58.90	63.32	85.87	89.05	123.34	153.67	55.51	87.00
		Export share Std Dev	62.39	63.55	73.62	111.38	117.91	151.25	170.27	75.87	108.85
		Offshoring mean	..	..	..	..	..	..	..	..	..
		Offshoring Std Dev	..	..	..	..	..	..	..	..	..
	2006	Import penetration mean	50.57	58.51	61.19	57.68	57.86	55.20	96.87	52.89	64.84
		Import penetration Std Dev	30.53	25.55	25.01	37.17	39.87	50.31	44.25	31.36	44.97
		Export share mean	54.68	59.37	65.01	74.92	87.69	109.77	210.54	57.35	83.38
		Export share Std Dev	52.52	53.00	59.67	87.20	102.88	129.21	123.78	63.08	91.47
		Offshoring mean	51.47	54.48	62.26	52.69	57.11	56.79	78.56	48.49	58.99
		Offshoring Std Dev	26.01	28.16	24.16	29.96	28.58	30.76	33.59	28.94	30.67

Source: Authors' calculations.

Table A1.2. Trade values by occupation (‘cont)

Country	Year	Indicator	(1)Manager	(2)Prof	(3)Tech	(4)Clerk	(5)Service	(6)Primary	(7)Craft	(8)P&M	(9)Elementary
South Africa	2003	Import penetration mean	15.25	6.32	8.07	10.68	8.74	9.42	16.35	17.81	16.61
		Import penetration Std Dev	15.61	11.18	12.97	13.71	8.36	2.41	10.04	13.33	12.90
		Export share mean	15.59	6.46	7.57	10.87	10.68	15.11	29.34	20.37	21.52
		Export share Std Dev	17.56	13.88	14.18	14.83	13.15	4.19	20.27	19.31	19.52
		Offshoring mean	9.60	5.98	8.39	4.56	4.89	5.40	11.38	13.28	11.14
		Offshoring Std Dev	12.67	10.24	12.17	9.34	5.46	1.98	8.95	12.69	12.29
	2006	Import penetration mean	12.22	4.62	7.33	10.32	7.88	8.19	10.13	10.44	15.29
		Import penetration Std Dev	14.05	8.55	10.03	14.26	6.67	3.90	5.87	11.93	12.51
		Export share mean	13.41	4.78	5.92	11.17	8.82	12.06	16.80	14.00	20.89
		Export share Std Dev	16.71	11.91	12.88	17.56	10.02	5.17	13.54	17.45	20.35
		Offshoring mean	7.81	3.82	7.13	3.80	5.34	7.13	8.83	7.82	9.13
		Offshoring Std Dev	10.72	7.14	9.42	8.68	5.10	3.56	5.13	10.46	10.20
United Kingdom	2003	Import penetration mean	42.78	52.78	46.72	44.77	31.28	41.00	36.44	49.33	40.95
		Import penetration Std Dev	22.87	24.43	22.27	23.16	16.19	19.24	17.24	23.04	22.77
		Export share mean	37.45	50.54	42.89	39.42	20.76	32.35	31.07	42.90	34.02
		Export share Std Dev	25.82	26.03	24.14	25.20	20.17	28.26	20.40	24.32	23.39
		Offshoring mean	34.69	44.52	38.10	36.44	26.46	35.00	31.18	41.23	33.24
		Offshoring Std Dev	19.20	19.66	19.45	19.72	13.32	15.51	13.71	18.08	17.44
	2006	Import penetration mean	44.27	54.37	49.17	46.37	33.24	41.13	38.79	49.66	41.64
		Import penetration Std Dev	23.23	23.96	22.50	23.08	15.83	15.71	17.76	22.39	22.14
		Export share mean	37.48	51.19	43.66	40.38	20.18	28.59	31.42	43.16	34.78
		Export share Std Dev	26.52	26.03	24.77	25.48	20.35	24.86	21.93	23.89	24.94
		Offshoring mean	39.49	48.81	42.56	40.01	31.84	38.72	38.84	45.51	40.62
		Offshoring Std Dev	18.12	17.62	18.77	19.35	12.87	12.87	12.89	16.57	16.32
United States	2003	Import penetration mean	15.57	18.26	14.78	9.77	6.47	8.08	27.13	18.74	19.08
		Import penetration Std Dev	16.93	19.99	17.52	14.38	9.26	2.94	13.15	13.96	14.34
		Export share mean	10.73	14.39	11.30	6.49	6.30	12.25	5.79	12.66	12.88
		Export share Std Dev	13.46	17.15	13.65	10.73	7.96	2.39	5.02	11.82	11.77
		Offshoring mean	5.81	1.34	3.57	1.79	2.34	9.28	27.59	10.17	10.66
		Offshoring Std Dev	11.08	5.72	9.10	6.11	6.04	3.33	13.89	12.63	12.94
	2006	Import penetration mean	17.75	20.18	16.09	11.46	7.16	9.63	33.91	22.36	22.22
		Import penetration Std Dev	19.26	22.98	19.53	17.20	10.82	3.05	11.92	16.03	16.43
		Export share mean	12.87	16.56	12.92	8.19	6.59	13.08	5.06	14.97	16.07
		Export share Std Dev	16.14	20.32	16.12	13.90	9.07	2.71	3.98	14.47	14.58
		Offshoring mean	6.50	1.40	3.67	2.01	2.51	9.21	35.77	11.57	11.84
		Offshoring Std Dev	12.36	6.16	9.68	6.95	6.57	3.55	14.22	14.38	14.24

Note: 1-Managers and senior officials, 2-Professionals, 3-Technicians and associate professionals, 4-Clerks, 5-Service and Sales Workers, 6-Skilled primary, 7-Craft and trade, 8-Plant and machinery, 9-Elementary.

Source: Authors’ calculations.

Table A1.3. Changes in Duration Share for Unemployed

		2004	2005	2006	2007	2008
Total	1 week-3 months	-15.0%	2.3%	4.8%	-0.5%	**16.9%**
	3-6 months	..	-12.0%	1.9%	1.4%	..
	6 months-1 year	..	-3.1%	-6.4%	-8.7%	..
	> 1 year	..	4.0%	-16.8%	9.6%	..
Canada	1 week-3 months	-31.8%	0.1%	2.5%	1.4%	**40.3%**
	3-6 months	..	2.9%	-7.0%	4.0%	..
	6 months-1 year	..	-7.1%	-5.1%	4.6%	..
	> 1 year	..	0.6%	-7.9%	-14.1%	..
Israel	1 week-3 months	-9.8%	0.1%	7.5%	3.9%	3.9%
	3-6 months	-24.3%	6.4%	-25.4%	1.1%	10.8%
	6 months-1 year	-20.7%	-12.0%	2.7%	-6.0%	**13.3%**
	> 1 year	28.0%	1.2%	2.9%	-1.1%	-7.6%
United Kingdom	1 week-3 months	-0.9%	-0.8%	-7.4%	0.4%	-1.1%
	3-6 months	-6.9%	5.6%	2.7%	-3.8%	-4.5%
	6 months-1 year	14.1%	-6.3%	18.1%	-10.1%	3.1%
	> 1 year	-1.3%	2.7%	-2.4%	10.9%	3.5%
United States	1 week-3 months	2.6%	3.2%	7.9%	-3.0%	2.4%
	3-6 months	15.1%	-19.3%	6.2%	0.8%	-11.9%
	6 months-1 year	-9.3%	-1.2%	-10.1%	-12.0%	3.6%
	> 1 year	14.3%	6.2%	-26.6%	**25.6%**	-26.3%

Source: Authors' calculations based on unweighted sample values from LFS.

