**Department of Economics**

# Globalisation and Labour Markets

## Rory O'Farrell

Thesis submitted for assessment with a view to obtaining the degree of
Doctor of Economics of the European University Institute

Florence
March 2010

EUROPEAN UNIVERSITY INSTITUTE
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Prof. Rick van der Ploeg, University of Oxford

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Any errors or mistakes in this thesis are my own.

**Rory O Farrell**

*European University Institute*

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ii

# Abstract

In this thesis how labour markets are affected by globalisation is examined. The thesis takes the form of three chapters. The first chapter looks at the state of trade unions in Europe and how they have been affected by globalisation; the second chapter is theoretical in nature and shows how the increasing size of trade blocs and lower transport costs can help to explain the decline in trade union density; and the third chapter looks at how the ability of firms to locate production in more than one country can affect wages and unemployment.

The first chapter describes trends related to trade unions in Europe, before examining how globalisation can affect trade unions and how trade unions may respond. Since the 1980s there has been a general decline in trade union density and strike activity. At the same time there has been an increase in globalisation. Although common explanations have been put forward for the decline of trade union density across European countries, no cointegration has been found between trends in trade union density. Despite declines in trade union density, unions have continued to be successful in gaining wage premia for their members. The increase in globalisation has been associated with an increase in the elasticity of demand for labour. This affects the employment/wage trade off faced by trade unions. There is also some evidence that multinationals can use their cross-border bargaining power to reduce wages. Unions have reacted to globalisation by cooperating internationally, but any progress towards cross border collective bargaining has been at best slow. A simple model is presented in the chapter in order to anticipate the issues discussed in chapters two and three. The model suggests that unions will be more likely to cooperate internationally if they are substitutes in production and if the reservation wage is low.

The second chapter looks at how multinational enterprises (MNEs) can affect wages and unemployment. While the increase in international firm mobility has been well documented, its effects on macroeconomic aggregates and in the labour market are still controversial. MNEs benefit from an international outside option during wage bargaining, leading to a decrease in average wages. How-

ever, a strategic incentive to hire extra workers in a foreign (home) plant in order to reduce wages in the home (foreign) plant has an indirect positive effect on wages due to spillovers resulting from an increased demand for labour. In a framework of frictional unemployment, permitting MNEs leads to a decrease in unemployment. Abstracting from transport and plant fixed costs, MNEs lead to higher wages. However, including transport and plant costs generally leads to lower wages, though the effects are small. The strategic hiring effect is important in mitigating the fall in wages.

Finally, in the third chapter a model is presented which shows how increased product market competition due to an increase in the size of trade blocs and a lower cost of transporting goods internationally can lead to a decline in trade union density. Increasing international product market competition harms unionised workers more than workers who bargain wages individually. This is as union wages are a function of average revenue but individually bargained wages are a function of marginal revenue. Increasing competition narrows the gap between average and marginal revenue. This lowers the incentive to be a member of a trade union, which leads to a fall in trade union density. Globalisation can lead to falling union density despite a stable union wage premium and increasing union wages.

# Contents

# List of Tables

# List of Figures

# Chapter 1

# The State of Trade Unions in Europe

## 1.1  Introduction

Since the late 1970s trade union density and strike days have declined. In 1979 almost half of Italian workers were members of trade unions, and each worker spent an average of two working days on strike. By 2006, Italian trade union density was down to a third of the workforce and they spent an average of 14 minutes on strike. Even for countries using the Ghent system, whereby trade unions pay or administer unemployment insurance, though there has not been a large decrease in union membership there has been a large decrease in strike activity. Throughout Europe the face of trade unionism has changed. Strikes are less frequent, bargaining tends to be less centralised, and trade union density has decreased. In this paper I will outline some of the recent changes affecting European trade unions. In section two trends in EU trade union density, coverage, and strike activity, as well as the degree of centralisation of union bargaining, are outlined. In the third section how globalisation affects unions is outlined and in section four the institutional response of unions is described. In section five a simple model is presented in order to anticipate the isssues discussed in chapters two and three of this thesis. Section six concludes.

## 1.2  Recent trends in trade union strength

Across the majority of countries in Europe there has been a decline in trade union density, though the decline appears to have stabilised. The major division in European industrial relations systems is between countries that use the Ghent system, whereby unemployment benefits are administered by trade unions, and those that do not. This difference in industrial relations systems is of major

importance in explaining the differing trends of trade union density in Europe.
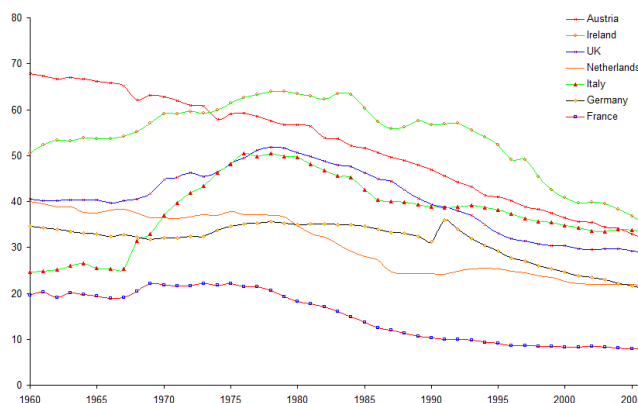


Figure 1.1: Trade union density for selected EU countries not using the Ghent system, 1960-2006: Source ICTWSS database
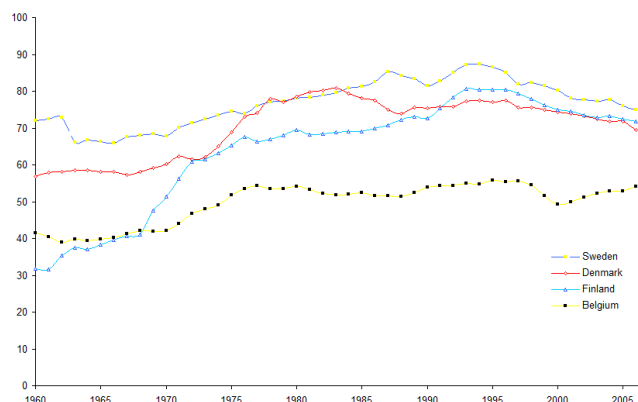


Figure 1.2: Trade union density for EU countries using the Ghent system, 1960-2006: Source ICTWSS database

Figure 1.1 shows the pattern of union density for seven EU countries that do not use the Ghent system. For Italy, Ireland and the UK trade union density increased until 1980 and then declined. These three countries share a voluntarist system (Waddington and Hoffman, 2000) whereby the state plays a relatively small role and does not extend agreements to those that do not participate in negotiations. In Ireland trade union membership has actually increased, though not at the same pace as employment. It has been suggested that the pre-1979 rise in union density in the UK was largely

2
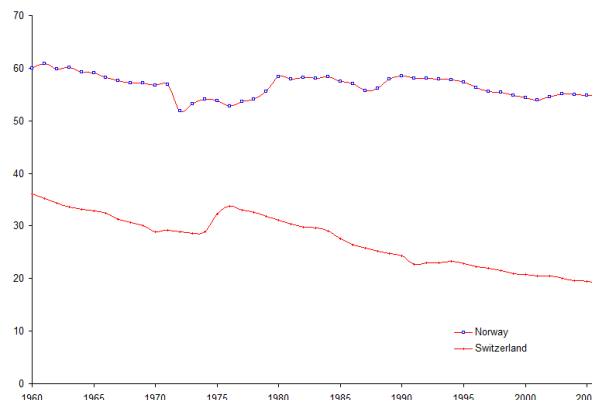
Figure 1.3: Trade union density for Norway and Switzerland, 1960-2006: Source ICTWSS database

due to the unionisation of the public sector (Ebbinghaus and Visser, 2000). Austria has shown a steady decline in union density since 1960, while both France and Netherlands have shown stable union density until approximately 1980 and then a steady decline. For Germany the decline did not start until the mid-1980s followed by a short term increase in union density due to reunification. Though the decline in density has been remarked upon before, using up to date data shows that with the exception of Ireland and Austria trade union density is stabilising.

A different pattern emerges with regard to countries using the Ghent system. Trade union bargaining can be viewed as a public good for covered workers. This is as collective agreements usually apply to all workers in the bargaining unit, regardless of whether they belong to a union, and in some countries collective agreements can be extended beyond firms that are engaged in bargaining. This means that many workers may free ride and not pay union dues or other costs such as attending meetings. The Ghent system provides a selective incentive, in the form of unemployment insurance, to trade union members, and this helps to explain the higher trade union density in countries that use the Ghent system. As can be seen in Figure 1.2, Finland's sharp increase in union density during the late 1960s and early 1970s can be explained by the adoption of the Ghent system during this time (Waddington and Hoffman, 2000). Both Finland and Sweden show a peak in union density in 1994, and a slight decline afterwards which has since stabilised. This decline coincides with both membership of the EU in 1995, and a reduction in unemployment following recessions in the early 1990s. Lower unemployment can reduce the selective incentive to be a trade union member as the attractiveness of unemployment insurance is reduced. In Belgium trade unions administer rather than fund unemployment insurance. This helps to explain the lower level of Belgian trade union density.

Denmark's pattern of union density differs from the other Ghent countries in that it increases until about 1980 and shows a moderate decrease afterwards. Similar to Italy, Ireland, and the UK, Denmark has a voluntarist industrial relations system (Waddington and Hoffman, 2000) and Denmark shows a similar hump-shaped pattern of union density with a peak around 1980, though the post 1980 decline in union density is less severe. Denmark also joined the EU at the same time as Ireland and the UK. Figure 1.3 shows union density for two non-EU countries. Norwegian union density has been remarkable stable and at a high level. This is despite Norway not using the Ghent system and the reason of the high level of density is something of a puzzle. Switzerland's decline in density has been similar to that of Austria, with the exception of a rise in density in the late 1970s.

Many explanations have been put forward for the decline in union density, such as increased numbers of women in the workforce, a shift away from manufacturing, increased competition and institutional changes. With the exception of institutional changes these changes should be common to European countries. However, using data from 14 European countries Checchi and Lucifora (2002) say that there is no generalised downward trend in European trade union density. Blaschke (2000) states that union density has increased in the Ghent countries but that controlling for the Ghent system there was no European pattern in unionisation, though trade has had a small negative effect. Focusing on patterns in trade union density across the OECD rather than EU, Blanchflower (2007) finds a general decline in trade union density since 1970. Using UK data, Konings and Walsh (2000) find that employment loss due to increased competition is higher in non-unionised firms than in unionised firms. This is as increased competition reduces union rents, reducing the incentive for firms to fire workers. The effect of this would be to increase union density in the short-run. Preugschat (2008) models how when it is costly for a union to organise a workplace, an increase in firm entry and exit can lead to lower trade union density. Disney et al. (1995) and Machin (2000) find that the main reason for the decline of British trade unionism is a failure to organise in new establishments, evidence which supports the model of Preugschat (2008). Acemoglu et al. (2001) put forward a model in which deunionisation is caused by skill biased technical change. As the outside option for skilled workers improves due to technical change they have less incentive to remain in a union with unskilled workers. Looking at data from 1950 to 1995, Ebbinghaus and Visser (1999) note that union density had increased with the increase in large industrial conglomerates, institutionalised collective employment relations and the increase in social citizenship rights. These processes reversed at the same time as unions declined. However, Disney et al. (1995) note that for Britain many of the compositional shifts, such as expansion of the service sector and increased female participation in the labour force, occurred during the 1970s before union density peaked and density also declined in

4

sectors where unions have traditionally found it easier to organise.

Table 1.1: Cointegration test of trade union density for 13 European Countries The countries included are Austria, Belgium, Germany, Denmark, Finland, France, Ireland, Italy, Netherlands, Norway, Sweden, Switzerland and the UK, using trade union density for 1960-2006 from the ICTWSS database.

| Test | Deterministic terms | No. of lagged differences | $H_0 : r = r_0$ | Test statistic | P value |
|---|---|---|---|---|---|
| Saikkonen & Lütkepohl test | Constant | 2 | $r_0 = 11$ | 16.43 | 0.0086 |
|  |  |  | $r_0 = 12$ | 3.52 | 0.0720 |
|  | Constant and Trend | 2 | $r_0 = 8$ | 74.18 | 0.0083 |
|  |  |  | $r_0 = 9$ | 45.19 | 0.0515 |
|  | Orthogonal trend | 2 | $r_0 = 11$ | 15.65 | 0.0037 |
| Johansen Trace test | Constant | 2 | $r_0 = 11$ | 26.91 | 0.0042 |
|  |  |  | $r_0 = 12$ | 10.67 | 0.0245 |
|  | Constant and Trend | 2 | $r_0 = 11$ | 26.40 | 0.0407 |
|  |  |  | $r_0 = 12$ | 10.21 | 0.1194 |
|  | Orthogonal trend | 2 | $r_0 = 9$ | 52.13 | 0.0173 |
|  |  |  | $r_0 = 10$ | 27.33 | 0.0957 |
|  |  |  | $r_0 = 11$ | 10.95 | 0.2182 |

Despite common downward trends in trade union density, Table 1.1 to 1.3 show no evidence of cointegration between countries. I first test for the 13 European countries for which trade union density data from 1960 to 2006, is available, and then I repeat the exercise dividing the sample into Ghent countries and non-Ghent countries. Cointegration rank tests for higher dimensional systems (such as those presented) tend to have low power (Lütkepohl and Kratzig, 2004). This means that the results of Table 1.1 are more likely to show cointegration, when in fact none is present, than Table 1.2 or Table 1.3. In view of this, any evidence in favour of cointegration is very weak. From Table 1.1, looking where constant and trend deterministic term are assumed, the Saikkonen and Lütkepohl test shows evidence of cointegration as it shows there are nine cointegrating relations in a system of 13 variables and a trend. However, the Johansen Trace test does not support this. For none of the models do both the Johansen Trace test and the Saikkonen and Lütkepohl test indicate cointegration. Therefore it can be concluded that there is no-cointegration of trade union density in Europe. This is something of a puzzle as trade unions across Europe have been affected by similar trends such as changes in technology and increasing globalisation. However, the absence of cointegration maybe due to trade unions across countries having different characteristics and reacting differently to changes.