Table A1.4. Transition Matrices

Total			Above Avg - Offshoring			Above Avg - Import Penetration			Above Avg - Export Share		
	Employed	Unemployed		Employed	Unemployed		Employed	Unemployed		Employed	Unemployed
Employed	94.88	5.12	Employed	99.19	0.81	Employed	96.28	3.72	Employed	94.06	5.94
Unemployed	93.05	6.95	Unemployed	87.5	12.5	Unemployed	94.47	5.53	Unemployed	95.49	4.51
OECD			At/Below Avg - Offshoring			At/Below Avg - Import Penetration			At/Below Avg - Export Share		
	Employed	Unemployed		Employed	Unemployed		Employed	Unemployed		Employed	Unemployed
Employed	94.74	5.26	Employed	94.54	5.46	Employed	94.25	5.75	Employed	94.65	5.35
Unemployed	93.01	6.99	Unemployed	92.65	7.35	Unemployed	92.14	7.86	Unemployed	92.35	7.65

Source: Authors' calculations based on unweighted sample values from LFS.

Annex 2

Regression Tables

Table A2.1. Regression results for trade and Unemployment outcomes[a,b,c]

	Brazil		Canada		Israel		South Africa		United States	
DEP VAR	Industry	Occupation	Industry	Occupation	Industry	Occupation	Industry	Occupation	Industry	Occupation
Trade Regression										
Export Share	0.009***	-0.387***	-0.074***	-0.456***	0.011***	-0.105***	0.001***	-0.335***	-0.0355***	-0.611***
	(0.0017)	(0.0132)	(0.0004)	(0.0063)	(0.0003)	(0.0039)	(0.0003)	(0.0056)	(0.0002)	(0.016)
Skill_2 x Export Share	-0.021***	0.362***	0.080***	0.461***	-0.001**	0.109***	-0.018***	0.523***	0.057***	0.825***
	(0.0018)	(0.0131)	(0.0005)	(0.0066)	(0.0004)	(0.0037)	(0.0004)	(0.0073)	(0.0003)	(0.0150)
Skill_3 x Export Share	0.058***	0.237***	0.015***	0.453***	-0.013***	0.125***	-0.034***	0.421***	0.108***	0.650***
	(0.0032)	(0.0134)	(0.0005)	(0.0064)	(0.0004)	(0.038)	(0.0005)	(0.0062)	(0.0004)	(0.0254)
Skill_4 x Export Share	-0.0010	0.137***	0.039***	0.567***	-0.007***	0.118***	**	**	0.097***	1.854***
	(0.0013)	(0.0177)	(0.0005)	(0.0063)	(0.0005)	(0.0038)			(0.0005)	(0.0161)
Import Penetration	0.052***	0.337***	0.081***	0.539***	-0.024***	0.098***	0.002***	0.229***	0.054***	-0.446***
	(0.0013)	(0.0131)	(0.0004)	(0.0068)	(0.0023)	(0.0034)	(0.0002)	(0.0041)	(0.0002)	(0.0145)
Skill_2 x Import Penetration	-0.022***	-0.331***	-0.091***	-0.542***	-0.007***	-0.091***	-0.011***	-0.458***	-0.103***	0.052***
	(0.0014)	-0.0129	(0.0005)	(0.0072)	(0.0011)	(0.0035)	(0.0004)	(0.0063)	(0.0002)	(0.0136)
Skill_3 x Import Penetration	-0.086***	-0.154***	-0.024***	-0.545***	0.043***	-0.131***	0.005***	-0.306***	-0.112***	0.399***
	(0.0025)	(0.0141)	(0.0005)	(0.0069)	(0.0013)	(0.0041)	-0.0003	(0.0049)	(0.0003)	(0.0142)
Skill_4 x Import Penetration	-0.003	0.333***	0.074***	-0.657***	-0.0020	-0.118***	**	**	-0.162***	-0.925***
	(0.0036)	(0.0231)	(0.0005)	(0.0068)	(0.0013)	(0.0035)			(0.0004)	(0.0151)
Pseudo R-squared	0.065	0.069	0.057	0.540	0.067	0.059	0.094	0.123	0.061	0.072
N	3.11E+07	9.43E+07	2.10E+08	7.20E+08	8.60E+06	1.14E+07	1.08E+06	2.97E+06	7.19E+08	2.10E+09
Offshoring Regression										
Offshoring	0.054***	-0.130***	-0.012***	-0.001**	-0.042***	-0.038***	-0.022**	-0.290***	0.026***	0.053***
	(0.0015)	(0.0035)	(0.0002)	(0.0003)	(0.0024)	(0.0026)	(0.0005)	(0.0056)	(0.0001)	(0.0005)
Skill_2 x Offshoring	-0.015***	0.025***	0.007***	-0.002***	-0.006***	0.049***	-0.0002	0.264***	-0.053***	-0.055***
	(0.0016)	(0.0027)	(0.002)	(0.0003)	(0.0030)	(0.0016)	(0.0008)	(0.0055)	(0.0002)	(0.0005)
Skill_3 x Offshoring	0.007***	0.042***	0.032***	-0.013***	0.009***	0.063***	-0.015***	0.354***	-0.026***	-0.054***
	(0.0022)	(0.0034)	(0.0002)	(0.0003)	(0.0033)	(0.0021)	(0.001)	(0.0059)	(0.0003)	(0.0006)
Skill_4 x Offshoring	0.102***	0.236***	-0.026***	-0.002***	0.070***	0.034***	**	**	-0.059***	-0.033***
	(0.0042)	(0.0082)	(0.0002)	(0.0004)	(0.0032)	(0.0017)			(0.0003)	(0.0006)
Pseudo R-squared	0.064	0.069	0.048	0.055	0.076	0.067	0.063	0.101	0.059	0.074
N	3.11E+07	9.43E+07	2.10E+08	7.20E+08	1.64E+06	1.15E+07	3.46E+06	2966501	8.29E+08	2.10E+09

a) Unemployment models estimated by probit regression. Marginal effects are reported and evaluated at the mean. Dummy variables are evaluated for a discrete change from 0 to 1. p<0.10, ** p<0.05, *** p<0.01, Robust standard errors in parentheses. ** indicates omitted variable. Results for skill level 2-4 are marginal with respect to base.

b) Year, Industry*time and occupation dummies included but not reported for industry equations while year and occupation*skill*time dummies included for the occupation-specific equations. All equations also include age, education dummies, skill dummies, gender and marital status dummies but not reported. All trade variables are lagged.

c) All regressions are weighted.

Source: Authors' calculations.

Table A2.2. Regression results for trade and wage outcomes including skill[a,b,c]

	Brazil		Canada		United Kingdom		United States	
DEP VAR	Industry	Occupation	Industry	Occupation	Industry	Occupation	Industry	Occupation
Trade Regression								
Export Share	0.192***	-0.266***	0.379***	-0.487***	0.948***	-2.212***	0.579***	16.239***
	(0.0075)	(0.0448)	(0.0008)	(0.0116)	(o.oo55)	(0.0801)	(0.0022)	(0.0355)
Skill_2 x Export Share	0.212***	0.476***	-0.234***	0.292***	-0.293***	2.178***	-0.188***	-12.489***
	(0.0080)	(0.0441)	(0.009)	(0.0123)	(0.0076)	(0.1063)	(0.0029)	(0.0366)
Skill_3 x Export Share	-0.194***	0.012***	0.219***	0.281***	-0.026***	4.947***	-0.753***	-17.656***
	(0.0115)	(0.0463)	(0.008)	(0.0018)	(0.0066)	(0.0836)	(0.0033)	(0.0355)
Skill_4 x Export Share	-0.083***	1.031***	0.151***	0.544***	0.379***	-7.571***	0.204***	-20.085***
	(0.0170)	(0.0541)	(0.009)	(0.0117)	(0.0161)	(0.2792)	(0.0036)	(0.053)
Import Penetration	1.264***	-0.234***	-0.212***	0.550***	-0.772***	2.115***	-0.032***	-9.556***
	'(0.0062)	(0.0455)	(0.0007)	(0.0126)	(0.0059)	(0.0699)	(0.0023)	(0.0276)
Skill_2 x Import Penetration	-1.091***	-0.167***	0.087***	-0.361***	0.110***	-1.389***	-0.023***	6.811***
	(0.0065)	(0.0448)	'(0.008)	(0.0133)	(0.0082)	(0.0828)	(0.0025)	(0.0284)
Skill_3 x Import Penetration	-0.251***	0.631***	-0.206***	-0.308***	-0.138***	-4.081***	0.557***	11.261***
	(0.0093)	(0.0496)	(0.0008)	(0.0129)	(0.0072)	(0.0606)	(0.0028)	(0.0279)
Skill_4 x Import Penetration	-0.708***	-1.072***	0.007***	-0.596***	-0.780***	5.409***	-0.374***	12.983***
	(0.0143)	(0.0702)	(0.0008)	(0.0127)	(0.0165)	(0.1800)	(0.0031)	(0.0436)
Pseudo R-squared	0.5680	0.5890	0.4670	0.5460	0.4050	0.4640	0.3710	0.3690
N	2.90E+07	6.58E+07	6.63E+07	5.59E+08	2.15E+06	6.77E+06	6.15E+07	2.19E+08
Offshoring Regression								
Offshoring	1.622***	-0.127***	0.195***	0.059***	0.228***	-0.057***	0.843***	-0.129***
	(0.0057)	(0.0127)	(0.0003)	(0.0007)	(0.0029)	(0.0067)	(0.0023)	(0.0061)
Skill_2 x Offshoring	-1.037***	-0.075***	-0.069***	-0.037***	-0.130***	-0.017***	-0.360***	0.0487***
	(0.0057)	(0.0093)	(0.0004)	(0.0006)	(0.0047)	(0.0030)	(0.0025)	(0.0057)
Skill_3 x Offshoring	-0.619***	0.073***	-0.066***	-0.035***	0.071***	-0.061***	-0.403***	-0.138***
	(0.0083)	(0.0127)	(0.0004)	(0.0006)	(0.0038)	(0.0023)	(0.0029)	(0.0061)
Skill_4 x Offshoring	-0.634***	-0.861***	0.063***	-0.062***	-0.650***	-0.0070	-0.548***	0.293***
	(0.0015)	(0.0254)	(0.0005)	(0.0006)	(0.0100)	(0.0081)	(0.0031)	(0.0062)
Pseudo R-squared	0.5520	0.5890	0.4870	0.5460	0.4440	0.4630	0.3590	0.3740
N	2.09E+07	6.58E+07	1.66E+08	5.59E+08	2.15E+06	6.77E+06	6.54E+07	2.19E+08

a) Wage equations estimated by OLS. p<0.10, ** p<0.05, *** p<0.01, Robust standard errors in parentheses. Results for skill level 2-4 are marginal with respect to base.

b) Year, Industry*time and occupation dummies included but not reported for industry equations while year and occupation*skill*time dummies included for the occupation-specific equations. All equations also include age, education dummies, skill dummies, gender and marital status dummies but not reported. All trade variables are lagged.

c) All regressions are weighted.

Source: Authors' calculations.

Table A2.3. Regression results for duration model[a,b,c]

	Industry regressions		Occupation regressions	
	Duration < 3 months			
Export share	0.0134		-0.0737***	
	(0.95)		(-2.82)	
Import penetration	-0.00969		0.260***	
	(-0.30)		(7.18)	
Offshore		0.104***		0.346***
		(5.12)		(17.91)
	Duration 3-6 months			
Export share	-0.00706		0.0405***	
	(-0.95)		(2.82)	
Import penetration	0.00509		-0.143***	
	(0.30)		(-7.17)	
Offshore		-0.0595***		-0.190***
		(-5.11)		(-17.79)
	Duration 6-12 months			
Export share	-0.00466		0.0247***	
	(-0.95)		(2.82)	
Import penetration	0.00336		-0.0871***	
	(0.30)		(-7.17)	
Offshore		-0.0345***		-0.115***
		(-5.11)		(-17.78)
	Duration >12 months			
Export share	-0.00172		0.00851***	
	(-0.95)		(2.81)	
Import penetration	0.00124		-0.0301***	
	(0.30)		(-7.14)	
Offshore		-0.0105***		-0.0397***
		(-5.07)		(-17.52)
N	61971	56414	190928	190928
pseudo R-sq	0.138	0.202	0.156	0.157

a) For all equations: Industry*time dummies included but not reported. Also included are age, education dummies, skill dummies, occupation dummies, gender and marital status dummies but not reported. All trade variables are lagged.

b) p<0.10, ** p<0.05, *** p<0.01, Robust standard errors in parentheses.

c) Includes Canada, Israel, and the United States.