Table 1.2: Cointegration test of trade union density for the four Ghent countries The countries included are Belgium, Denmark, Finland, and Sweden, using trade union density from 1960-2006 from the ICTWSS database.

| Test | Deterministic terms | No. of lagged differences | $H_0 : r = r_0$ | Test statistic | P value |
|---|---|---|---|---|---|
| Saikkonen & Lütkepohl test | Constant | 8 | $r_0 = 2$ | 20.25 | 0.0015 |
| | | | $r_0 = 3$ | 1.64 | 0.2342 |
| | Constant and trend | 8 | $r_0 = 3$ | 12.47 | 0.0021 |
| | Orthogonal trend | 8 | $r_0 = 2$ | 43.78 | 0.0000 |
| Johansen Trace test | Constant | 8 | $r_0 = 2$ | 49.29 | 0.0000 |
| | | | $r_0 = 3$ | 12.18 | 0.0118 |
| | Constant and trend | 8 | $r_0 = 3$ | 19.44 | 0.0023 |
| | Orthogonal trend | 8 | $r_0 = 2$ | 40.01 | 0.0000 |

In order to explain the trends in density there has been some research on why people join unions. There have been several theories on why people join unions including the utilitarian motive theory and the social customs theory. Using data for European countries, Visser (2002) finds evidence supporting the social custom theory. The social custom theory suggests that people join unions due to peer pressure among other reasons, and that this pressure has decreased. Using UK data, Charlwood (2002) examines why non-union workers wish to join trade unions. Forty per cent of British non-union workers wish to join a trade union (50 per cent for manual workers and 33 per cent for non-manual workers). Job dissatisfaction and believing that their pay is low are insignificant motives for joining a union for the whole sample, but these motives are significant for non-manual workers. A very strong relationship between the perceived instrumentality of unions and willingness to join was found. Those with left-wing views, former union members and those from the traditional geographic areas of mining, manufacturing and industry are more likely to join. Using West German micro data from 1980 to 2000, Schnabel and Wagner (2005) find evidence that casts doubt on the social custom theory of union membership. As non-union members of a union also benefit from collective agreements, the social custom motive has been put forward as a solution to the free rider problem. The authors suggest that as the government provides services that had been provided by unions this reduces the selective incentive of union membership and makes it more difficult for unions to attract members. They describe as a stylised fact that men are more likely to be union members and explain this by their greater attachment to the labour market. The data suggests that personal, occupational and

6

Table 1.3: Cointegration test of trade union density for nine non-Ghent European countries The countries are Austria, Germany, France, Ireland, Italy, Netherlands, Norway, Switzerland and the UK, using trade union density from 1960-2006 from the ICTWSS database.

| Test | Deterministic terms | No. of lagged differences | $H_0 : r = r_0$ | Test statistic | P value |
|---|---|---|---|---|---|
| Saikkonen & Lütkepohl test | Constant | 3 | $r_0 = 7$ | 17.94 | 0.0044 |
| | | | $r_0 = 8$ | 0.25 | 0.6784 |
| | Constant and trend | 3 | $r_0 = 6$ | 32.02 | 0.0165 |
| | | | $r_0 = 7$ | 10.78 | 0.2723 |
| | Orthogonal trend | 3 | $r_0 = 7$ | 17.94 | 0.0013 |
| Johansen Trace test | Constant | 3 | $r_0 = 7$ | 32.75 | 0.0004 |
| | | | $r_0 = 8$ | 14.96 | 0.0030 |
| | Constant and trend | 3 | $r_0 = 7$ | 32.10 | 0.0060 |
| | | | $r_0 = 8$ | 13.23 | 0.0363 |
| | Orthogonal trend | 3 | $r_0 = 7$ | 18.08 | 0.0184 |

attitudinal variables such as gender, occupational status, firm size and political orientation play a role in the unionisation process, a finding consistent with Charlwood (2002). Gender and occupational characteristics are the most robust over time. Using data from several countries, Blanchflower (2007) finds an inverted U shape age profile of union membership with people in their late 40s most likely to be union members. This was found to be robust across countries. Public sector workers are also more likely to be unionised. Using UK data they also find that men are more likely to be members, the more educated in the public sector are more likely to be union members, but the more educated in the private sector are less likely to be members, full time workers are more likely to be members than part-time workers and middle aged workers are most likely to be members. Apart from the inverted U-shape age profile results were mixed for the other European countries, perhaps due to smaller sample sizes. Schnabel and Wagner (2007) also perform a multi-country analysis using data from 18 EU countries. They note the large variation in union density across countries and find that the individual characteristics of workers and firms play a major role in determining union membership with social factors playing a minor role. In contrast to Blanchflower (2007) and Charlwood (2002), which both used UK data, a left-wing political orientation and dissatisfaction at how things are done at work were significant in determining union membership in only a few countries, though these were significant for the UK in their study. They find that the presence of a union in a workplace and

workers attitudes concerning strong unions are the main determinants of membership and no evidence was found that blue collar workers are the backbone of membership. With larger monetary and non-monetary benefits workers are more likely to join a union. The inverted U shape of Blanchflower (2007) was not found, possibly due to more control variables being used. The Ghent System was found to be important in increasing union density. Rather than using survey data from one country, Checchi and Lucifora (2002) look at union density across 14 European countries. They find that institutions such as minimum wages, job security legislation and wage indexation crowd out unions. However, inflation and institutions which lower the cost of organising help to increase union membership.
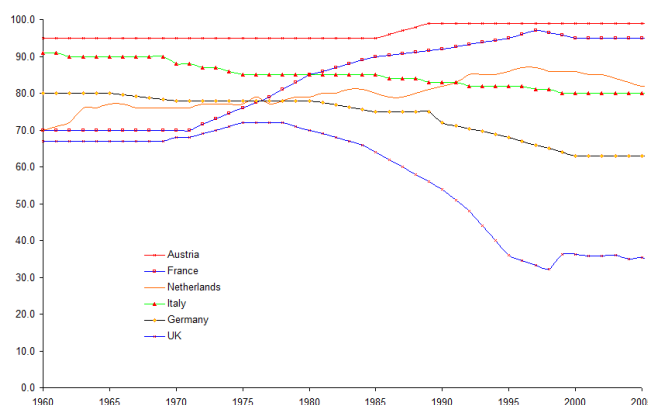


Figure 1.4: Trade union coverage for selected EU countries not using the Ghent system, 1960-2006: Source ICTWSS database

Though there has been a decline for non-Ghent countries in union density, a different picture emerges in terms of union coverage, which depends very much on national institutions. In a report from the European Commission (2009) it is found that the percentage of workers in firms that are part of employer federations (employer density), rather than trade union density, explains union coverage. It must be noted that data available are less reliable than for union density. Looking at Figure 1.4, for Austria union density has remained stable, with a slight increase. France and the Netherlands show stable union coverage until the late 1970s and then a steady increase. Interestingly this coincides with the pattern of stable union density until the late 1970s and then a steady decline. The legal extension of collective agreements to non-unionised firms could perhaps have reduced the incentive of trade unions to recruit new members. However, the declines in coverage for the UK and Germany are in line with declines in union density. Italian coverage shows a steady decline despite the hump shaped trend in union density.

8
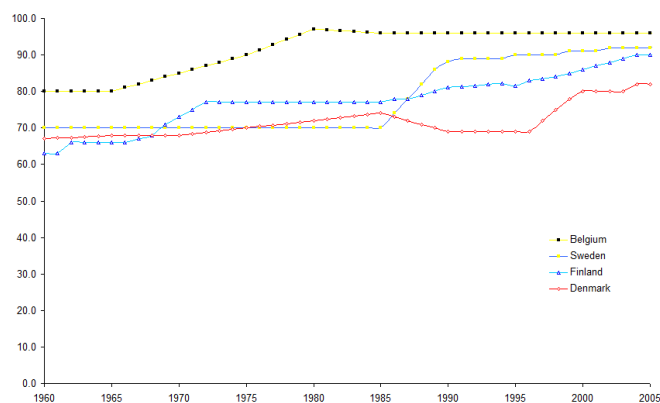
Figure 1.5: Trade union coverage for EU countries using the Ghent system, 1960-2006: Source ICTWSS database
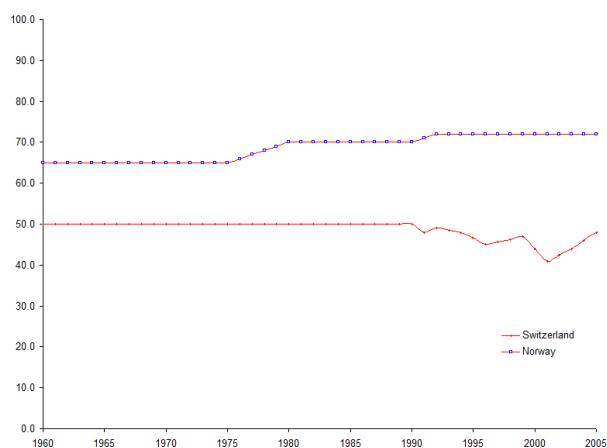


Figure 1.6: Trade union coverage for Norway and Switzerland, 1960-2006: Source ICTWSS database

9

For the Ghent countries it can be seen in Figure 1.5 that coverage has moved broadly in line with changes in union density, though Belgium has the highest level of coverage, and the lowest density of the Ghent countries. Figure 1.6 shows that Norwegian coverage is stable, as is its union density, and that Switzerland shows a stable pattern of coverage, despite the steady decline in union density.
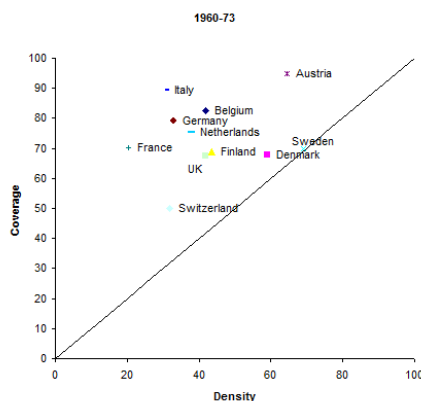


Figure 1.7: Average trade union coverage and density for European countries, 1960-73: Source ICTWSS database
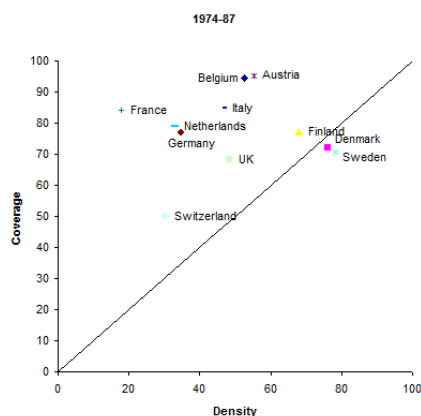


Figure 1.8: Average trade union coverage and density for European countries, 1974-87: Source ICTWSS database

Figures 1.7 to 1.10 show a divergence in patterns of trade union membership and coverage for eleven European countries. Union coverage is plotted against union density. For countries on the 45 degree line there is a one to one relationship between coverage and density, while the further above the 45 degree line a country is the greater the degree of free riding. As is expected, the countries with the greatest state involvement in industrial relations are farthest from the 45 degree line. This

10
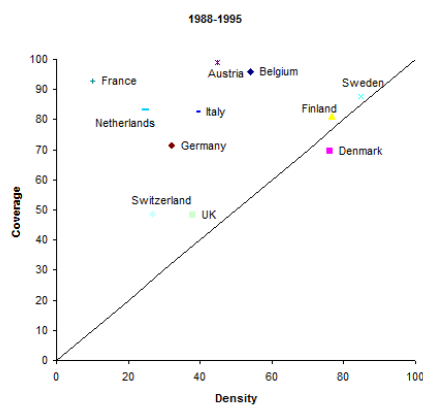
Figure 1.9: Average trade union coverage and density for European countries, 1988-95: Source ICTWSS database
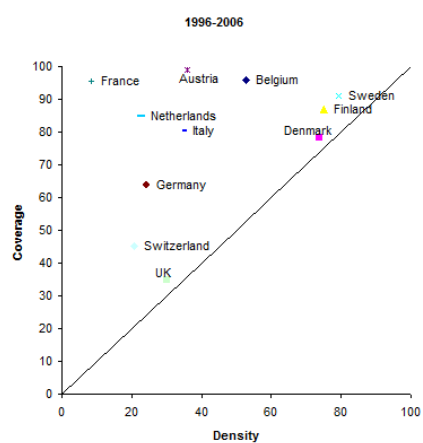


Figure 1.10: Average trade union coverage and density for European countries, 1996-2006: Source ICTWSS database

11

is as the state provides services that are a substitute for union services (Schnabel and Wagner, 2005). Prior to 1974 most countries were clustered in an area of union density of between 40 and 55 percent and union coverage of between 60 and 80 percent. However there is a clear pattern of dispersal that can be seen from the graphs. This is due to a decline in union density in some countries and changes in the institutional framework. As can be seen, Sweden and Denmark are close to the 45 degree line. This is as the Ghent system provides selective incentives to join a union and there is little compulsory extension of union agreements to non-union firms. Comparing Figure 1.7 to Figure 1.8 there is decrease in free riding for Finland as it adopted the Ghent system in the late 1960s. The UK has moved closer to the 45 degree line. One explanation for the decline of British union density has been the end of the closed shop system. This system made union membership compulsory for all workers in a firm and helped to prevent free riding. Simultaneously, Wages Councils were also abolished (Waddington and Hoffman, 2000). As Figure 1.11 shows there has been a steady decline in free riding, suggesting that UK unions have been successful in recruiting covered workers into unions, despite the end of closed shops.
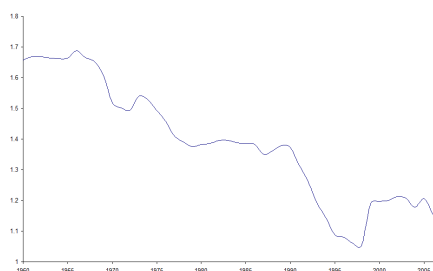


Figure 1.11: Ratio of union coverage to union density for the UK, 1960-2006: Source ICTWSS database

There has also been a reduction in the number of days lost due to strike action. This decline has been most pronounced after 1980, but as there is a wave pattern to strike activity it is difficult to establish trends. Strike pay is also a selective incentive (Schnabel and Wagner, 2007) so if workers feel that they are less likely to be involved in strike action then strike pay will be less of a selective incentive. Also, if there are less workers in a trade union, the union may be less willing to call a strike as they do not expect it to be successful. There is a huge variation across countries in the number of days lost to strike action, making graphical representation difficult. Presented are graphs of strike days per 1,000 unionised workers. Controlling for the number of unionised workers in this way helps to smooth out some of the heterogeneity, but there are still large differences between countries, and even between those with similar industrial relations systems.

Strike activity across the Ghent countries shows a general decrease since 1971. However, as seen in Figure 1.12 and Figure 1.13, though there are similar levels of strike days for Denmark and Finland, and also for Belgium and Sweden (with the exception of a spike in strike activity in 1980), Denmark and Finland show far higher levels of strike activity than Sweden, despite having similar industrial relations systems. Why this is so poses something of a puzzle, and may be due to state intervention. In addition to Denmark and Finland, as seen in Figure 1.14 voluntarist Italy, Ireland and the UK show a high level of days lost to strike action, though there has been a steady decrease.

There is a consistent wave pattern to the number of strike days, as can be seen clearly for France in Figure 1.15, and why this is the case could be an interesting area of research. Piazza (2005) suggests a link between the decreased number of strike days and increased globalisation and that the degree to which bargaining is centralised is negatively associated with strikes. However, Sweden and the UK show a lower level in the time since bargaining has become more decentralised.