Annex 3

Data Annex

A large amount of data was collected and synthesised to create the database used in this study. Six Labour Force Surveys were collected and analysed for the purposes of harmonisation.[27] The countries were chosen based on comparability of reported variables, years covered and standards used as well as to reflect a variety of economic conditions. The sample thus consists of Brazil, Canada, Israel, South Africa, the United Kingdom (UK) and the United States (US). The study covers the period 2003-2008. As stated above, of interest in this work is the short and medium run adjustment period and so our sample period is limited to 6 years. Using this approach, we can focus on a relatively recent period, prior to the impact of the economic crisis, which has consistent reporting standards. We can also break the sample down into shorter time periods.

Not all data were available for all countries, however. Of the variables of most interest here, Israel reported no wage information and South Africa only reported this information in bands. Only Canada and South Africa reported variables relating to tenure and union membership. Finally, the United Kingdom provided no information on industry or occupation of unemployed persons.

Harmonising the Labour Force Surveys

Original data by industries for Canada were reported using the NAICS 2002 classification in 43 categories. We employed a concordance to convert the data into the ISIC classification and used this as a basis of industry classification for all the countries. Data on occupation were reported in NOCS-S 2001, grouped in 47 categories.

Data for Brazilian industries were grouped into 59 categories, based on ISIC classification. These values were mapped to the 43 industries based on the Canadian survey. For occupation, data reported for 54 categories were aggregated to match the 47 categories from the Canadian survey.

For Israel, data for industries were reported in ISIC at the 4 digits level. We used the established concordance to map these to 43 categories. For occupation, data were reported at the 3 digit level based on ILO ISCO 88. We used a concordance to group to the 47 major categories from the Canadian survey.

Industry classification for South Africa was based on the International South Africa Industrial Classification of all Economic Activities. This classification is ISIC based and was mapped to the 43 industries as above. Occupations were coded at the four digits level on the basis of the South Africa Standard Classification of Occupations (SASCO). These were then mapped to the 47 major categories.

27 The authors wish to thank ELS for the labour force surveys and in particular Pascal Marianna for his assistance in processing and harmonising the data.

Industries in the United Kingdom survey were reported by SIC92. We used a concordance between SIC 92 and ISIC to create our 43 categories. For occupation, data were reported in SOC 2000, and were grouped into 47 categories.

Industries for the United States were first reported by using the Census Code. We used a concordance to convert these ones into NAICS and then grouped into the 43 categories from the Canadian survey. For occupations, we used the same procedure by converting first census codes into SOC and then mapped to have the 47 categories from the Canadian survey.

We followed a similar procedure when concording for occupations. We used the 47 categories reported in the Canadian survey as the basis for concordance. As with all concordances, caution is suggested. The basic principles underlying the various classification systems are different, and thus some overlaps ensue. For example, the SOC system reported by the United States classifies workers into occupational definitions where similar job duties, and in some cases skills, education, and/or training, are grouped together. The ISCO system which classifies occupations based on the duties and tasks undertaken.[28]

Trade Variables

Trade variables are defined per standard OECD definitions. Export share is calculated as exports as a percentage of production. The export share of production shows the importance of the foreign market for a given industry in a country. This indicator may change over time as supply and demand conditions change in foreign and domestic markets. Import penetration shows imports as a percentage of total domestic demand (this latter is estimated as production less exports plus imports). For a given country (or country group), a value close to 100 in a certain industry, implies that domestic demand is mainly fulfilled by imports and domestic production tends to be exported. A value close to 0 means self sufficient, i.e. domestic demand is mainly satisfied by domestic production.

There are a number of approaches available for measuring off-shoring. Indeed, OECD (2007) devotes an entire chapter outlining the problems in measuring off-shoring. Horgos (2007) evaluates empirically five measures of off-shoring and shows that the best results were achieved using the IIGO measure while the IITI and VS measures also performed very well. Thus, based on these results and the broad usage of the measure elsewhere, we have applied the IITI method in the results presented in this paper. We have taken the values as provided by the OECD STAN database. These values have the advantage of being calculated from inputoutput tables harmonised and vetted by the OECD. The tables provide data for three time periods: mid 1990s, early 2000s and mid 2000s. We have attached these to our data applying the ‘early 2000s to the year of 2003 and ‘mid 2000s’ to the year 2006, interpolating the values for the missing years. See www.oecd.org/industry/industryandglobalisation/44484093.pdf for the specifics of years and country coverage.

Other trade variables, import penetration and export share, are obtained from the STAN database with the exception of South Africa and Brazil. These values were calculated by the authors consistent with the approach used for the OECD countries. Underlying data used in the calculations was taken from industrial statistics from the country data files, including input-output tables, of the OECD.

28 We wish to thank colleagues at the US DOL and BLS, as well as Statistics Canada for providing us with concordances and useful advice.

Finally, Tables A3.4 and A3.5 provide further details of the variables included in the analysis and Tables A3.6 to A3.8 provide some descriptive statistics for the underlying database.

Table A3.1. List of regrouped occupations

0	Armed forces
1	Management of companies and Public Administrations
2	Tehnicians and Professionals
3	Professional and Technical Support
4	Administrative employees
5	Workers in catering services, personal protection and salespersons
6	Skilled workers in agriculture and fishing
7	Artisans and skilled workers in manufacturing, construction, and mining, excluding plant and machinery operators
8	Plant and machinery operators and assemblers
9	Unskilled

Table A3.2. Concordance table for the industries

Industry in 43 categories based in Canada industry list	ISIC 2 digit level	Industry in 43 categories based in Canada industry list	ISIC 2 digit level
1	01	25	36
	05	26	50
2	02		51
4	10	27	52
	11	28	60
	12		61
	13		62
	14		63
5	40		64
	41	30	65
7	45		67
8	15	31	66
	16	32	70
9	17	33	71
10	18	34	72
	19		73
11	20		74
12	21	35	37
14	23		90
15	24	36	80
16	25	37	85
17	26	38	22
18	27		92
19	28	39	55
20	29	40	91
21	30		93
	32		95
	33	41	75
22	31	43	99
23	34		
	35		

Table A3.3. Industry groupings

Primary	1	Agriculture
	2	Forestry and Logging with support activities
	3	Fishing, Hunting and Trapping
	4	Mining and Oil and Gas Extraction
Manufacturing	8	Food, Beverage and Tobacco Product Manufacturing
	9	Textile Mills & Textile Product Mills
	10	Clothing Manufacturing & Leather & Allied Product Manufacturing
	11	Wood Product Manufacturing
	12	Paper Manufacturing
	13	Printing and Related Support Activities
	14	Petroleum and Coal Products Manufacturing
	15	Chemical Manufacturing
	16	Plastics and Rubber Products Manufacturing
	17	Non-Metallic Mineral Product Manufacturing
	18	Primary Metal Manufacturing
	19	Fabricated Metal Product Manufacturing
	20	Machinery Manufacturing
	21	Computer and Electronic Product Manufacturing
	22	Electrical Equipment, Appliance and Component Manufacturing
	23	Transportation Equipment Manufacturing
	24	Furniture and Related Product Manufacturing
	25	Miscellaneous Manufacturing
Services	5	Utilities
	6	Prime Contracting
	7	Trade Contracting
	26	Wholesale Trade
	27	Retail Trade
	28	Transportation
	29	Wharehousing and Storage
	30	Finance
	31	Insurance Carriers & Related Activities and Funds & Other Financial Vehicles
	32	Real Estate
	33	Rental & Leasing Services and Owners & Lessors of Other Non-Financial Assets
	34	Professional, Scientific and Technical Services
	35	Management, Administrative and Other Support
	36	Educational Services
	37	Health Care and Social Assistance
	38	Information, Culture and Recreation
	39	Accommodation and Food Services
	40	Other Services
	41	Federal Government Public Administration (including Defence Services)
	42	Provincial and Territorial Public Administration
	43	Local, Municipal & Regional Public Administration and Aboriginal, Inter & Other Extra-Territorial Public Admin

Table A3.4. Time coverage for variables

	Brazil	Canada	Israel	South Africa	UK	USA
Gender	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008
Age	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008
Marital Status		2003-2008	2003-2008	2003-2008	2003-2008	2003-2008
LFS	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008
Industry	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008
Previous industry reported for unemployed	2003-2008	2003-2008	2003-2008			2003-2008
Occupation	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008
Education	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008
Wage (hourly)	2003-2008	2003-2008		2003-2007	2003-2008	2003-2008
Duration	2003-2008	2004-2007	2003-2008	2003-2008	2003-2008	2003-2008
Dependents		2003-2008	2003-2008		2003-2008	2003-2008
Usual Hrs worked	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008
Actual Hrs worked	2003-2008	2003-2008	2003-2008	2003-2008	2003-2008	
Union		2003-2008		2003-2007		2003-2008
Tenure	2003-2008*	2003-2008			2003-2008	
Offshoring	2003, 2006	2003, 2006	2006	2003, 2006	2003, 2006	2003, 2006
Import Penetration	2003, 2006	2003-2006	2003-2008	2003, 2006	2003-2007	2003-2009
Export Share	2003, 2006	2003-2006	2003-2008	2003, 2006	2003-2007	2003-2009

Table A3.5. Labour force harmonised variables

Demographics	Variable Name
Age	**age**
15-24	1
25-29	2
30-34	3
35-44	4
45-54	5
55-59	6
60-64	7
65-69	8
70+	9
Sex	**sex**
Men	1
Women	2
Marital Status	**marstat**
Single	1
Married	2
Separated	3
Divorced	4
Widowed	5
Position (eg head of household)	**relref**
Head	1
Spouse	2
Child/Child in-law	3
Parent/Parent In-law	4
Other	5
Dependents (children living at home >15yrs – or however most consistently defined)	**dependent**
no	0
yes	1
Education	**edu**
No High school (No qualifications)	1
High School (Below NVQ level 2, NVQ level 2, NVQ level 3)	2
Trade/technical training (Trade apprenticeships and some)	3
Degree (NVQ level 4)	4
Higher Degree (NVQ level 5)	5
Other (other qualifications)	6
Spouse working?	**statussp**
employed	1
unemployed	2
inactive	3
Occupation of spouse	**occupsp**

Table A3.5. Labour force harmonised variables (cont.)

Employment	Variable Name
Working?	**lfsstat**
Employed	1
Unemployed	2
Other	3
Occupation (now and previous)	**occupation**
Industry (now and previous)	**industry**
Belong to a union	**union**
Yes	1
No but covered	2
No	3
Usual Hours worked	**usualhrs**
Actual Hours worked	**actualhrs**
Wage	**wage**
Employment	**empstat**
Employee	1
Self-employed	2
Unpaid family work	3
Underemployment want longer hours?	**undemp**
Yes	1
No	2

Unemployed	Variable Name
How long?	**timeunemp**
More than 1 week but less than 3 months	1
3 months- 6 months	2
6 months to a year	3
More than a year	4
Searching? (why/why not) available	**avail**
No	1
Yes	0
Reason not looking	**notlook**
Waiting for reply/recall	1
Going to school	2
Family responsbilities	3
Illness/disability	4
Think no work available	5
Other	6
Main method of looking for work	**method**
Registered with job agency, etc	1
Enquired at workplace, factory, etc	2
Answered/placed ad	3
Sought assistance from family or friend	4
Tried to open business or similar activity	5
Other	6
Occupation (last job)	**prevoccupation**
Industry (last job)	**previndustry**

Table A3.6. Gender distribution, weighted

		2003	2004	2005	2006	2007	2008
Brazil	Men	46.48	46.32	46.40	46.27	46.30	46.30
	Women	53.52	53.68	53.60	53.73	53.70	53.70
Canada	Men	52.55	52.73	52.56	52.68	52.87	52.80
	Women	47.45	47.27	47.44	47.32	47.13	47.20
Israel	Men	48.21	48.08	48.42	48.38	48.30	48.23
	Women	51.79	51.92	51.58	51.62	51.70	51.77
South Africa	Men	46.71	46.48	47.76	47.74	47.91	46.97
	Women	53.28	53.47	52.18	52.24	52.07	53.03
United Kingdom	Men	46.67	46.68	46.84	46.93	46.72	46.53
	Women	53.33	53.32	53.16	53.07	53.28	53.47
United States	Men	51.26	51.04	51.34	51.67	51.32	51.63
	Women	48.74	48.96	48.66	48.33	48.68	48.37
Total database	Men	51.40	51.24	51.48	51.77	51.50	51.75
	Women	48.60	48.76	48.52	48.23	48.50	48.25

Source: Authors' calculations.