### 1.2.1 Has the trade union wage premium been maintained?

A measure of the strength of unions is if they can gain wage premia for those they represent. With the exception of Britain, there has been relatively little research conducted on the trade union wage premium in Europe. Blanchflower and Bryson (2002) find that the wage gap in the UK is pro-cyclical, which is consistent for evidence from the US (Bratsberg and Ragan, 2002; Blanchflower and Bryson, 2004) while Kaufman (2002) finds that UK wage premia have been stable over the long term. Blanchflower and Bryson (2002) estimate the trade union wage premium for 19 countries, including 12 European countries using data from 1994 to 1999. The results are presented in Table 1.4. There is no clear pattern to the data. Denmark has a significant wage premium, while Sweden does not, despite having similar labour institutions. The insignificant wage premium for some countries may be due to non-union workers being covered by union agreements. As union wage agreements tend to be extended to non-members a distinction should be made between the union membership premium and the premium associated with being covered by union agreements. Using data for the Italian metal-mechanical industry Dell 'Aringa and Lucifora (1994) find a 4.4 per cent premium for blue collar workers and a 7.7 per cent premium for white collar workers who are covered by firm level collective bargaining agreements. Using 1995 data for Spain, Card and De la Rica (2006) estimate the firm level collective agreement premium to be between five and 10 percent, with higher premia for the more highly paid workers. Using 1995 to 2000 data, Braun and Scheffel (2007) find that in Germany those covered by a collective industry agreement enjoy a premium of 6.1 per cent while those covered by a

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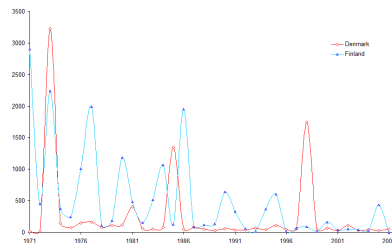
Figure 1.12: Strike days per unionised worker for Denmark and Finland, 1971-2006: Source ICTWSS database and ILO LABORSTA database
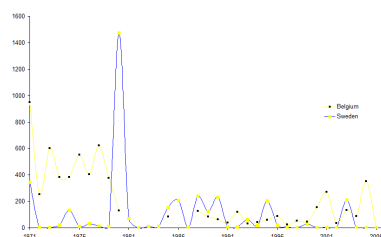


Figure 1.13: Strike days per unionised worker for Belgium and Sweden, 1971-2006: Source ICTWSS database and ILO LABORSTA database
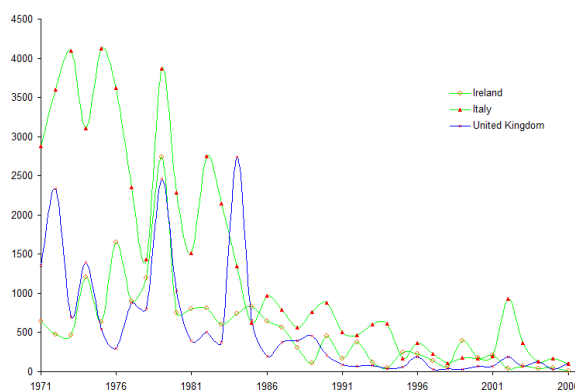


Figure 1.14: Strike days per unionised worker for Ireland, Italy and the United Kingdom, 1971-2006: Source ICTWSS database and ILO LABORSTA database

14
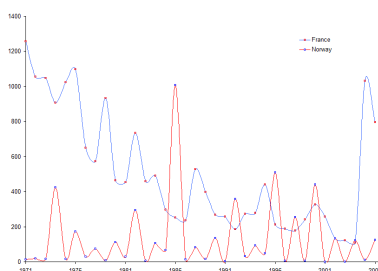
Figure 1.15: Strike days per unionised worker for France and Norway, 1971-2006: Source ICTWSS database and ILO LABORSTA database

firm agreement gain a premium of 5.7 per cent. Braun (2008) finds that Danish workers got a wage premium of 11.85 per cent from 1999 to 2002. Using 1995 data for Belgium, Denmark and Spain, Plasman et al. (2006) find that single employer bargaining raises wages by about four percent with respect to multi-employer bargaining. These higher estimates for the collective bargaining premium is consistent with evidence for Australia (Wooden, 2001), suggesting that the figures of Blanchflower and Bryson (2002) underestimate the collective bargaining premium in some cases. Because of the lack of comparable European studies it is not possible to draw conclusions of the evolution of the European trade union premium over time. However, despite declines in union density and numbers of strikes, it appears that European trade unions are still able to negotiate wage premia for those they represent.

Table 1.4: Results of Blanchflower and Bryson (2002)

| European Countries | | Non-European Countries | |
|---|---|---|---|
| Austria | 15% | Australia | 11.8% |
| Cyprus | 13.7% | Canada | 8.3% |
| Denmark | 15.9% | Chile | 15.9% |
| France | Insignificant | New Zealand | 9.9% |
| Germany | Insignificant | Japan | 15.9% |
| Italy | Insignificant | US | 13.2% in 1973 to 9.1% in 2001 |
| Netherlands | Insignificant | | |
| Norway | 7.3% | | |
| Portugal | 17.9% | | |
| Spain | 6.9% | | |
| Sweden | Insignificant | | |
| UK | 14.2% in 1993 to 6.3% in 2000 | | |

15

### 1.2.2 Patterns in centralisation

With the exception of the UK, the degree of wage coordination separates European trade unions from those of other regions. Using ICTWSS coordination scores for 2007, only the UK had the lowest coordination score of one, representing fragmented bargaining mainly at company level. It shared this score with the US and Canada. Though France and Luxembourg also had low coordination, with a score of two representing a mixture of firm and industry level bargaining with weak enforceability. Though in the past several countries had the highest degree of coordination, where there was economy wide bargaining with enforceable agreements between central bargaining umbrella groups, now only Ireland fits this description. The majority of countries have an intermediate level of wage coordination, with industry wide bargaining, or a mixture of economy wide and industry bargaining with central organisations negotiating unenforceable guidelines. However, there is no clear pattern as to what causes the degree of centralisation, with no patterns for Ghent/non-Ghent, EU/non-EU, or Eurozone/non-Eurozone countries. Van Gyes (2007) suggest that there has been a decrease in the centralisation of union bargaining in Europe. Marginson and Sisson (2002) suggest that European bargaining is moving neither towards more centralised bargaining nor American style bargaining, but that there has been a convergence of bargaining systems in internationally exposed areas such as car manufacture. Nickel et al. (2005) make a distinction between the centralisation of wage bargaining and the degree of coordination (whereby the aggregate employment implications of wage determination are taken into account when wage bargains are struck). Driffil (2006) points to the decrease in the centralisation of wage bargaining, with Ortigueira (2006) suggesting that skill biased technical change reduces the willingness of skilled workers to bargain alongside unskilled workers. This is due to the tendency of centralised bargaining to compress wages. Overtime the degree of coordination tends to be volatile as negotiations break down and bargaining is conducted at a lower level, or occasionally the government intervenes and imposes a wage schedule. Only Ireland and Italy have had a general increase in coordination since 1960.

The non-monotonic relationship between the centralisation of wage bargaining and unemployment was proposed by Calmfors and Driffil (1998). A review of the topic is given by Driffil (2006). Iversen (1999) suggests that where there is an intermediate level of centralisation of wage bargaining then a non-accommodating monetary policy should be followed, but when wage bargaining is highly centralised then monetary policy should be accommodating. This is as with centralised bargaining there tends to be wage compression during negotiations and then wage drift after. In contrast to Nordic countries Austria showed low inflation, low unemployment but also higher inequality as wage

16

bargaining at the top level negotiated the overall increase, while at a lower level how this increase is distributed was negotiated. They propose that where wage bargaining is centralised unions will internalise the effect of higher wages on the demand for labour and will therefore moderate their wage demands, leading to lower unemployment. Driffil (2006) finds that the non-monotonic relationship between the coordination of union bargaining and unemployment has not been entirely overturned, the empirical relevance is questionable. Calmfors (2001) tries to predict the effect of European Monetary Union (EMU) on bargaining structures. Due to EMU wages will need to be more flexible as monetary policy can no longer be used. As national level bargaining tends to be more flexible, EMU could lead to the increase in the centralisation of bargaining. However, those bargaining at the national level will no longer internalise the reactions of the central bank, as it will no longer be a national central bank. Overall, Calmfors (2001) considers that EMU will probably promote the national coordination of wage bargaining.

It has been suggested that wage centralisation affects both wage compression and aggregate unemployment. Using 1986 and 1992 data for Portugal, Hartog, Pereira and Vieira (2002) find that single firm bargaining consistently gave the smallest blue collar/white collar wage gap. However, using European Structure of Earnings Survey data from 1995 for Italy, Belgium and Spain, Dell 'Aringa and Pagani (2007) find that the wages of workers covered by just multi-employer contracts are no more compressed than the wages of those covered by both multi-employer and single-employer contracts in Italy and Belgium. This suggests that employers unilaterally pay wage supplements to those not covered by single employer contracts and that the wage compression due to union agreements that is found in other regions was not found in Europe. Using Italian data, Checchi and Pagani (2005) find that local bargaining reduces inequality. For Spain the results were mixed. Using the same data set for Spain, Card and de la Rica (2006) find that with local bargaining wages are less compressed than with centralised bargaining. Domínguez and Gutiérrez (2004) account for selection bias regarding which workers will seek firm level agreements and find that in Spain collective agreements at firm level reduce wage dispersion, though due to firm and worker characteristics firms that have signed such agreements have higher dispersion. For the Netherlands, Hartog, Leuven, and Teulings (2002) find that firm level bargaining leads to a two percent higher return to each year of education than industry level bargaining, firms covered by mandatory extension of industry agreements, or firms not covered by any collective agreement. Using 1998 and 1999 data for Portugal, Cardoso and Portugal (2005) find a difference between the collectively bargained contractual wage and the actual wage. This "wage cushion" was found to have a de-equalising effect, increasing the returns to education and tenure. Again using the European Structure of Earnings Survey data from 1995, but for the

manufacturing sector in Belgium, Denmark and Spain, Plasman et al. (2006) find that single employer bargaining raises wage dispersion in Belgium and Denmark, but reduces it in Spain. They suggest that in countries with more centralised bargaining systems single employer bargaining serves to increase wage differences, but countries with a less centralised, "Anglo Saxon" style bargaining system single employer bargaining serves to compress wages. This is as in a centralised environment minimum industry wages are set at a national or industry level, so during wage bargaining the outside option is the industry level agreement. Given the inconsistency of results for Spain, the evidence for the hypothesis of Plasman et al. (2006) is at best mixed.

Apart from compression effects, the level at which bargaining occurs can affect the level of wages. Obviously where industry or national agreements set out minimum wage rates for an industry then single employer bargaining will only serve to increase wages. In Portugal multi-firm agreements consistently gave the highest premium for blue and white collar workers (Hartog, Pereira and Vieira, 2002) while in the Netherlands there was no significant difference between the wage premium of being included in a firm level or industry level collective bargain (Hartog, Leuven, and Teulings, 2002). Both forms of bargaining gave a premium of about 4.1 per cent above the wages of those covered by either no collective agreement or the mandatory extension of industry agreements. There was no significant difference between being covered by mandatory extension and not being covered by any collective agreement. Granqvist and Regnér (2008) find that in Sweden that those who collectively take part in pay review or individual bargaining, with the agreement of their union, gain significantly higher wages than those who do not. However there is a selection bias as only those who expect to receive higher wages are likely to engage in bargaining.

## 1.3   Globalisation

It is a stylised fact that there has been an increase in trade and international investment since 1980. There has been a increase in economic globalisation, with economic integration being particularly close among EU states. Pavelin and Barry (2005) found a substantial increase in the geographical dispersion of multinational enterprise (MNE) production plants in the EU between 1987 and 1993. It is to be expected that globalisation has had an affect on unions in Europe. Piazza (2005) suggests a link between increased globalisation and a decreasing number of strike days, though the link could be simply coincidental. Both the effect of labour market institutions on FDI, and the effect of FDI on unions have been examined. Although market size is the most important determinant of where MNEs

18

locate, labour market institutions have a significant impact on where firms locate (Bognanno et al., 2005). Cooke (1997) finds that unionisation discourages US firms from investing in a country, though US FDI is positively associated with countries with work councils. However, Cooke and Noble (1998) find that a country's skill base and level of education is the most important factor in determining US FDI, and is more important than union status.

That MNEs pay higher wages has been described as a stylised fact (Girma and Gorg, 2007). Aitken, et al., (1996) find that in Mexico and Venezuela foreign firms pay higher wages. However, when controlling for firm and worker specific characteristics this foreign wage premium disappears. Girma et al., (2002) find that in the UK foreign firms are 8-15 per cent more productive than domestic firms, and the main reason foreign firms are more productive is due to technology (Girma and Gorg, 2007). Conyon et al. (2002) find that domestic mergers cause a decrease in wages but foreign acquisition leads to higher wages due to productivity changes. Girma and Gorg (2007a) find that UK firms taken over by US firms pay higher wages but firms acquired by EU firms do not, possibly due to a greater technology gap with the US than EU. Controlling for firm and individual effects, though not union status, Heyman et al. (2007) use Portuguese data and find no evidence that foreign firms pay identical workers higher wages. Also using Portuguese data, Almeida (2007) studies the acquisition of firms and finds that it is not foreign ownership, but multinational status that is important in explaining the foreign ownership wage premium. Wages in plants tend to rise when taken over by a MNE.

Hijzen et al. (2005) use UK data to show that international outsourcing reduces the demand for unskilled labour. Konings and Murphy (2006) look at MNEs that already have plants in more than one country and ask whether changes in wages cause the firm to relocate jobs between plants. They find that changes in wages in Northern European plants have a small effect on employment and no effect was found for changes in wages for Central European countries. Using Swedish data Braconier and Ekholm (2000) find that workers in high income countries employed in affiliates of Swedish MNEs are substitutes for workers in the parent firm, though workers in affiliates in different countries are compliments. Becker et al. (2005) use both Swedish and German data. They find that in MNEs from either country, affiliate employment tends to substitute for employment at the parent firm. Braun and Scheffel (2007) look at the effect of outsourcing on the trade union wage premium. Using German data they find the wage premium associated with collective agreements at the industry and firm level are reduced for low skilled workers. Though the wages of medium skilled workers remained stable, the wages of high skilled workers increased, though there was no interaction between union coverage and the increased wages. Using Danish data Braun (2008) shows that in MNEs the normal union

19

wage premium disappears. This is consistent with the theory that MNEs have an advantage in wage bargaining when it has plants in more than one country that are substitutes. Though most of the theoretical literature focuses on how globalisation affects the outside option of unions during wage bargaining, using data from Belgium, France, Germany, Italy and the UK, Dumont et al. (2006) find that globalisation reduces workers bargaining power and suggest that greater labour market tightness increases bargaining power. However they neglect the role of changes in the outside option. In contrast Brock and Debbelaere (2006) use Belgian data and find that trade has had no effect on the bargaining power parameter of workers, though technical change improves the bargaining power of workers.

It has been suggested that an increase in the price elasticity of demand for labour reduces the bargaining power of labour as there is a greater wage/employment trade off. There are two main effects through which globalisation can affect the price elasticity of demand for labour. There is a scale effect which is due to greater product market competition. This product market competition increases the price elasticity of demand for output, and as labour is a derived demand it affects the price elasticity of demand for labour. There is also a substitute effect as firms can choose different inputs. In line with studies for other regions (e.g. Slaughter, 2001 for the US; and Haouas and Yagoubi, 2004 for Tunisia) there is at best mixed support for the idea that globalisation has increased the price elasticity of demand for labour in Europe. Crino (2009) states that in studies using industry level data little or no evidence is found in support of globalisation increasing the elasticity of labour demand, but research using firm level data does support it. Using UK and German data Hatzius (2000) looks at how FDI affects factor demand elasticities. He finds that a one per cent increase in unit labour costs causes a decrease in the manufacturing stock of 1.7 per cent. The effect of labour costs on domestic manufacturing investment was more negative during the 1980s when FDI was relatively high than in the 1970s when FDI was low with the change concentrated in the relatively high FDI industries. This suggests that the long run labour demand elasticity may have risen. Jean (2000) finds some evidence that trade has increased the price elasticity of demand for labour in France while Riihimaki (2005) finds more relative growth in elasticities for skilled labour than unskilled. Krishna et al. (2001) find no link between trade and labour demand elasticities in Turkey, while Fabbri et al. (2003) find that elasticity for UK low skilled labour has increased, a finding which contrasts with Riihimaki (2005). Bruno et al. (2004) focus on the substitute effect on the price elasticity of demand for labour. Using data from 1970 to 1996 for France, Italy, Japan, Sweden, the UK and the US they only find a significant substitution effect for the UK, with mixed results for Italy and France. Using data from eleven European countries, Navaretti et al. (2003) find that MNEs show smaller elasticities than national firms. The elasticities for MNEs has little variation across countries with

20

the ratio of national firm elasticities to MNE elasticities is positively correlated with indices of labour market regulation, suggesting that MNEs can sidestep regulations. They also find that employment adjustment in MNE affiliates is significantly faster than for national firms. Overall any evidence in support of globalisation affecting elasticities is at best weak.

## 1.4 International trade union cooperation

Multinationals have been described as

*"pushing down wages and conditions for workers the world over by playing one national workforce off against another."*[1]

However, at best, transnational collective bargaining is underdeveloped in Europe. Even in Ireland, where the majority of union members are in unions organised on an all-Ireland basis, and where there is one peak union organisation for the whole country, unions bargain wages separately with firms in the jurisdictions of the Republic of Ireland and Northern Ireland. However, there have been cross-border negotiations regarding non-pay issues[2]. There have however also been some advances in recent years with regard to cooperation between unions in Europe.