Table A3.7. Age distribution of the sample, weighted

		2003	2004	2005	2006	2007	2008
Brazil	15-24	24.2	23.7	23.3	22.6	22.1	21.4
	25-29	10.8	10.7	10.8	11.1	10.9	11.0
	30-34	10.7	10.6	10.5	10.1	9.9	9.9
	35-44	19.9	20.0	19.5	19.3	19.3	19.1
	45-54	15.5	15.6	16.1	16.1	16.3	16.6
	55-59	5.3	5.4	5.5	6.0	6.2	6.5
	60-64	4.1	4.4	4.4	4.5	4.7	4.8
	65-69	3.5	3.6	3.4	3.6	3.6	3.7
	70+	6.1	6.3	6.4	6.8	6.9	7.1
Canada	15-24	16.7	16.7	16.6	16.5	16.4	16.2
	25-29	7.5	7.4	7.6	7.4	7.4	7.4
	30-34	7.8	7.5	7.4	7.4	7.2	7.2
	35-44	18.3	17.8	17.2	16.9	16.4	15.7
	45-54	16.0	16.2	16.5	16.6	16.9	17.0
	55-59	7.0	7.3	7.4	7.4	7.4	7.4
	60-64	6.3	6.4	6.6	6.7	7.0	7.3
	65-69	5.8	5.9	5.9	6.0	6.1	6.3
	70+	14.5	14.7	14.8	15.0	15.2	15.3
Israel	15-24	29.6	29.4	28.8	28.8	29.1	29.1
	25-29	7.6	7.7	7.5	7.4	7.2	7.0
	30-34	7.1	7.0	7.2	6.9	6.7	6.9
	35-44	12.0	11.5	11.5	11.3	11.1	11.0
	45-54	10.9	10.9	11.0	11.0	10.7	10.6
	55-59	5.2	5.7	6.0	6.0	6.0	6.0
	60-64	5.0	4.8	5.0	5.2	5.5	5.8
	65-69	6.2	6.3	6.3	6.2	5.9	5.5
	70+	16.3	16.5	16.7	17.2	17.7	18.0
South Africa	15-24	30.3	30.2	30.1	29.9	29.6	30.1
	25-29	12.8	12.8	13.3	13.3	13.3	13.3
	30-34	10.8	10.6	11.8	11.9	11.9	11.9
	35-44	18.7	18.9	16.6	16.4	16.4	16.7
	45-54	12.6	12.8	12.4	12.5	12.5	12.7
	55-59	4.0	3.9	4.5	4.5	4.5	4.7
	60-64	3.5	3.5	3.9	3.9	4.0	3.8
	65-69	2.5	2.5	3.0	3.0	3.1	2.6
	70+	4.8	4.9	4.4	4.5	4.7	4.2

Table A3.7. Age distribution of the sample, weighted (cont.)

		2003	2004	2005	2006	2007	2008
United Kingdom	15-24	13.3	13.5	14.0	14.4	15.0	15.2
	25-29	5.1	4.9	5.0	5.0	5.0	5.1
	30-34	6.3	6.0	5.7	5.5	5.1	4.9
	35-44	12.3	12.5	12.3	12.3	11.9	11.5
	45-54	10.8	10.6	10.6	10.4	10.6	10.4
	55-59	7.1	7.1	7.0	6.9	6.6	6.2
	60-64	8.4	8.5	8.5	8.7	9.1	9.4
	65-69	9.9	10.1	10.0	9.8	9.7	9.8
	70+	26.7	26.9	26.9	27.1	27.0	27.6
United States	15-24	13.1	13.2	13.0	13.0	12.8	12.8
	25-29	9.4	9.4	9.8	9.8	9.8	10.0
	30-34	10.5	10.4	9.7	9.6	9.6	9.5
	35-44	23.4	22.7	22.4	21.7	21.2	21.0
	45-54	21.6	21.8	22.1	21.8	22.0	22.1
	55-59	8.0	8.1	8.6	9.0	9.0	8.8
	60-64	5.2	5.4	5.4	6.0	6.2	6.2
	65-69	3.1	3.2	3.1	3.2	3.4	3.8
	70+	5.7	5.9	5.9	5.8	6.0	6.0
Total Database	15-24	13.7	13.8	13.6	13.6	13.3	13.3
	25-29	9.2	9.2	9.5	9.5	9.5	9.6
	30-34	10.2	10.0	9.4	9.3	9.2	9.2
	35-44	22.6	22.0	21.6	21.0	20.5	20.2
	45-54	20.8	20.9	21.2	21.0	21.2	21.3
	55-59	7.8	7.9	8.4	8.7	8.8	8.6
	60-64	5.4	5.5	5.6	6.1	6.3	6.3
	65-69	3.5	3.6	3.5	3.6	3.8	4.1
	70+	6.9	7.1	7.2	7.1	7.3	7.3

Source: Authors' calculations.

Table A3.8. Education level distribution, weighted

		No High school (No qualifications)	High School (Below NVQ level 2, NVQ level 2, NVQ level 3)	Trade/technical training (Trade apprenticeships and some)	Degree (NVQ level 4)	Higher Degree (NVQ level 5)	Other (other qualifications)	Not reported
Brazil	2003	43.12	25.43	..	10.88	0.38	0.10	20.09
	2004	42.55	26.42	..	11.22	0.38	0.06	19.38
	2005	41.04	27.74	..	11.81	0.41	0.13	18.87
	2006	40.34	28.41	..	12.26	0.39	0.10	18.50
	2007	39.45	29.37	..	12.86	0.36	0.09	17.87
	2008	38.63	30.27	..	13.34	0.41	0.08	17.27
Canada	2003	11.65	38.37	36.70	9.38	3.89	..	..
	2004	11.36	38.37	36.94	9.64	3.70	..	..
	2005	10.99	38.28	36.61	9.94	4.19	..	..
	2006	10.62	38.40	36.22	10.49	4.26	..	..
	2007	10.06	37.82	36.86	10.81	4.45	..	..
	2008	9.68	37.45	37.23	11.01	4.63	..	..
Israel	2003	41.69	36.25	9.59	6.87	4.70	0.89	..
	2004	41.39	36.05	9.94	6.60	4.86	1.16	..
	2005	41.07	35.67	10.15	6.97	5.03	1.11	..
	2006	41.11	35.75	9.72	6.93	5.38	1.10	..
	2007	39.88	36.76	9.83	7.26	5.25	1.02	..
	2008	39.50	36.98	10.00	7.57	5.13	0.82	..
South Africa	2003	33.47	62.17	0.64	1.97	1.10	0.61	0.04
	2004	32.81	63.04	0.62	1.91	1.20	0.40	0.03
	2005	30.90	63.40	1.95	2.13	1.06	0.47	0.08
	2006	29.82	64.42	2.17	2.14	0.96	0.43	0.05
	2007	28.58	65.88	2.04	2.07	0.96	0.39	0.08
	2008	26.14	67.09	2.55	2.26	0.97	0.98	..
United Kingdom	2003	14.44	25.03	4.16	9.74	..	5.67	40.96
	2004	14.64	25.23	4.09	9.80	..	4.77	41.47
	2005	13.89	25.77	3.65	10.01	..	5.28	41.41
	2006	13.57	26.21	3.54	10.20	..	5.18	41.31
	2007	13.38	26.23	2.86	10.86	..	5.24	41.44
	2008	18.85	29.77	3.63	13.11	..	6.96	27.66
United States	2003	5.01	37.10	21.49	21.50	14.91	..	..
	2004	4.70	36.73	21.57	22.04	14.95	..	..
	2005	4.69	36.72	21.84	21.92	14.83	..	..
	2006	4.59	36.01	21.48	22.72	15.21	..	..
	2007	4.49	35.52	21.13	22.89	15.97	..	..
	2008	4.19	35.09	21.11	23.88	15.73	..	..
Total database	2003	6.12	37.29	23.38	19.76	13.32	0.01	0.13
	2004	5.85	36.99	23.54	20.20	13.28	0.01	0.12
	2005	5.79	36.97	23.76	20.12	13.22	0.01	0.13
	2006	5.62	36.38	23.36	20.92	13.59	0.01	0.12
	2007	5.44	35.89	23.12	21.13	14.29	0.01	0.12
	2008	5.15	35.49	23.19	21.99	14.08	0.01	0.09

Source: Authors' calculations.