International trade union cooperation takes two main forms, bilateral cooperation and participation in federations. Most European trade unions are simultaneously members of four different federations. There are the International Trade Union Confederation (ITUC), and the European Trade Union Confederation (ETUC). These exist to represent unions covering all sector and skill levels at the international and European level. The International Trade Union Confederation (ITUC) was formed in November 2006. In practice, the ITUC has a strong focus on promoting union rights in developing countries and acts almost as a human rights organisation for trade unionists. The ETUC was founded in 1973 and covers trade unions both within and outside the European Union. A large part of its work is lobbying European Union institutions with regard to EU directives and European Central Bank policy. At a sectoral level, European trade unions also tend to be members of Global Union Federations (GUFs) such as the International Metalworkers Federation or International Transport Workers Federation, and European Industry Federations such as the European Metalworkers Federation and the European Federation of Building and Wood Workers.

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[1] Derek Simpson, speaking on the proposed merger of the UK's UNITE union and the US based USW. [online http://www.amicustheunion.org/default.aspx?page=6359 accessed 4/6/08]

[2] I am grateful to Rosemary Platt for this information.

The rhetoric of international cooperation was described as being ahead of the reality, with calls for international unity coming from leaders of unions affected by globalisation rather than grass roots[3]. Only about one percent of trade union budgets go to international activities. Cross border collective bargaining is hampered by the fact that striking in support of workers abroad is illegal in many European countries such as Germany. Though the ITUC does campaign for the right of cross border sympathy strikes, the ITUC lacks leverage in negotiations and can only rely on the force of arguments. Trade unions in developed countries have an incentive to support the ITUC as by raising standards in developing countries, unions in richer countries benefit by reducing the outside option of internationally mobile firms. The ITUC also has a role with regard to creating International Framework Agreements. The ITUC does not negotiate with multinational firms, but they do deal with governments and international organisations such as the World Bank.

Though it is as yet unfeasible to collectively bargain pay across countries, agreements have been reached on non-pay issues. International Framework Agreements (IFAs) are negotiated between MNEs such as Mercedes and Peugeot and Global Union Federations. Unions in developed countries use their leverage to ensure core minimum labour standards are met in the firm and their subsidiaries. In an interview with Marcello Malentacchi of the International Metalworkers Federation, it was said that the International Metalworkers Federation uses tactics such as protests at embassies, and use of the internet has helped to coordinate this. They also use the tactics of social movements, such as taking advantage of the fact that producers of consumer goods are sensitive to their public image. As there is no global enforcement mechanism, enforcement requires an ability on the part of unions to compel firms to abide by the agreement. Approximately 90 per cent of IFAs were signed by firms with headquarters in Europe (Eurofound, 2009a).

European Framework Agreements are broader in scope than International Framework Agreements. These are negotiated between European employer organisations (e.g. UNICE and CEEP) and the ETUC, and then transformed into EU directives. It should be noted that EU directives are also applied to trade unions outside the EU such as Norway, Switzerland and Iceland. European Framework Agreements cover non pay issues such as agreements regarding parental leave, harassment and violence at work, and health and safety issues (Eurofound, 2009b). In a case study of the European chemical industry, Le Quex and Fajertag (2001) find there was modest transnational cooperation among unions internationally, though wage policy has served as a fault-line. Cross-border collective bargaining partnerships have been established by the European Metalworkers Federation (European

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[3]Interview with James Howard of the ITUC

Metalworkers Federation, 2009). These involve sharing of information by unions across borders and the European Metalworkers Federation agreed common norms for wage policy. Taylor and Mathers (2004) have suggested that the ETUC is undergoing a strategic shift from being an institutional social partner with the EU to becoming a campaigning social movement. One would expect the level of attention unions pay to the effects of globalisation on the labour market would depend on the sector and skill levels of those they represent. It would be expected that sectors more affected by firm mobility would place a greater emphasis on international cooperation. Also if low skilled workers are more affected than high skilled, as evidence of Braun and Scheffel (2007) would suggest, then unions representing low skilled workers will make greater efforts to cooperate internationally. There is some anecdotal evidence to support this. In July 2008 Unite the Union, a British based union, and the US based United Steelworkers agreed to merge into a global union, which bring together workers across Britain, the Caribbean, Ireland and North America (New York Times, 2008). Both these unions represent blue-collar industrial workers. In contrast, Dorel Oancea, President of the FSCR (a federation of cement producers trade unions in Romania), stated that for workers in cement factories the threat of relocation is not very realistic, so globalisation is not very important to their members.

There has also been bilateral cooperation between trade unions. Romanian unions have advised Spanish unions on how to recruit Romanian migrant workers in the agricultural sector, and Polish unions have similarly assisted Irish unions in recruiting Polish migrant workers. Though these contacts are often initiated between the unions, the various umbrella organisations also help to facilitate such cooperation. Cooperation was shown when Polish and German workers for Volkswagen Engine agreed not to take over production from another facility in the event of protest actions. Also, advanced cooperation was shown during a down turn at an Eastern German plant, union representatives at Polkowice (Poland) and Salzgitter (Western Germany) agreed to reduce production volumes at their sites (Bernaciak, 2008). However such advanced cooperation is very much the exception rather than the rule.

## 1.5   A simple model of international bargaining

In anticipation of the issues involving globalisation and labour markets discussed in chapters two and three, a simple model is presented. The following model can help illustrate when unions will wish to cooperate internationally. The key ingredients of the model are as follows:

- it is a partial equilibrium model

- a multinational firm has a plant in two countries, $i$ and $j$

- unions bargain wages with the firm in each country, but do not bargain over the level of employment

- unions decide whether to cooperate internationally, and

- workers have some hold up power, so they can not be simply replaced if bargaining fails.

For simplicity this model abstracts from costs of coordinating wage bargaining internationally, however it can still provide some useful insights. Unions and the firm bargain over a share of the output of the firm $F(H_i, H_j)$, where $H_i$ represents the number of workers employed in country $i$, and $H_j$ represents the number of workers employed in country $j$. It is assumed that workers within a country are substitutes so $\frac{\partial^2 F(H_i, H_j)}{\partial H_i^2} < 0$ and $\frac{\partial^2 F(H_i, H_j)}{\partial H_j^2} < 0$. When the union of one country bargains alone it wishes to maximise its surplus from the bargain, $H_i(w_i - \bar{w}_i)$, where $H_i$, represents the number of workers employed in the plant of country $i$, $w_i$ is the wage received if the union bargains alone with the firm and $\bar{w}_i$ is the reservation wage which workers can get from alternative employment. The firm will wish to maximise its surplus from the bargain which is the difference between the profits of the firm if the bargain is successful and the firm's outside option. If the bargain is successful the profit of the firm is given by $F(H_i, H_j) - w_i H_i - w_j H_j$ which is simply output less the wage bill for country $i$ and country $j$. The outside option of the firm is to continue production in the other country in which case its profits will be $F(0, H_j) - w_j H_j$. For simplicity it is assumed that wages are bargained simultaneously in the two countries, so if wage negotiations break down in country $i$, the firm or union can not renegotiate wages in country $j$. As is standard in the literature the bargain is represented by the Nash product

$$\max_{w_i} [H_i(w_i - \bar{w}_i)]^{\delta_i} [F(H_i, H_j) - w_i H_i - w_j H_j - (F(0, H_j) - w_j H_j)]^{1-\delta_i}$$

where $\delta_i$ represents the bargaining power of workers in country $i$. Maximising the Nash product leads to the wage

$$w_i = \delta_i \left[ \frac{F(H_i, H_j) - F(0, H_j)}{H_i} \right] + (1 - \delta_i)\bar{w}_i. \tag{1.1}$$

so workers are paid a weighted average of the marginal output of the plant they work in, $F(H_i, H_j) - F(0, H_j)$, and the reservation wage. Similarly for workers in country $j$,

$$w_j = \delta_j \left[ \frac{F(H_i, H_j) - F(H_i, 0)}{H_j} \right] + (1 - \delta_j)\bar{w}_j.$$

24

If the two unions agree to cooperate internationally then they will bargain with the firm over the total wage bill $H_i w_i^c + H_j w_j^c$ where $w_i^c$ and $w_j^c$ are the coordinated wages for workers in country $i$ and $j$ respectively. In contrast to when the unions bargain separately, now the outside option of the firm is zero, and the firm's surplus should bargaining be successful is given as $F(H_i, H_j) - H_i w_i^c - H_j w_j^c$. The bargain is represented by the Nash product

$$\max_{H_i w_i^c + H_j w_j^c} \left[ H_i \left( w_i^c - \bar{w}_i \right) + H_j \left( w_j^c - \bar{w}_j \right) \right]^{\gamma} \left[ F(H_i, H_j) - H_i w_i^c - H_j w_j^c \right]^{1-\gamma}$$

where $\gamma$ is the bargaining power of workers when they coordinate internationally. Maximising this leads to

$$H_i w_i^c + H_j w_j^c = \gamma F(H_i, H_j) + (1 - \gamma) \left( H_i \bar{w}_i + H_j \bar{w}_j \right) \tag{1.2}$$

which shows the total wage bill to be a weighted average of the output of the firm and the reservation wages. The firm is only concerned with the total wage bill and not how it is split between the workers in the two countries. The two unions bargain with each other over how to share the total amount of wages. If negotiations break down between the two unions and they do not agree to cooperate internationally then their outside option is the wage gained by bargaining with the firm alone, $w_i$ and $w_j$. The bargain between the two unions is represented by the Nash product

$$\max_{w_i^c, w_j^c} \left[ H_i \left( w_i^c - w_i \right) \right]^{\beta} \left[ H_j \left( w_j^c - w_j \right) \right]^{1-\beta}$$

subject to equation (1.2), where $\beta$ is the bargaining power of the union in country $i$ when negotiating with the union in country $j$. This leads to the total wage bill for country $i$ as

$$H_i w_i^c = \left( (1 - \beta) \delta_i + \beta (\gamma - \delta_j) \right) F(H_i, H_j) + \beta \delta_j F(H_i, 0) - (1 - \beta) \delta_i F(0, H_j)$$
$$+ \left( 1 - (1 - \beta) \delta_i - \beta \gamma \right) H_i \bar{w}_i - \beta (\gamma - \delta_j) H_j \bar{w}_j$$

if unions coordinate, and for country $j$ as

$$H_j w_j^c = \left( \beta \delta_j + (1 - \beta) (\gamma - \delta_i) \right) F(H_i, H_j) - \beta \delta_j F(H_i, 0) + (1 - \beta) \delta_i F(0, H_j)$$
$$- (1 - \beta) (\gamma - \delta_i) H_i \bar{w}_i + \left( 1 - \beta \delta_j - (1 - \beta) \gamma \right) H_j \bar{w}_j.$$

Of more interest however is the net benefit gained by unions cooperating internationally which is

$$H_i w_i^c - H_i w_i = \beta \left\{ \begin{array}{c} F(H_i, H_j) (\gamma - \delta_i - \delta_j) + (\delta_j F(H_i, 0) + \delta_i F(0, H_j)) \\ - H_i \bar{w}_i (\gamma - \delta_i) - H_j \bar{w}_j (\gamma - \delta_j) \end{array} \right\} \tag{1.3}$$

for workers in country $i$, and

$$H_j w_j^c - H_j w_j = (1 - \beta) \left\{ \begin{array}{c} F(H_i, H_j) (\gamma - \delta_i - \delta_j) + (\delta_j F(H_i, 0) + \delta_i F(0, H_j)) \\ - H_i \bar{w}_i (\gamma - \delta_i) - H_j \bar{w}_j (\gamma - \delta_j) \end{array} \right\}$$

25

for workers in country $j$.

Looking at equation (1.3) gives insights as to when workers will wish to cooperate internationally. It should be remembered that the cost of coordination is assumed to be zero, which is not the case in reality (and in some countries such as Germany such international cooperation is illegal). Imposing a coordination cost would lead to an indeterminacy when the unions bargain over their shares of the total wage bill and what portion of the coordination cost they should pay, as workers are only interested in the wage net of the coordination cost and are indifferent between the infinite wage and coordination cost combinations that yield the same net wage. The size of the benefit of coordination for workers in country $i$ is clearly increasing in $\beta$, the bargaining power of the union in country $i$ when negotiating with the union in country $j$. This is as they can capture more of the potential surplus of coordinated bargaining at the expense of the other union. If the bargaining power of the unions cooperating, $\gamma$, is greater than the sum of their bargaining power when bargaining separately, $\delta_i + \delta_j$, then the net benefit is increasing in total output, $F(H_i, H_j)$. This is as greater bargaining power allows workers gain a greater share of output at the expense of the firm. However, there is no reason to expect that $\delta_i + \delta_j$ would be greater than or less than $\gamma$, and it would prove an interesting area for future research. International coordination of wage bargaining is also more likely to result in a net benefit if

$$F(H_i, H_j) < \frac{\delta_j}{(\delta_i + \delta_j)} F(H_i, 0) + \frac{\delta_i}{(\delta_i + \delta_j)} F(0, H_j).$$

This would require that workers in the two countries are substitutes. If workers in the two countries are complimentary then they are not as likely to benefit from coordination. This result is in line with that of Stole and Zwiebel (1996) that when workers are substitutes (and the revenue-labour-product function is concave) then workers will wish to bargain wages collectively, but when they are compliments they will wish to bargain wages separately.

The net benefit to workers in country $i$ is also decreasing in the reservation wage of country $i$ and $j$ if $\gamma > \delta_i$ and $\gamma > \delta_j$ respectively. As seen from equation (1.1), if the value of $\delta_i$ were low (and the bargaining power for workers is higher when they cooperate internationally than act alone), then the reservation wage would play an important role in determining the wage when the union in country $i$ bargains wages alone. A high reservation wage would thus reduce the benefit of cooperating internationally. Though no such assumption is made in the model, it would be surprising if empirically it was found that by cooperating internationally workers reduce their bargaining power with respect to bargaining alone.

In summary the results of this model suggest that unions are more likely to cooperate when their bargaining power is increased by cooperating, when workers in the two countries are substitutes, and in the case where bargaining power increases by cooperating internationally, when the reservation wage is low. This is consistent with the case of the merger of Unite the Union and the US based United Steelworkers.

There is agreement among trade unionists that there is little prospect of transnational collective bargaining in the near future, due to different systems and regulations across countries. Sharing of strike funds is one potential avenue of cooperation. However, there is as yet not sufficient international solidarity to support strike action across national borders. It is believed that the introduction of the Euro will facilitate international wage bargaining, but that differing trade union systems in different countries pose an obstacle to wage bargaining. One potential area to improve cooperation is ensuring that firms do not move production from a unionised plant in one country during a strike to a unionised plant in another country. Calmfors (2001) has suggested that EMU could lead to national coordination of wage policy but that the coordination costs for transnational bargaining are most likely too high.

## 1.6   Conclusion

The face of European trade unionism has changed. Strikes are less common, centralised wage bargaining has decreased, and for non-Ghent countries union density has declined. At the same time, with the exception of the UK, over half of European workers are still covered by union agreements, though data is missing for some countries. Also, for countries that have experienced declines in union density, unionisation rates are stabilising. These two facts, plus the fact that European trade unions continue to gain wage premia through collective bargaining, suggest that European trade unions continue to play an important role in the labour market. Despite similar reasons being put forward for the decline in trade union density across Europe, no cointegration was found between trends in trade union density across Europe.

Globalisation has appeared as a challenge for European unions. There is evidence that multi-national firms reduce trade union wage premia and there is mixed evidence of the effect of trade on bargaining power. Globalisation has also had an affect on the price elasticity of demand for labour, which has a negative effect on the wage/employment trade off. A simple model shows that unions are more likely to cooperate internationally if workers are substitutes across countries, if cooperation increases their bargaining power, and if the reservation wage is low. Trade unions are adapting to the

globalised world, but at a slow pace.

# Chapter 2

# The Effect of International Firm Mobility on Wages and Unemployment

## 2.1 Introduction

On 1st November, 2006, the International Trade Union Confederation was formed in another attempt for the workers of the world to unite. Trade unions feel threatened by the increasing mobility of firms and consider that they face "unbridled capitalist competition". When commenting on a possible merger of a British and a US union, the joint general secretary of Britain's largest union said:

> *"Multinational companies are pushing down wages and conditions for workers the world over by playing one national workforce off against another."*[1]

Firms are now more mobile. Due to legislative and technological changes, capital mobility has increased across the world. Following the introduction of the Single European Act, intra-EU foreign direct investment (FDI) rose from 25 per cent of total inward stock in 1980 to 40 per cent in 1988, and capital movement has largely been two way (Erickson and Kuruvilla, 1994). Pavelin and Barry (2005) find a significant increase in the geographical dispersion of multinational enterprises (MNEs) in Europe between 1987 and 1993. International capital has become more mobile due to reductions in barriers to

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[1] Derek Simpson, speaking on the proposed merger of the UK's UNITE union and the US based USW. [online http://www.amicustheunion.org/default.aspx?page=6359 accessed 4/6/08]

movements of capital such as lower transport costs for movement of capital goods, lower tariffs, lower costs of adapting equipment to foreign standards and conditions, lower costs of training workers to use the equipment and lower costs in providing parts maintenance and customer service from abroad (Eaton and Kortum, 2001). Trade unions have responded by increasing cooperation internationally, and working through umbrella organisations such as the global union federations and the European Trade Union Confederation, but so far cooperation in the area of transnational collective bargaining has not taken place. Although firm mobility may improve the bargaining position of firms when the demand for labour is held constant, it is important to understand the effect of firm mobility on wages and unemployment in general equilibrium. In this paper I ask, what is the effect of increased firm mobility on wages and unemployment?

Although market size is the most important determinant of where MNEs locate, labour market institutions have a significant impact on firm location (Bognanno et al., 2005). Despite their advantage in bargaining, that MNEs pay higher wages has been described as a stylised fact (Conyon et al., 2002). However, controlling for plant size and education greatly reduces the foreign ownership wage premium (Lipsey and Sjoholm, 2004). Heyman et al. (2007) find that there is no evidence that foreign firms pay identical workers higher wages, suggesting that the reason foreign firms pay more is due to them employing a higher proportion of skilled workers. Using UK data, Girma and Gorg (2007) find that when a firm is taken over by a US firm that wages rise significantly, however there is an insignificant response when the firm is acquired by an EU firm. They suggest that this is due to a larger technology gap between the US and the UK than the EU and the UK. This evidence suggests that where multinationals pay more, it is due to higher productivity. Controlling for firm and individual characteristics, Braun (2008) finds that the trade union wage premium disappears in foreign firms. Using German data Braun and Scheffel (2007) estimate the effect of outsourcing on the union wage premium. They find that the wage premium is reduced for the low skilled in sectors affected by outsourcing while the wages of those not covered by collective agreements are unaffected. This supports the idea that once firm and individual characteristics are controlled for, multinational firms pay lower wages due to their advantage in bargaining.

I put forward a new mechanism for how globalisation can affect labour markets. The model I present is an extension of the new trade model of Markusen and Venables (1998) by including labour market frictions and union bargaining. In the presence of union bargaining firms have an incentive to open a plant abroad to improve their outside option during bargaining. This leads to an increase in the demand for labour. This effect has been ignored in the partial equilibrium literature, where labour

demand is constant. In addition, in the presence of frictional labour markets there is a possibility for the increased demand for labour to lead to both lower unemployment and higher wages. The main elements of my model are:

- two countries, with mobile firms but immobile labour;

- multinational enterprises (MNEs) arise endogenously;

- labour markets are frictional, with a plant based union that bargains on behalf of workers; and,

- Cournot sector firms believe they can affect the product market but not the labour market.

I shall now explain how openness can lead to higher wages and employment. Imagine a two country economy where there are no transport costs or labour market frictions, workers are paid their marginal product, and there are no plant fixed costs, just headquarter fixed costs. In this economy firms will be indifferent as to whether they will operate as a national firm or as a MNE. If the model is extended to include a cost of transporting the good internationally and there are fixed costs in establishing a plant then firms face a trade off as to whether they will operate as a national firm and incur the cost of transporting the good internationally or operate as a MNE and incur the fixed cost of having an additional plant abroad. A model similar to this was examined by Markusen and Venables (1998). However in their model full employment was assumed and they were not concerned by the effect of MNEs on wages. The only conclusion that can be drawn is that if it is more productive for firms to operate as MNEs, and they are permitted to operate, then real wages will rise due to the greater output. If this model is extended to include labour market frictions and plant level wage bargaining where workers are represented by a union there is an extra incentive for firms to operate as a MNE. Firms are motivated to become a MNE to reduce the outside option of workers in the wage bargain.

If bargaining breaks down between workers and a national firm all the workers separate from the firm. The outside option of the workers is unemployment and the outside option of the national firm is zero. For MNEs however, if bargaining breaks down in the home (foreign) plant, production can continue in the foreign (home) plant so the outside option is positive. As I assume that unions cannot cooperate internationally, MNEs are aware that every worker they hire in one plant will reduce the wages of workers in the plant of the other country. Therefore, every extra worker in the foreign (home) plant makes this outside option more attractive for the firm. This is the strategic hiring incentive. The direct effect of this outside option is to reduce wages for workers in MNEs. However, what are the indirect effects? The general equilibrium effects of hiring extra workers to affect the wage bargain

have been examined before, in a setting of individual rather than union bargaining over wages. In a paper by Krause and Lubik (2007), where labour is the only factor, accounting for intra-firm bargaining increases wages by about 20 per cent and unemployment declines about 15 per cent. In an unpublished version of a paper by Cahuc et al. (2008), where both labour and capital are present, accounting for intra-firm bargaining raises wages again by about 20 per cent and unemployment decreases by 12 per cent if capital is held constant.

There are two homogeneous good sectors in the model. One good is a competitively traded good, while the other good is characterised by Cournot competition. In the Cournot sector firms hire a large number of workers. Workers are represented by trade unions that bargain at the plant level. A specific resource is used only in the competitive sector. The strategic hiring incentive is important as the increased demand for labour increases labour market tightness. This improves the value of unemployment (which is the outside option for workers) by making it easier for unemployed workers to find a job, and decreases the outside option for firms by making it more difficult for firms to fill a vacancy. Also, drawing labour into the Cournot sector increases the resource/labour ratio in the competitive sector and increases wages in the competitive sector. This can increase wages in the Cournot sector due to two feedback effects. The first is that as wages are higher in the competitive sector, the value of unemployment is increased for workers, as the value of alternative employment is improved. Both these effects improve the bargaining position of workers during wage bargaining and lead to higher wages. Counterintuitively, the availability of an outside option to MNEs may actually raise wages for all workers. The increased level of hirings also means more of the Cournot good is produced which leads to a fall in prices, which increases the real wage for workers. Apart from the direct negative effect of the improved bargaining position of MNEs, there are other indirect negative effects. One is that drawing labour from the competitively traded sector reduces the supply of the competitively traded good, increasing the price level. The second is that MNEs that are less efficient than national firms may be able to operate as they face lower wage costs than national firms due to their advantage in wage bargaining. This lower productivity per worker would lead to lower wages, and as less of the Cournot good is produced, an increase in the price level.

The paper is organised as follows. In section two a review of some of the literature regarding wage bargaining in open economies is presented. In section three I present the model and the equilibrium is outlined. In section four, the results of the numerical analysis are presented. Section five concludes.

## 2.2 Literature review

There has been much written in a partial equilibrium framework, where the demand for labour is held constant, on the effect of the international outside option of MNEs on wages. A review of the microeconometric literature on FDI and labour markets is given by Gaston and Nelson (2002). Zhao (1995) finds that both one way and two way FDI decreases wages as it increases the outside option of the firm with respect to the case of no FDI. This is despite two way FDI increasing the employment options of workers. In his framework unemployment is caused by the existence of a union. In the model of Bughin and Vannini (1995) unemployment is again due to the attempt of unions to gain wages premiums. With regard to inward investment, unions are indifferent to firms entering rather than exporting into the country if the plant they open is unionised and there is one national union. However, if the new plant is not unionised unions would prefer the foreign firm export into the country as FDI would reduce their power. Skaksen and Sorensen (2001), again using a partial equilibrium framework, find that if workers are complimentary then they may gain from FDI. However if workers are substitutes in two countries then workers lose from FDI with Betrand competition between the two unions for employment being the result if they are perfect substitutes. This result is analogous to that of Stole and Zwiebel (1996) in that workers would benefit from being in a single union if they are substitutes (where the labour revenue product function is concave), but that they benefit from bargaining for wages separately if they are complimentary (where the labour revenue product function is convex). Lorz (1997) uses a simple Bertrand model where unions compete with each other to attract mobile firms. Full employment is achieved by unions if they seek the world competitive wage. However, as more countries are involved, union leverage goes to zero, and wages reach the competitive wage. Straume (2003) looks at how trade and FDI interact. He finds that workers in a unionised firm would be happy to merge with a non-unionised firm if trade costs are high, as the unionised plant is not under pressure to keep costs low so as to keep exports competitive. FDI can also reduce wages in richer countries by moving jobs to poorer countries. Leahy and Pavelin (2004) note that the advantage in wage bargaining gives firms an extra incentive to open plants in other countries.

Trade theory predicts a convergence of factor incomes, which would suggest a decrease in wages in the richer country and an increase in the poorer country. Blecker (1996) finds that in the short run investment in the poorer country may stimulate demand in the richer country, and thereby increase wages and employment in the rich country. In the medium term the effect on workers in the richer country is ambiguous as they can buy cheaper goods from the poorer country. Analysing a small open

economy with capital mobility, Bertocchi (2003) finds that factor incomes always converge, though the income shares will not necessarily converge and depend on the bargaining institutions. There has been relatively few models of open economies which include labour market matching frictions. Arnold (2002) looks at North-South trade with labour market frictions. Unemployment in the Northern country increases as the Southern country imitates the products of the Northern country. Faster imitation leads to more frictional unemployment. In contrast, Janiak (2006) finds that trade openness leads to higher unemployment and higher real wages. This is due to larger more efficient firms expanding and hiring more workers, while smaller less efficient firms go bankrupt. As the larger firms can produce goods more cheaply, the real wage increases, though Felbermayr et al. (2007) find that average productivity may not increase due to transport costs and that unemployment should decrease when the cost of posting a vacancy decreases relative to average firm productivity. These models however deal with trade and not the ability of firms to locate abroad. Azariadis and Pissarides (2007) looked at the effect of international financial capital mobility on employment dynamics after shocks to total factor productivity, multinational firms were not included in the model. Mitra and Ranjan, (2007) look at off-shoring and unemployment but ignore strategic hiring effects.

In a general equilibrium model, Zhao (1998) again finds that FDI leads to lower wages. However, the effect is reduced by firm specific bargaining and industry wide unions. Again the improved outside option for firms leads to a fall in wages. If both unions and bargaining are firm specific then unions cannot play firms against one another, leading to lower wages. Eckel and Egger (2009) look at the effect of multinationals on wage bargaining and find that firm mobility leads to a rise in wages. Their model extends that of Melitz (2003) to include MNEs. Wages rise due to MNEs having higher productivity. Multinationals may locate abroad due to the potential to save money in the wage bargain. However, there are no labour market matching frictions, and firms simply choose the number of workers so their marginal return equal wages. Unemployment is largely ignored.

## 2.3   The model

The model I present extends the "new trade" model of Markusen and Venables (1998) by including labour market frictions and bargained wages. There are two countries, a home country $h$ and a foreign country $f$; and two homogeneous goods, $X$ and $Y$. The $Y$ sector good is a competitively traded good and the $X$ sector is characterised by Cournot competition. Countries are endowed with a continuum of two factors, labour ($L$), and resources ($R$). Resources are only used in the competitively traded good sector. In this paper a star is used to denote things that happen in country $f$. So, $R$ is

the resource endowment in country $h$ and $R^*$ is the resource endowment of country $f$. I only present the equations for one country to avoid duplication. Though labour is mobile between sectors, it is immobile between countries. The competitively traded good sector firms are small and produce in only one country (though they may sell their product in either country). In contrast, firms in the Cournot good sector may operate as national firms which produce in only one country, or as MNEs and have production plants in both countries. Time is discrete. In presenting the model I shall first outline the labour market and workers value functions. I shall then outline the product market, showing how the utility function leads to product demands and solving the problem of the firm leads to product supply. I then proceed to explain the key element of the model, how wages are bargained. Finally for this section, the equilibrium is outlined.

## 2.3.1 Labour market

The labour market is characterised by frictional unemployment. This means that if a firm posts a vacancy this period there is a probability that it shall fill this vacancy and have a worker next period. It is costly to post a vacancy. Country $i$ has a continuum of measure $L$ workers. There is a Cobb-Douglas matching technology $su^\rho v^{1-\rho}$, which gives the total number of matches between unemployed workers (the mass of workers looking for a job) with vacancies, where $u$ is the mass of unemployed workers in the home country, $v$ is simply the total sum of the vacancies posted by the different firms operating in the home country, and $\rho$ and $s$ are parameters. It should be noted that $u$ is the mass of unemployed workers and not the rate of unemployment.

Dividing the total number of vacancies by the number of unemployed workers we get labour market tightness which is written as

$$\theta = \frac{v}{u}. \tag{2.1}$$

Dividing the matching function by $v$ we get the intensive matching function

$$q\left(\theta\right) = s\left(\frac{u}{v}\right)^\rho = s\theta^{-\rho}. \tag{2.2}$$

If a firm posts a vacancy this period, the probability that it will fill the vacancy this period (and so have a worker available to work next period) is given by $q\left(\theta\right)$. This term is increasing in $u$ so the more unemployment there is the easier it is for a firm to find a worker.

### 2.3.1.1 Workers' value functions

It is assumed that all agents in the economy are risk neutral. Workers in a country may work for one of four types of firm. They may work for

- a competitively traded good sector firm based in their home country,

- a Cournot sector national firm based in their home country,

- a Cournot sector MNE firm based in their home country, or

- a Cournot sector MNE firm based in the foreign country.

Different types of firms may pay different wages. The value to a worker of having a job depends on the type of firm he is working for, and depends on the wage he receives this period and the discounted value of his state next period. The value to workers of being employed is

$$W_i^k = w_i^k + \beta \left( \lambda U' + (1 - \lambda) W_i^{k\prime} \right), \quad k = Y, M, N, \quad i = h, f, \tag{2.3}$$

where $w_i^k$ is the wage, $U'$ is the value of being unemployed next period, $\beta$ is the discount rate and $\lambda$ is the exogenous probability that the worker will separate from the firm at the end of this period. The value of having a job is increasing in the wage, the value of continuing to have a job next period, and due to the risk of unemployment it is increasing in the value of being unemployed. Subscript $i$ denotes the nationality of the firm the worker is employed by, and is only relevant if the worker is employed by a multinational firm. The superscript $k$ denotes the type of firm, $Y, N, M$, the worker is working for. Superscript $Y$ is for a competitively traded good sector firm, $M$ is for a Cournot sector MNE and $N$ denotes a Cournot sector national firm.