Table A3.9. ILO mapping of ISCO-08 major groups to skill levels

Skill Level	ISCO-08 major groups
3 + 4	1 - Managers, senior officials and legislators,
4	2 - Professionals
3	3 - Technicians and associate professionals
2	4 - Clerks
	5 - Service and sales workers
	6 - Skilled agricultural and fishery workers
	7 - Craft and related trades workers
	8 - Plant and machine operators, and assemblers
1	9 - Elementary occupations
1 + 4	0 - Military occupations

Notes: For occupation 1, for individuals with degree or higher, we assign them to skill level 4 and 3 otherwise.

For occupation 0, we assign individuals with degree or higher to skill level 4 and 1 otherwise.

Annex 4

Technical Annex

Unemployment effects

In our sample, the relationship between trade and the probability of unemployment can be modelled as follows:

$$\Pr\left(unempl_{ijkxt}\right) = \beta_0 + \beta_1 trade_{jkt} + \gamma z_{it} + d_t + d_{jt} + d_k + u_{ijkxt} \qquad (1a)$$

For each country *x*, $unempl_{ijkxt}$ is a binary variable equal to unity if individual *i* in industry *j* and occupation *k* in each time period is unemployed, and zero otherwise. Our approach is to estimate equation (1a) by contrasting the role of industry and occupation level exposure to trade.[29] The term *trade* includes several measures for industry exposure to trade: a measure of an industry's exposure to off-shoring; import penetration and export shares of the industry.[30]

An important limitation of this study (and indeed, most papers in this literature) is that we are unable to fully separate the impact of trade and off-shoring from other changes in the labour market. Two primary identification challenges exist. The first is in determining the direction of causality. It could be that trade and off-shoring are the result of changes in the domestic labour market. Given our data is measured at the individual level and includes wage and worker characteristics at this level, we hope this issue will not seriously affect our results. As noted in Ebenstein et al. (2012), it is difficult for an individual worker to affect trade outcomes.

Second it may be that technological change is correlated with trade in a manner preventing causal interpretation of our estimates. For example, of more routine tasks are more easily performed overseas or automated, we will be unable to accurately characterise the counterfactual of how wages would have evolved in the absence of globalisation. Insofar as some workers face competitive pressure from low-wage workers in foreign counties and automation, it will be difficult to separately identify the impact of either exposure.

Often total factor productivity, capital accumulation, computer adaption or other proxies are used to measure technological change. However, finding an appropriate and consistent instrumental variable for technology across our sample proved elusive. Therefore we have

29 In all surveys examined for this study except the United Kingdom, unemployed persons indentified industry of last employment. Thus the United Kingdom is not included in these, or the duration, regressions.

30 Import penetration is defined as the ratio of imports over domestic absorption, off-shoring defined as the ratio of total imported intermediate purchases to total intermediate inputs (the ratio to industry value added can also be applied) and export share is the share of exports in total production (OECD 2007). See the Data Annex for details on trade measures.

attempted to control for technological change through the use of dummies.[31] We experimented with several dummy structures in an attempt to balance finding the appropriate control for these unobservable while at the same time ensuring the dummies do not absorb all of the variation in the data.[32] We experimented with several types of dummy structures and found that one controlling for macroeconomic impacts, industry/time interaction for technology and occupational differences found this balance. Thus, we included a year dummies, d_t, allowing for changes in macro-economic conditions within each country; an industry-time interaction terms, d_{jt}, in order to control for industry-level output as well as technological change specific to each industry and an occupational dummy, d_k in order to absorb features specific to each occupation. z is a vector of individual characteristics and demographic factors which includes age, gender, education, marital status and, and u_{ijkxt} is the disturbance term.[33]

As stated earlier, we intend to go beyond standard measures of sector outcomes to analyse the impact of trade at the individual level across occupations in different country contexts. Following Ebenstein et al. (2012) we calculate an occupation-specific measure of trade activity, allowing an analysis of the occupational effects of trade. To the extent that workers relocate within sectors or leave sectors altogether but remain in the same occupation, then occupation-specific measures may be more appropriate to capturing trade's effect on labour market adjustment. The trade variables will be restated to occupation level as follows:

$$\delta_{jk} = L_{jk} / L_k \quad \text{and} \quad \sum_{j=1}^{J} \delta_{jk} * trade_{jt} \tag{2}$$

Here δ_{jk} is the share of occupation k in industry j and defined as the share of all workers in occupation k working in industry j (L_{jk}) over all workers in occupation k (L_k). We can then calculate the occupation-specific trade impact for occupation k, multiplying this share by our various trade measures.[34] By measuring outcomes at the occupation level, we can obtain additional information as to the occupation adjustment costs, which may differ from the more general industry costs, due to trade.

Following Equation (1a) is further estimated at the occupation level with the following modifications:

$$\Pr\left(unempl_{ijkxt}\right) = \beta_0 + \beta_1 trade_{jkt} + \gamma z_{it} + d_t + d_{kst} + u_{ijkxt} \tag{1b}$$

where the dependent variable is as above with the exception of the dummy structure. Here we include an occupation specific technology change variable, d_{kst} in addition to the macro-economic variable. The s refers to skill level as we believe that technological change

31 There is a long tradition in the literature of using dummies to control for unobservable changes such as technological change. See, for example, Baum (2006) for a discussion of the use of dummy, or indicator, variables.

32 A dummy structure absorbing all of the variation leads to perfect collinearity with the variables of interest dropping these variables from the estimating equation. In some extreme cases, all variables can be dropped leaving just the dummy.

33 To the extent that industry-time dummies dampen our trade effect, our results will understate trade's impact on private labour market adjustment.

34 We are grateful to Avraham Ebenstein for providing us his code for this calculation.

effects will vary across different skill levels.[35] We do not include the occupation dummy by itself in this specification because it provides no additional information, and *trade* now includes a measure of each occupation's exposure to trade, that is, we construct *occupation-specific* import penetration, export shares and off-shoring measures. We estimate both 1a and 1b using a probit model.