Unemployed workers do not participate in the product market. They do gain some utility, $z$, which is the utility a worker receives from non-market activities. This can be considered home production which the agent does not sell on the market. The value of being unemployed is

$$U = zP(X_c, Y_c) + \beta \left( (1 - \theta q(\theta)) U' + \theta q(\theta) E(W') \right). \tag{2.4}$$

$\theta q(\theta)$ is the probability that a worker finds a job this period. The value of unemployment is in nominal terms so it was necessary to multiply $z$ by the price index $P(X_c, Y_c)$. The origin of the price index is outlined in the next subsection. The value of being unemployed is increasing in the value of $z$. Also, as the average value of having a job next period, $E(W')$, is greater than the value of unemployment next period, the value of unemployment is increasing in $\theta q(\theta)$. This means that with a tighter labour market, and lower unemployment, the value of unemployment will be higher as it will make it easier for the worker to find a job. As an unemployed worker does not know what type of firm he will work

36

for next, $E(W')$ is simply a weighted average of the values of being employed in the various types of firms and is given by

$$E(W') = \frac{\bar{v}^Y}{v}W^{Y\prime} + \frac{\bar{v}^N}{v}W^{N\prime} + \frac{\overline{v}_h^M}{v}W_h^{M\prime} + \frac{\bar{v}_f^M}{v}W_f^{M\prime},$$

where $v$ is the total number of vacancies in the country, and $\bar{v}_i^k$ are the total number of vacancies posted in the home country by a country $i$ headquartered firm, and where $k = Y, M, N$. It can also be useful to define the average wage as

$$E(w) = \frac{\bar{v}^Y}{v}w^Y + \frac{\bar{v}^N}{v}w^N + \frac{\overline{v}_h^M}{v}w_h^M + \frac{\bar{v}_f^M}{v}w_f^M.$$

## 2.3.2 Product market

The competitively traded good serves as numeraire and is internationally mobile without any cost of transportation. There are transportation costs if the Cournot good is shipped internationally. A firm in the Cournot sector can either be a national firm which has a plant in only one country (and which may export abroad), or a multinational enterprise (MNE), which has a headquarters in their home country but a manufacturing plant in both countries. It is possible for national firms and MNEs to coexist. As with the model of Markusen and Venables (1998), costs (with the exception of hiring costs which were not present in the model of Markusen and Venables (1998)) are measured in terms of labour used. Labour is used in production in both sectors, however resources are only used in the competitively traded sector. It is useful to think of $Y$ as a competitively traded product which uses the resource land. As in Markusen and Venables (1998), the utility of the representative consumer is given by $X_c^\delta Y_c^{1-\delta}$, where $Y_c$ is the amount of the competitively traded good consumed in the country, $X_c$ is the total amount of the Cournot good consumed in the home country, and

$$X_c = nX_h^N + n^*X_f^N + mX_h^M + m^*X_f^M,$$

where $n$ is the number of national firms based in country $h$; $n^*$ is the number of national firms based in the foreign country; $m$ is the number of MNEs headquartered in the home country; and $m^*$ is the number of MNEs headquartered in the foreign country. $X_h^N$ is the amount of the Cournot good produced by a home country based national firm for the market of the home country. The subscript index is for the country of origin of the firm. Therefore $X_f^N$ is the amount of the Cournot good produced by a foreign country based firm and exported to the home country, $X_h^M$ is the amount of the Cournot good produced by a home country headquartered MNE for its home market, and $X_f^M$ is the amount of $X$ produced by a foreign country headquartered MNE in its country $h$ plant for the market of country $h$.

Using the budget constraint that national income equals national expenditure we get $M = P(X_c) X_c + Y_c$, where $P(X_c)$ is the price of the Cournot good in the home country and $M$ is the national income of the home country. Though $M$ is used to denote national income and as a superscript to denote multinational firms, it is believed that in their use they shall not cause confusion. Maximising utility subject to the budget constraint I get the product demands

$$X_c = \frac{\delta M}{P(X_c)}, \; Y_c = (1-\delta) M. \tag{2.5}$$

The indirect demand equation for $X_c$ is given by

$$P(X_c) = \frac{\delta M}{X_c}.$$

By definition as numeraire, the nominal price of the competitively traded good is equal to 1. The price index for the economy is defined as

$$P(X_c, Y_c) = P(X_c)^{\delta}.$$

This was calculated by inserting equation (2.5) into the utility function, which gave an indirect utility function in terms of prices and nominal income, and then rescaling.

### 2.3.2.1 Competitively traded good sector firms

In the competitively traded sector firms are small, with one worker per firm. Therefore the mass of workers, $L^Y$, and the mass of firms in the competitively traded sector are identical. Competitively traded good sector firms consider themselves too small to affect the market. The firms use resources and one unit of labour. As the resource is freely traded and not subject to any frictions, all the resource will be used each period, so $R = L^Y \hat{R}$. The amount of resources used by an individual firm is given by $\hat{R}$. There is no cost in trading the competitively traded good internationally. Competitively traded good sector firms only have one worker and there are no competitively traded good sector MNEs. The value this period of a filled job to an entrepreneur in the competitively traded sector is given as

$$J^Y = y - w^Y - r\hat{R} + \beta(1-\lambda) J^{Y\prime}, \tag{2.6}$$

where we have the production technology $y = \hat{R}^{1-\alpha}$, and $r$ is the rental rate of resources in the home country, $w^Y$ is the wage and $\lambda$ is the exogenous probability that the job-worker pair will separate. This is the probability that either the firm will exit, $\eta$, or the worker will leave the firm, $\widetilde{\lambda}$, and $\lambda = \eta + \widetilde{\lambda} - \widetilde{\lambda}\eta$. Why exogenous firm exit is required is explained in the appendix. If $\alpha = 1$ then the specific resource is irrelevant. A lower value of $\alpha$ increases the effect that drawing labour from the

38

competitively traded sector has on wages. $1 - \alpha$ is the share of output in the competitively traded sector that goes to resources. Maximising the above for $\hat{R}$ and using the fact that all firms in the competitively traded sector act symmetrically, we get that

$$r = (1 - \alpha) \left( \frac{L^Y}{R} \right)^\alpha. \tag{2.7}$$

Similarly, the total amount of the competitively traded good produced in the economy can be given as

$$Y = \left( L^Y \right)^\alpha R^{1-\alpha}. \tag{2.8}$$

The value of posting a vacancy in the competitively traded sector is

$$V^Y = -\phi P \left( X_c, Y_c \right) + (1 - \eta) \beta \left( q \left( \theta \right) J^{Y\prime} + (1 - q \left( \theta \right)) V^{Y\prime} \right), \tag{2.9}$$

where $\phi$ is the real cost of posting a vacancy and $q \left( \theta \right)$ is the probability that the firm will fill the vacancy. When a firm decides to post a vacancy they take $\theta$ as given. $\eta$ is the exogenous probability that the firm will cease to exist. As a firm is deemed to exist from the moment it posts a vacancy, there is a possibility that the firm will expire before it even manages to hire a worker.

Due to the free entry condition $V^Y \leq 0$. In the steady state this holds with equality where there is a positive number of competitively traded good sector firms operating in the home country. Due to the nature of the Cobb-Douglas production function, in the steady state there will always be a positive number of competitively traded good sector firms operating in the home country whenever $R > 0$. This, combined with equation (2.9) leads to

$$J^{Y\ \prime} \leq \frac{\phi P \left( X_c, Y_c \right)}{\beta \left( 1 - \eta \right) q \left( \theta \right)}, \tag{2.10}$$

with equality in the steady state if $R > 0$. The firm has a value due to the barrier to entry caused by the cost of labour market frictions. $\dfrac{\phi P \left( X_c, Y_c \right)}{q \left( \theta \right)}$ is the nominal cost of filling a vacancy. The value of a filled job is increasing in labour market tightness, and decreasing in unemployment. This is as if the labour market is tight it is harder to fill a vacancy and more difficult for new firms to enter the market. Dividing the cost of filling a vacancy by $\beta \left( 1 - \eta \right)$ gives the undiscounted value of having a filled job next period.

### 2.3.2.2 Cournot sector firms

Good $X$ is a homogeneous good and firms producing good $X$ act according to Cournot competition, taking the competitively traded good as numeraire. Cournot sector firms are aware of

39

their effect on the price of the good but take the actions of the other firms as given. There is a cost $\tau$ associated with transporting the Cournot good internationally. Firms in the Cournot sector are either national firms or MNEs. In the model of Markusen and Venables (1998), firms function as MNEs in order to avoid the shipping cost. In this model there is the added motivation of possibly reducing labour costs by improving the firms bargaining position. The superscripts $N, M$ designate whether the firm is a national firm or a multinational respectively. Technology in the Cournot sector is increasing returns to scale. Firms need a minimum number of plant workers, $G$, and headquarter workers, $F$, before they can produce and sell their goods. It takes one worker to produce one unit of the good. Trade costs, $\tau$, are also in terms of the number of workers needed to transport the good. The nationality of a MNE is defined by the location of its headquarters, which is where it employs $F$ headquarter workers. Cournot firms are large and hire a continuum of workers, allowing the use of the law of large numbers. Therefore the probability that a worker separates from the firm can be interpreted as the proportion of workers separating from the firm at the end of the period. It is assumed that firms cannot switch from being a national firm to a MNE or vice versa. The firm makes its decision as to what type of firm it will be when it forms. This restriction does not pose any problems as I solve for the steady state and I do not examine the dynamics of the model. Though Cournot sector firms consider they are large enough to affect the price of the Cournot good, they do not account for any effect they may have on the labour market, on national income or the price index for the economy.

Firms face a trade off as to whether they will face the transportation cost when exporting, or if they will open a second plant abroad and face the cost of paying wages to non-production workers in the foreign plant. The number of workers employed in non-production activities and transport activities has an important effect on productivity in the Cournot sector and therefore the wage. If workers are diverted to non-production activities by MNEs opening second plants in order to gain an advantage in wage bargaining, then productivity and wages can fall. I will now outline the problem facing national firms and MNEs.

**National Firms**    The value of a national firm producing in the home country is

$$V^N\left(H^N\right) = \max_{v^N, X_h^N, X_h^{N*}} \left\{ \begin{array}{c} P\left(X_c\right) X_h^N + P\left(X_c^*\right) X_h^{N*} - w^N\left(H^N\right) H^N - \phi P\left(X_c, Y_c\right) v^N \\ + \left(1 - \eta\right) \beta V\left(H^{N\,\prime}\right) \end{array} \right\} \quad (2.11)$$

subject to the price of the good

$$P\left(X_c\right) = \frac{\delta M}{X_c}, \ P\left(X_c^*\right) = \frac{\delta M^*}{X_c^*},$$

40

the law of motion for hiring workers

$$H^{N\,\prime} = \left(1 - \widetilde{\lambda}\right) H^N + q\left(\theta\right) v^N, \tag{2.12}$$

and that production is constrained by the number of workers hired by the firm and the number of workers required for non-production functions

$$H^N = F + G + X_h^N + (1 + \tau) X_h^{N*}, \tag{2.13}$$

where $v^N$ are the vacancies posted and $H^N$ is the number of workers hired by the national firm. The value of the firm is simply the revenue minus the wage cost and cost of posting vacancies, plus the discounted probability of the value of the firm next period. I assume the cost of posting a vacancy, $\phi$, is paid by the firm to some agency in their own country who has the same consumption preferences as anyone else in that country. While the cost of posting a vacancy is constant in real terms, from equation (2.12) it can be seen that the cost of filling a vacancy is increasing in labour market tightness and decreasing in unemployment. Equation (2.13) shows that $F$ headquarter non-production staff and $G$ plant non-production staff are required in order to produce the good. As can be seen, the firm discounts the future due to both impatience and also as there is the probability that the firm will exit at the end of the period. Using the first order conditions for $X_h^N$ and $X_h^{N*}$ we can get the quantities of the Cournot good supplied by national firms to their domestic and foreign markets. These are given by the equations

$$X_h^N = \frac{(1+\tau)^2 M \left(X_c^*\right)^2 X_c + \left(H^N - F - G\right) X_c^2 M^* - X_c^* X_c^2 M^* \left(1 + \tau\right)}{(1+\tau)^2 M \left(X_c^*\right)^2 + X_c^2 M^*},$$

and

$$X_h^{N*} = \frac{-\left(1+\tau\right) M \left(X_c^*\right)^2 X_c + X_c^* M^* X_c^2 + \left(1 + \tau\right) \left(H^N - G - F\right) M \left(X_c^*\right)^2}{(1+\tau)^2 M \left(X_c^*\right)^2 + M^* X_c^2}.$$

It is ambiguous as to whether $X_h^N$ is increasing or decreasing in $\tau$. A decrease in $\tau$ means there are more workers available for production which could lead to an increase in $X_h^N$. However, it also means it is cheaper to export. When there is more than just one firm in the Cournot sector, $X_h^{N*}$, is strictly decreasing in $\tau$. Using these equations the revenue of a national firm is given by

$$REV^N = \frac{\delta\left\{[(1+\tau)MX_c^* - M^* X_c]^2 + MM^* \left(H^N - F - G\right)(X_c + (1+\tau)X_c^*)\right\}}{(1+\tau)^2 M(X_c^*)^2 + M^* X_c^2}, \tag{2.14}$$

as $REV^N = P\left(X_c\right) X_h^N + P\left(X_c^*\right) X_h^{N*}$. It is quite clear that revenue increases with the number of employees hired by the firm, and is decreasing in the number of non-production workers $(F + G)$ required. The first order condition for vacancies (using the assumption that next period the firm will

remain a national firm) leads to the condition for the optimal number of hirings

$$\frac{\partial V^N \left( H^N \,' \right)}{\partial H^N \,'} = \frac{\phi P \left( X_c, Y_c \right)}{\beta \left( 1 - \eta \right) q \left( \theta \right)}.$$

Similar to the case for the commodity sector, equation (2.10), the discounted nominal benefit of having an extra worker next period is equal to the nominal cost of filling a vacancy.

The envelope condition for hirings, combined with the first order condition for $X_h^N$ and $X_h^{N*}$ leads to

$$\frac{\partial V^N \left( H^N \right)}{\partial H^N} = -\frac{\partial w_h^N}{\partial H^N} H^N - w_h^N + \phi P \left( X_c, Y_c \right) \frac{\left( 1 - \tilde{\lambda} \right)}{q \left( \theta \right)} + \frac{\partial \, REV^N}{\partial \, H^N}. \qquad (2.15)$$

The benefit of having an extra worker comprises of a strategic hiring effect, the benefit of not needing to incur the expenses of replacing the worker, an effect on revenue, minus the wage of the worker. $\frac{\partial w_h^N}{\partial H^N}$ is a strategic hiring effect. Due to Cornot competition and the concave labour revenue product function, adding one more worker will affect the wage of the other workers. $\phi P \left( X_c, Y_c \right) \frac{\left( 1 - \tilde{\lambda} \right)}{q \left( \theta \right)}$ is the benefit of not needing to replace a worker. It takes account of the probability $\tilde{\lambda}$ that the worker will separate from the firm due to natural wastage. The last term on the right is also the shadow price of not being able to hire workers instantly. When calculating $\frac{\partial \, REV^N}{\partial \, H^N}$ one must take note that $H^N$ has an effect on $X_c$ and $X_c^*$. It can be shown that

$$\frac{\partial \, REV^N}{\partial \, H^N} = \frac{\delta M M^* \left( X_c + \left( 1 + \tau \right) X_c^* - \left( H^N - F - G \right) \right)}{\left[ \left( 1 + \tau \right)^2 M \left( X_c^* \right)^2 + X_c^2 M^* \right]}.$$

This term is positive so long as there is more than one firm in the Cournot good sector. The value of a start up national firm in the $X$ sector is

$$V^N \left( 0 \right) = \max_{v^N} \left\{ -\phi P \left( X_c, Y_c \right) v^N + \left( 1 - \eta \right) \beta V^N \left( H^N \,' \right) \right\}$$

subject to

$$H^N \,' = q \left( \theta \right) v^N.$$

This is identical to the value of a national firm, but with $H^N \, = 0$.

As with firms which are already operating, we get the condition that

$$\frac{\partial V^N \left( H^N \,' \right)}{\partial H^N \,'} = \frac{\phi P \left( X_c, Y_c \right)}{\beta \left( 1 - \eta \right) q \left( \theta \right)},$$

so new firms will post as many vacancies as are necessary to have the same number of workers as other firms that are already operating. All operating national firms have the same number of workers.

42

Due to the free entry condition, $V^N(0) \leq 0$, with equality if $n > 0$. We can substitute out $v^N$ using equation (2.12). This leads to

$$V^N\left(H^{N\,\prime}\right) \leq \frac{\phi P\left(X_c, Y_c\right) H^{N\,\prime}}{\beta\left(1 - \eta\right) q\left(\theta\right)} \tag{2.16}$$

with equality in the steady state when $n > 0$. This is very similar to equation (2.10), and shows an equal value per filled job for the two types of firm. This is as both types of firm only hire in one country, they face identical hiring costs, and due to the free entry condition, when $n > 0$ vacancies will be posted for both types of firm so the the value of a filled job will be the same in each firm.

**MNEs** I now present the problem of the multinational firm. This is slightly more involved as the MNE has workers in both countries. Both plants produce the same good and the workers in both plants are substitutes. The value of a Cournot sector firm that operates as a multinational is given by

$$V^M\left(H_h^M, H_h^{M*}\right) = \max_{v_h^M, v_h^{M*}, X_h^M, X_h^{M*}} \left\{ \begin{array}{c} P\left(X_c\right) X_h^M + P\left(X_c^*\right) X_h^{M*} \\ -w_h^M\left(H_h^M, H_h^{M*}\right) H_h^M \\ -w_h^{M*}(H_h^M, H_h^{M*})H_h^{M*} - \phi P\left(X_c, Y_c\right)\left(v_h^M + v_h^{M*}\right) \\ +\left(1 - \eta\right)\beta V^M\left(H_h^{M\prime}, H_h^{M*\prime}\right) \end{array} \right\}, \tag{2.17}$$

subject to

$$H_h^{M\prime} = \left(1 - \widetilde{\lambda}\right) H_h^M + q\left(\theta\right) v_h^M, \tag{2.18}$$

$$H_h^{M*\prime} = \left(1 - \widetilde{\lambda}\right) H_h^{M*} + q\left(\theta^*\right) v_h^{M*}, \tag{2.19}$$

$$H_h^M = F + G + X_h^M, \tag{2.20}$$

and

$$H_h^{M*} = G + X_h^{M*}. \tag{2.21}$$

Similar to the value function for national firms, the value of MNEs is given by the revenue, minus the wage and vacancy costs, plus the discounted value of the firm next period. As can be seen from equation (2.20), the firm needs at least $F + G$ workers in the home plant to fulfill headquarter services and plant services. As $G$ is the minimum number of people required for each plant, a lower value of $G$ makes it easier for a firm to open a plant abroad. Also, a lower value of $F$, makes it easier for the firm to move its headquarters. Equations (2.20) and (2.21) show the role of labour market tightness in hiring workers, as a loose labour market, and high unemployment, make it easier to find a worker. Similarly to the case for national firms, we can get the envelope conditions for hirings as

$$-H_h^M \frac{\partial\, w_h^M}{\partial\, H_h^M} - w_h^M - H_h^{M*} \frac{\partial\, w_h^{M*}}{\partial\, H_h^M} + \phi P\left(X_c, Y_c\right) \frac{\left(1 - \tilde{\lambda}\right)}{q\left(\theta\right)} + \frac{\partial\, REV_h^M}{\partial\, H_h^M} = \frac{\phi P\left(X_c, Y_c\right)}{\left(1 - \eta\right)\beta q\left(\theta\right)},$$

and

$$-H_h^{M*}\frac{\partial\, w_h^{M*}}{\partial\, H_h^{M*}} - w_h^{M*} - H_h^M\frac{\partial\, w_h^M}{\partial\, H_h^{M*}} + \phi P\left(X_c, Y_c\right)\frac{\left(1-\tilde{\lambda}\right)}{q\left(\theta^*\right)} + \frac{\partial\, REV_h^M}{\partial\, H_h^{M*}} = \frac{\phi P\left(X_c, Y_c\right)}{\left(1-\eta\right)\beta q\left(\theta^*\right)}, \quad (2.22)$$

where $REV_h^M = P\left(X_c\right)X_h^M + P\left(X_c^*\right)X_h^{M*}$, $\frac{\partial\, REV_h^M}{\partial\, H_h^M} = \frac{\delta M\left(X_c - X_h^M\right)}{X_{ic}^2}$, and $\frac{\partial\, REV_h^M}{\partial\, H_h^{M*}} = \frac{\delta M^*\left(X_c^* - X_h^{M*}\right)}{X_{jc}^2}$. Though similar to the envelope condition for national firms (equation 2.15) a crucial difference is that hiring workers in one plant also lowers the wage bill in the second plant. The is shown by the appearance of the terms $\frac{\partial\, w_h^{M*}}{\partial\, H_h^M}$ and $\frac{\partial\, w_h^M}{\partial\, H_h^{M*}}$ in the envelope conditions. It is this which makes the strategic hiring effect stronger for MNEs and why *ceteris paribus* they hire more workers than national firms. This leads to a greater number of vacancies posted and greater labour market tightness.

As MNEs do not export we can take the amount of the Cournot good supplied to each market directly from the constraints (2.20) and (2.21). Similar to the national firm case we have that the value of a start up national firm in the Cournot sector is

$$V^M\left(0,0\right) = -\phi P\left(X_c, Y_c\right)\left(v_h^M + v_h^{M*}\right) + \left(1-\eta\right)\beta V^M\left(H_h^{M\,\prime}, H_h^{M*\prime}\right).$$

Due to the free entry condition, $V^M\left(0,0\right) \leq 0$, with equality in the steady state if $m > 0$. We can substitute out $v_h^M$ and $v_h^{M*}$ using equations (2.18) and (2.19), leading to

$$V^M\left(H_h^M, H_h^{M*}\right) \leq \frac{\phi P\left(X_c, Y_c\right)}{\left(1-\eta\right)\beta}\left(\frac{H_h^{M\prime}}{q\left(\theta\right)} + \frac{H_h^{M*}}{q\left(\theta^*\right)}\right), \qquad (2.23)$$

with equality when $m > 0$. This is somewhat different from equation (2.10) and equation (2.16) in that the undiscounted value of the firm is equal to the cost of hiring the full complement of workers in both countries.

### 2.3.3   Wage bargaining

When bargaining wages workers would like to maximise their surplus of being employed, $W_i^k - U$. Due to the cumbersome nature of the equations it is useful to substitute out all the elements agents take as given during the wage bargain. These are taken as given as agents either consider themselves too small to affect these variables or cannot commit to future variables. Setting $W_i^k = U$, and rearranging for wages, we get a variable that only includes variables taken as given by agents. The subscript $i$ refers to the nationality of the firm the worker is working for, and is only relevant if the worker is employed by a MNE. Thus we can define

$$\omega_i^k = z P\left(X_c, Y_c\right) + \beta\left(\left(1-\theta q(\theta) - \lambda\right)U' + \theta q(\theta)E\left(W'\right) - \left(1-\lambda\right)W_i^{k\prime}\right), \qquad (2.24)$$

$$k = Y, N, M, \quad i = h, f. \qquad (2.25)$$

44

From this it is easy to show that

$$W_i^k - U = w_i^k - \omega_i^k, \ k = Y, N, M. \tag{2.26}$$

$\omega_i^k$ is taken as given by firms and workers. It can be interpreted as a reservation wage for bargaining this period. This term is useful as it summarises the external labour market influences on the wage bargain. This reservation wage is increasing in $\theta q(\theta)$ and decreasing in unemployment, so when the labour market is tight workers will have a higher reservation wage. It is increasing in the average value of employment in the economy and $z$. It is decreasing however in $W_i^{k\prime}$. This is as workers are willing to accept a lower wage this period in anticipation of bargaining a higher wage next period. Workers may even be willing to accept a wage below $zP(X_c, Y_c)$. Using this substitution is useful, though it in no away affects the results of the model. The steady state value of wages are presented in the appendix.

#### 2.3.3.1   Competitively traded sector

As is standard in the literature wages are negotiated through Nash bargaining. The Nash product shows how the total benefit of the match, which is the production that will occur plus the value of not requiring to post another vacancy, will be divided between firms and workers. The Nash product takes the form

$$\max_{w^Y} \left\{ \left[ W^Y - U \right]^\gamma \left[ J^Y \right]^{1-\gamma} \right\}$$

where $\gamma$ is the bargaining power of workers. This leads to

$$\gamma J^Y = (1 - \gamma) \left[ W^Y - U \right]. \tag{2.27}$$

Using equations (2.6), (2.10), and (2.26) we get the wage for the competitively traded sector as

$$w^Y = \gamma \left( \alpha \left( \frac{R}{L^Y} \right)^{1-\alpha} + \phi P(X_c, Y_c) \frac{\left(1 - \tilde{\lambda}\right)}{q(\theta)} \right) + (1 - \gamma) \omega^Y.$$

This is a weighted average of the total benefit of the match and the reservation wage. The value of not needing to post the vacancy again, $\phi P(X_c, Y_c) \frac{(1-\tilde{\lambda})}{q(\theta)}$, is increasing in labour market tightness, which serves to increase the wage.

#### 2.3.3.2   Cournot sector national firms

Cournot sector firms are large, and a union negotiates wages on behalf of all workers in the firm. If negotiations break down all the workers are sacked. This, combined with the free entry

condition, means the outside option for the firm is zero. When modelling, the choice of outside option can depend on the motivation agents have on reaching an agreement, and can be either the income streams that agents receive during a dispute or their best alternative if negotiations break down (Binmore et al., 1986). As there is no strike-pay provided by unions, and firms have no revenue if there is a dispute, the outside options given are appropriate for both motivations.

The union wishes to maximise the surplus of the state of employment over unemployment for the members of the union. The union only bargains over wages and not over employment. There are criticisms over this right-to-manage approach (a discussion is given in Cahuc and Zylberberg, 2004), such as that it does not lead to Pareto efficient outcomes. However, there are two reasons why in this case it is appropriate. The first is that workers and firms take the number of workers in the firm as given. This is due to the labour market frictions. The firm cannot hire more workers this period, so it can only reduce the number of workers. However, with a right to manage approach the firm will have posted vacancies anticipating the wage, and so will have no incentive to reduce the number of workers. The second reason is that there is no commitment mechanism. Wages are renegotiated each period, so though it is possible to bargain over the number of vacancies, the firm may renege on hiring these workers next period. Also it would be difficult to understand what benefit current members gain from future hirings. Therefore the right to manage approach is the appropriate method.

Wages are found by maximising the Nash product

$$\max_{w^N} \left\{ \left[ H^N \left( W^N - U \right) \right]^\gamma \left[ V^N \left( H^N \right) \right]^{1-\gamma} \right\},$$

which leads to

$$H^N \left( 1 - \gamma \right) \left[ W^N - U \right] = \gamma V^N \left( H^N \right). \tag{2.28}$$

It is interesting to note that in the steady state the wages of those working for Cournot sector national firms and competitively traded good sector firms are the same. Using the free entry conditions it can easily be shown that in the steady state $V^N \left( H^N \right) = H^N J^Y$. Substituting this into equation (2.28), it is easy to show that where national firms exist in the steady state they will pay the same wage as competitively traded good sector firms. Given that national firms and competitively traded good sector firms only employ workers in their home countries, and during wage negotiations neither has the ability to continue production abroad if negotiations breakdown, it is perhaps not surprising that both should pay the same wage. Substituting equations (2.11), (2.16), and (2.26) into equation (2.28) we get

$$w^N = \gamma \left( \frac{REV^N}{H^N} + \phi P \left( X_c, Y_c \right) \frac{\left( 1 - \tilde{\lambda} \right)}{q \left( \theta \right)} \right) + \left( 1 - \gamma \right) \omega^N.$$

This is similar to the wage for the commodity sector in that it is a weighted average of the total benefit of the match continuing and the reservation wage. The wage depends on the revenue per worker. As there are $F + G$ workers engaged in plant and headquarter non-production activities, a high value for $F + G$ means that the revenue must be divided among more workers, leading to lower wages. Also for every unit of the good exported, there are $\tau$ workers involved in transporting the good rather than production. A higher $\tau$ also serves to reduce revenue per worker and the wage. It can be shown that the wage for commodity sector firms and Cournot sector national firms are equal. It is useful at this point to know that from this we get

$$\frac{\partial\ w^N}{\partial\ H^N} = \frac{\gamma}{(H^N)^2} \left[ H^N \frac{\partial\ REV^N}{\partial\ H^N} - REV^N \right],$$

which is used in the envelope condition for national firms. It is ambiguous as to whether this term will be positive or negative, but as $F + G$ go to zero this term becomes strictly negative.

### 2.3.3.3   Cournot sector MNEs

Calculating wages for the case of MNEs is more difficult. This is as the negotiating position of a firm is improved if it has a plant abroad. This is because if negotiations break down in one plant, it can continue producing in its plant in the other country, so long as this plant currently has sufficient workers for both headquarter and plant functions. This contrasts with Eckel and Egger (2009) where the firm does not face labour market frictions and can immediately increase the number of workers in the other plant. It is assumed that unions only represent the workers in one plant of one country, so there is no international cooperation between unions. Simultaneous bargaining is used. This is chosen as it is a more simple method than non-simultaneous bargaining. The assumption does not qualitatively affect the results of the model. The firm treats each bargaining unit (plant) as the marginal production unit. Due to the concave labour revenue product function the firm benefits from dividing workers into different bargaining units.

How wages are calculated in the foreign plant will be demonstrated first, followed by wages in the home plant.

**Wages in the foreign plant**   As before, wages are calculated by maximising the Nash product.

$$\max_{w_h^{M*}} \left\{ \left[ H_h^{M*} \left( W_h^{M*} - U^* \right) \right]^{\gamma} \left[ V^M \left( H_h^M, H_h^{M*} \right) - V^M \left( H_h^M, 0 \right) \right]^{1-\gamma} \right\}. \tag{2.29}$$

$V^M \left( H_h^M, 0 \right)$ is the outside option for the firm. As workers are split between two countries, workers bargain with management over the marginal, rather than the total, benefit of that production unit

continuing to produce. It is assumed that if negotiations break down in the foreign plant then all the workers in the foreign plant are sacked. However, the firm still has workers working in the domestic plant so the firm may operate similarly to a national firm for one period. As the firm operates under Cournot competition it assumes its actions have no effect on national income or labour market tightness. This assumption is kept even if negotiations with workers break down. The firm does assume it has an effect on the product market, though it ignores the possible reaction of other firms. Using these assumptions we get

$$\hat{X}_c^* - \hat{X}_h^{M*} = X_c^* - X_h^{M*}, \tag{2.30}$$

where $\hat{X}_c^*$ shows the of quantity of the Cournot good consumed in the foreign country in the case of negotiations breaking down in the foreign plant, and $\hat{X}_h^{M*}$ is the amount of the Cournot good that will be supplied by the firm to the foreign country if negotiations break down. A hat over a variable signifies the value of that variable when negotiations break down in the foreign plant. The outside option of the firm and the wage are detailed in the appendix. The wage is given as

$$w_h^{M*} = \gamma \left( \frac{REV_h^M - \widehat{REV}_h^M}{H_h^{M*}} + \phi P\left(X_c, Y_c\right) \frac{\left(1 - \tilde{\lambda}\right)}{q\left(\theta^*\right)} \right) + (1 - \gamma)\,\omega_h^{M*},$$

where $\widehat{REV}_h^M$ is the revenue of the firm if negotiations break down with workers in the foreign plant. It is interesting to note the difference between the wage equations for MNEs and for national firms. The inclusion of the term $\widehat{REV}_h^M$ shows that the greater is $\widehat{REV}_h^M$ the lower will be the wage for workers in the foreign plant. As there are $G$ non-production workers in the foreign plant, a high value of $G$ will decrease the marginal revenue of the plant per worker. It is also useful at this point to show

$$\frac{\partial\,w_h^{M*}}{\partial\,H_h^{M*}} = \frac{\gamma}{\left(H_h^{M*}\right)^2} \left[ H_h^{M*} \frac{\partial\,REV_h^M}{\partial\,H_h^{M*}} - \left(REV_h^M - \widehat{REV}_h^M\right) \right],$$

and

$$\frac{\partial\,w_h^{M*}}{\partial\,H_h^M} = \frac{\gamma}{H_h^{M*}} \left[ \frac{\partial\,REV_h^M}{\partial\,H_h^M} - \frac{\partial\,\widehat{REV}_h^M}{\partial\,H_h^M} \right],$$

which can be inserted into the envelope condition, equation (2.22). While it is ambiguous as to whether $\frac{\partial\,w_h^{M*}}{\partial\,H_h^{M*}}$ is negative (though for a smaller $F + G$ it will be more negative), $\frac{\partial\,w_h^{M*}}{\partial\,H_h^M}$ will always be negative as $REV_h^M > \widehat{REV}_h^M$ and the labour revenue product function is concave.