Wage effects

In addition to unemployment effects, we explore the adjustment of wages to our measures of trade. We estimate wage equations at the industry and occupation levels as follows:

$$wage_{ijkxt} = \beta_0 + \beta_1 trade_{jkxt} + \gamma z_{it} + d_t + d_{jt} + d_k + u_{ijkxt} \qquad (3a)$$

$$wage_{ijkxt} = \beta_0 + \beta_1 trade_{jkxt} + \gamma z_{it} + d_t + d_{kst} + u_{ijkxt} \qquad (3b)$$

where $wage_{ijkxt}$ is the log of hourly earnings by individual *i* working in industry *j* in each occupation *k*. The remaining explanatory and trade variables are as defined above. Again, we apply the same dummy structures for the industry and occupation specifications.[36]

The trade variables in all our specifications are potentially endogenous and simultaneously determined with the wage and unemployment status. To avoid or mitigate any simultaneity bias, we estimate all models using lagged values of the trade variables. The wage equations are estimated using fixed effects model.

We know from the theory, that trade can have a differential effect on various types of labour. Thus, for all models, we additionally include skill interaction terms in order to identify how each of the trade measures impacts on different skill levels. We use the skill level obtained from the ILO mapping of ISCO-08 major occupation groups to four skill levels (see Table A3.8 in the Data Annex).

If, as theory suggests, resource re-allocation in the face of increasing trade openness is relatively smooth, we would expect that the trade variables would not have a significant effect on individual wages at the industry level. However, if there are significant adjustment costs (as Davidson and Matusz suggest) we would expect there to be a significant negative impact of trade variables on the wage changes.

Duration

Finally, we examine adjustment costs through potential changes in the duration of unemployment. Duration models – or hazard models or survival analyses – can be thought of as being generated by what is called a 'failure time process.' A failure time process consisted of units – individuals, government, etc. – that are observed at some starting point of time. These units are in some state – individual is employed, a government is in power, etc – and are then observed over time. At any given point in time, these units are 'at risk' of experiencing

35 We included a skill dimension to the dummy structure of the industry equations as well but most variables relating to skill were then dropped due to collinearity with the dummy.

36 There is no reason, a priori to expect the appropriate dummy structure for equations measured across industries would be the same for those measured across occupations. However, for completeness we applied the same structure and found that for the occupation equations, including an industry-specific time, skill dummy caused all relevant variables to be omitted from the estimating equations, thus absorbing all the variation in the data.

some event where an event essentially represents a change or transition to another state – the individual losses their job, there is a change in government. After the event is experienced, the unit is either no longer observed or it is at risk of experiencing another kind of event. In some circumstances, units are not observed experiencing an event, that is, no transition is made from one state to another while the unit is observed – the individual remains employed, the government remains in power, etc.

Box A4.1. Estimating Unemployment Duration

As with the binary probit model, the ORM is estimated via maximum likelihood and the magnitude of the change in the outcome probability for a change in one of the independent variables depends on the levels of all of the independent variables.

The ordinal regression model is usually presented as a latent variable model. Defining y∗ as a latent variable ranging from the structural model:

$$y^{*}_{ijkxt} = \mathbf{x}\beta + u_{ijkxt} \qquad (4a)$$

where *i* is the individual observation and *u* is a random error.

The *measurement model* for binary outcomes is expanded to divide y^{*} into *n* ordinal categories:

$$y_i = m \text{ if } \tau_{m-1} \le y_i^{*} < \tau_m \text{ for } m = 1 \text{ to } n$$

where the *cutpoints or thresholds* τ_1 through τ_{n-1} are estimated. For our data, the ordered unemployment duration variable is: 1= < 3 months, 2= 3-6 months, 3= 6-12 months and 4= > 12 months. The observed response categories are tied to the latent variable by the measurement model:

$$y_i = \begin{cases} 1 & \text{if } \tau_0 = -\infty \le y_i^{*} < \tau_1 \\ 2 & \text{if } \tau_1 \le y_i^{*} < \tau_2 \\ 3 & \text{if } \tau_2 \le y_i^{*} < \tau_3 \\ 4 & \text{if } \tau_3 \le y_i^{*} < \tau_4 = \infty \end{cases}$$

Thus, when the latent y^{*} crosses a cutpoint, the observed category changes. The probability of observing $y = m$ for given values of the *x*'s corresponds to the region of the distribution where y^{*} falls between τ_{m-1} and τ_m:

$$\Pr(y = m \mid \mathbf{x}) = \Pr(\tau_{m-1} \le y^{*} < \tau_m \mid \mathbf{x})$$

Substituting $\mathbf{x}\beta + u$ for y^{*} and rearranging leads to the standard formula for the predicted probability in the ORM,

$$\Pr(y = m \mid \mathbf{x}) = F(\tau_m - \mathbf{x}\beta) - F(\tau_{m-1} - \mathbf{x}\beta)$$

where *F* is the cumulative distribution function for *u*. In ordinal probit, *F* is normal with Var(*u*) = 1.

Consistent with the preceding unemployment and wage models, the ORM equation is estimated at the industry and occupation levels. For our duration model, we estimate the following:

$$\Pr(unemp\_durat = m \mid \mathbf{x}) = F(\tau_m - \mathbf{x}\beta) - F(\tau_{m-1} - \mathbf{x}\beta) \qquad (4b)$$

$$\mathbf{x}\beta = \beta_1 trade_{jkxt} + \gamma \mathbf{z}_{it} + d_{xt} + d_{jt} + d_{kt}$$

Where

for the industry regressions and

$$\mathbf{x}\beta = \beta_1 trade_{jkxt} + \gamma \mathbf{z}_{it} + d_{xt} + d_{jt} + d_{kt} + u_{ijkxt}$$

for the occupation regressions and all regressors are defined above. Finally, the marginal change in the probability is computed as

$$\frac{\partial \Pr(y = m \mid \mathrm{x})}{\partial x_k} = \frac{\partial F(\tau_m - \mathrm{x}\beta)}{\partial x_k} - \frac{\partial F(\tau_{m-1} - \mathrm{x}\beta)}{\partial x_k}$$

Due to the limitations of the data we do not observe an individual's movement into and out of the state of unemployment.[37] Thus we cannot estimate the models using traditional duration analysis. We generate instead an ordered variable defined as categories of unemployment duration for single years (1 is <3 months, 2 is 3-6 months, 3 is 6-12 months, 4 is >12months). We then analyse the country data using the probit version of the ordinal regression model (ORM) to empirically assess the nature of the relationship (see Box A4.1 for details). However, given our panel is a 'psuedo-panel' where we have an individual dimension and a time dimension but the composition of the individual dimension changes over the time dimension. Thus, our data has an added "noise" component in that the changes that are observed may be due to the variable of interest (in our case, changes in trade) or due to a change in the underlying composition of the individual observed.

37 In a classic hazard function we observe an individual over time, entering or leaving a certain state. Given our dataset is made up of random individuals who are either employed or unemployed at the time of the survey, we do not observe the same individual moving from a state of employment to unemployment or vice versa. Thus, a standard question of a duration mode: given an individual has been (un)employed up until this point, what is the probability that they will remain (un)employed?, cannot be firmly established.