**Wages in the home plant**  If negotiations break down in the home plant production may continue in the foreign plant. However this requires $H_h^{M*} > F + G$, as the foreign plant must perform headquarter operations as well as plant operations. A tilde over a variable signifies the value of that variable if negotiations break down with workers in the home plant.

48

Similar to before the Nash product

$$\max_{w_h^M} \left\{ \left[ H_h^M \left( W_h^M - U \right) \right]^\gamma \left[ V^M \left( H_h^M, H_h^{M*} \right) - V^M \left( 0, H_h^{M*} \right) \right] \right\}, \tag{2.31}$$

is maximised, where $V^M \left( 0, H_h^{M*} \right)$ is the value of the firm if negotiations break down with workers in the home plant. How the outside option is calculated is outlined in the appendix. From this we get the wage

$$w_h^M = \gamma \left( \frac{REV_h^M - \widetilde{REV}_h^M}{H_h^M} + \phi P \left( X_c, Y_c \right) \frac{\left( 1 - \tilde{\lambda} \right)}{q \left( \theta \right)} \right) + \left( 1 - \gamma \right) \omega_h^M,$$

where $\widetilde{REV}_h^M$ is the revenue of the firm if negotiations with the home plant break down. If $H_h^{M*} < F + G$, then $\widetilde{REV}_h^M = 0$. As when bargaining with the workers in the foreign plant, a higher $\widetilde{REV}_h^M$ results in a lower wage.

Again, if negotiations with home workers breakdown then the firm can operate as a national firm in the foreign country. It is also useful at this point to show

$$\frac{\partial \, w_h^M}{\partial \, H_h^M} = \frac{\gamma}{\left( H_h^M \right)^2} \left[ H_h^M \frac{\partial \, REV_h^M}{\partial \, H_h^M} - \left( REV_h^M - \widetilde{REV}_h^M \right) \right],$$

and

$$\frac{\partial \, w_h^M}{\partial \, H_h^{M*}} = \frac{\gamma}{H_h^M} \left[ \frac{\partial \, REV_h^M}{\partial \, H_h^{M*}} - \frac{\partial \, \widetilde{REV}_h^M}{\partial \, H_h^{M*}} \right].$$

$\frac{\partial \, w_h^M}{\partial \, H_h^{M*}}$ will always be negative.

### 2.3.4 Equilibrium

In this section the equilibrium will be outlined. The model is solved for the steady state. It should be noted that the model must be solved numerically. Each period the proportion $\lambda$ of each type of job is destroyed. In the steady state these jobs must be replaced. The precise breakdown of how new firms are replaced is outlined in the appendix. The total number of jobs in the economy is given by $nH^N + mH_h^M + m^* H_h^{M*} + L^Y$. From this and equation (2.2) we get

$$v = \frac{\lambda \left( nH^N + mH_h^M + m^* H_h^{M*} + L^Y \right)}{q \left( \theta \right)}. \tag{2.32}$$

As $nH^N + mH_h^M + m^* H_h^{M*} + L^Y$ is simply employment, the level of unemployment is given by

$$u = L - \left( nH^N + mH_h^M + m^* H_h^{M*} + L^Y \right). \tag{2.33}$$

Rearranging equation (2.32) and then inserting this and equation (2.33) into equation (2.2) we get

$$\theta = \left( \frac{\lambda \left( nH^N + mH_h^M + m^* H_h^{M*} + L^Y \right)}{s \left( L - \left( nH^N + mH_h^M + m^* H_h^{M*} + L^Y \right) \right)} \right)^{\frac{1}{(1-\rho)}}. \tag{2.34}$$

Using equations (2.1), (2.33), and (2.34) we can write

$$v = \theta \left( L - \left( nH^N + mH_h^M + m^*H_h^{M*} + L^Y \right) \right).$$

National income is given by

$$M = R^{1-\alpha} \left( L^Y \right)^\alpha + nREV^N + m \left( REV_h^M - w_h^{M*}H_h^{M*} \right) + m^*w_f^M H_f^M,$$

which is the sum of the competitively traded good produced, the total output of national firms in the home country, the total revenue of a home country based MNEs less the wages they pay to foreign workers plus the wages earned by workers in the home country that work in foreign country based MNEs. I assume that the costs of posting a vacancy are part of the national income of the country where the firm is headquartered, so there is no need to subtract this from these firms' revenues in order to calculate national income. Defining world income as the combined income of the both countries, and using equation (2.5) we get

$$M_w = M + M^* = \frac{Y_c + Y_c^*}{1 - \delta} = \frac{Y + Y^*}{1 - \delta}$$

which leads to

$$M = M_w - M^*.$$

The model can be reduced to finding 15 variables. To reduce this complexity only the symmetric case is solved. This reduces the model to eight unknowns. Focusing on symmetric countries is satisfactory as according to UNCTAD (2008) data 68 per cent of inward FDI is to developed countries and 92 per cent of outward FDI is from developed countries. The model is solved using the Newton method of convergence. However, we have a nonlinear system and the free entry conditions lead to the inequalities (2.16) and (2.23). To solve the model numerically it is necessary to deal only with equations. In the Cournot sector there are four possible types of firms; national firms of countries $h$ and $f$, and MNEs based in countries $h$ and $f$. This leads to three possible cases. The following table outlines the possible cases.

| Case | | | Subcases |
|------|------|------|----------|
| 1 | $n > 0$ | $m > 0$ | $a, b$ |
| 2 | $n > 0$ | $m = 0$ | |
| 3 | $n = 0$ | $m > 0$ | $a, b$ |

Note that there is also a column marked subcases. This is as when a MNE is bargaining there is a kink in the equation for how hiring in the foreign plant affect wages. This is as if negotiations break down in the home plant, a minimum of $F + G$ workers are needed to continue production in

50

the foreign plant, as both plant and firm operations must be conducted in the foreign plant. Subcase $a$ is where $H_h^{M*} > F + G$ and subcase $b$ is where $H_h^{M*} \leq F + G$.

A simulation is carried out targeting plausible statistics of the small open European economies. The discount rate, $\beta$, was chosen to reflect each period lasting one month. The labour share of income is largely determined by the parameter $\alpha$, and is given as 62.5 per cent. The rate of unemployment is 5.69 per cent. The average duration of unemployment is 3.37 months and the average time to fill a vacancy is just over six months. $\delta$ was chosen so as to have approximately 20 per cent of those employed working in the Cournot sector and $\tau$ was chosen so as to have a solution with both MNEs and National firms operating and to have a plausible percentage of the employed workforce in multinationals (a figure of 15 per cent for the UK is given in Driffil (1999)). $z$ was chosen to have a plausible utility of unemployment. The parameters chosen for the model are given in Table 2.1.

Table 2.1: Parameter values

| $L$ | $R$ | $\alpha$ | $\beta$ | $\gamma$ | $\delta$ | $\eta$ | $\tilde{\lambda}$ | $\rho$ | $\phi$ | $s$ | $\tau$ | $F+G$ | $z$ |
|-----|-----|----------|---------|----------|----------|--------|-------------------|--------|--------|-----|--------|-------|-----|
| .5 | .35 | .6 | $\frac{10000}{10033}$ | .5 | .13 | .008 | .01 | .5 | .2 | .23 | .08217 | .03 | .2 |

## 2.4 Results

In this section I shall first present the results for a simplified model, where national firms and MNEs have identical cost structures and trade costs are set to zero ($\tau = G = 0$). Next the results of the full model are presented. This allows a comparison with the standard trade models. The baseline chosen is where trade exists between two countries but MNEs are suppressed. This contrasts with Eckel and Egger (2009) where they chose autarky as the baseline. As this paper concerns the effect of MNEs on bargaining, by comparing the model with trade but suppressed MNEs with the fully open economy we avoid confusion as to which effects are due to trade and which are due to MNEs. Finally the results of the model are presented where the international strategic hiring incentive is suppressed. This allows a comparison to be made which shows the importance of this effect. The wages in the model are presented in terms of the competitively traded good. It must be remembered however that the price of the Cournot good may be different for different parameters. In order to make a valid comparison of wages for the different cases it is necessary to divide all nominal variables by the price index.

Table 2.2 shows the results of a simplified version of the model. In this setup national firms have no advantage over MNEs, but MNEs have an advantage during wage bargaining, so both will

Table 2.2: Results of simplified model. All values are in real terms.

|  | Suppress MNEs | MNEs allowed |
|---|---|---|
| Unemployment rate | 0.0568851 | 0.0547885 |
| Average wage | 0.56044 | 0.576088 |
| Competitively traded good sector wage | 0.56044 | 0.576934 |
| Cournot sector wage | 0.56044 | 0.572712 |
| Number of national firms | 1.25181 | 0 |
| Number of MNEs | n/a | 0.790848 |
| National income | 0.422715 | 0.435704 |
| Competitively traded good sector employment | 0.377535 | 0.377842 |
| Workers per national firm | 0.0751088 | n/a |
| Workers per MNE (home plant) | n/a | 0.0599125 |
| Workers per MNE (foreign plant) | n/a | 0.0599125 |
| Cournot good consumption | 0.0564678 | 0.0710379 |
| Unemployment duration | 3.36586 | 3.23461 |
| Vacancy duration | 5.61628 | 5.84416 |
| Labour share of income | 0.625196 | 0.62488 |
| Share of workforce in MNEs | n/a | 0.200513 |
| Output per Cournot sector worker | 0.600579 | 0.749635 |

never coexist. As can be seen from Table 2.2, permitting MNEs leads to 2.8 per cent higher average wages, 24.8 per cent higher output per Cournot sector worker, 3.07 per cent higher national income, larger firm size (though plant size is smaller) and 3.69 per cent lower unemployment. When MNEs are allowed, although MNEs pay lower wages than competitively traded good sector firms, MNE wages are still higher than the wages of national sector firms in the case where MNEs are suppressed. Wages are pushed higher by increased tightness of the labour market and by the fact that workers are diverted from the competitively traded sector, increasing the marginal productivity of workers in that sector. As MNEs have an incentive to hire more workers there is an economy of scale effect. As there are no extra costs to setting up an extra plant, and MNEs hire extra workers, output per Cournot sector worker is higher. This increases the output for which unions bargain over, and reduces prices. Despite the higher wages, labour's share of income declines.

Now results for the full model are presented. To analyse the effect of MNEs on labour markets results for the economy where MNEs are suppressed and where MNEs need different levels of support staff are presented. The effect of increasing openness to MNEs is seen by increasing the relative efficiency of MNEs with respect to national firms, and the number of non-production workers in a national firm is kept constant. This is done by adjusting the ratio of non-production workers in a national firm to non-production workers in a MNE. This is given by $\frac{F+G}{F+2G}$. Reducing the number of non-production workers needed to perform plant operations makes it easier for MNEs to enter. The

relative number of MNEs and national firms in the model is sensitive to the ratio of MNE and national firm fixed costs. Only when the ratio is between 1.799875 and 1.800034 do MNEs and national firms coexist. This is as only the symmetrical case is shown. In the model of Markusen and Venables (1998) MNEs dominate when countries are symmetrical.
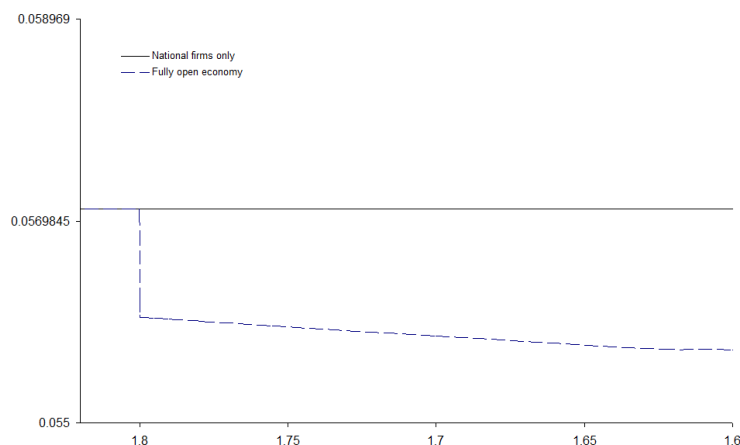


Figure 2.1: Results: Decrease in unemployment for an increase relative efficiency of multinational corporations.

As can be seen from Figure 2.1 opening an economy to MNEs leads to an unambiguous decrease in unemployment. The sharp decrease in unemployment occurs where national firms and MNEs coexist. Here the decrease is due to the extra hiring of MNEs rather than any improvement in productivity. The more gradual decrease after this is due to productivity changes rather than the tendency of MNEs to hire extra workers.

Figure 2.2 shows the effect of increasing openness on wages and productivity. The results are given as a percentage of wages and productivity when MNEs are suppressed. As can be seen, when an economy opens up Cournot sector productivity decreases. This is as MNEs become more important to the economy. MNEs can actually have lower productivity than national firms. This decrease in output per Cournot sector worker is despite the number of non-production workers for national firms remaining constant and the number of non-production workers required for MNEs actually decreasing. This is as MNEs have more workers involved in non-production activities, working in a second plant, so as to have an advantage in wage bargaining. MNEs can still successfully compete with national firms as they pay lower wages. As can be seen in the graph where wages and productivity sharply decrease, Cournot sector wages decrease more than Cournot sector productivity. This is due to the

53
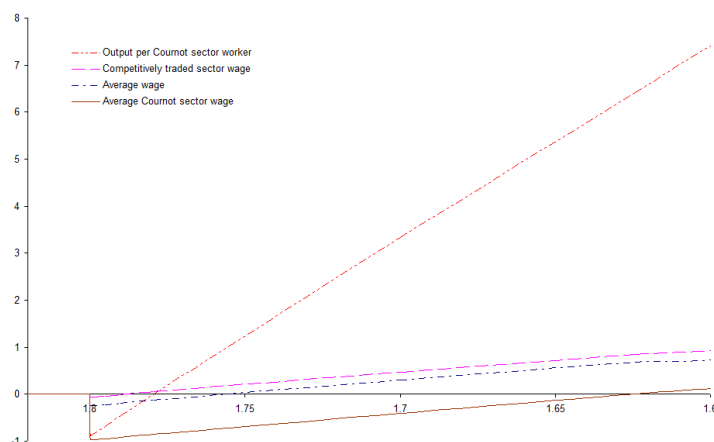
Figure 2.2: Results: Change in wages and productivity for an increase in relative efficiency of MNEs

fact that MNEs have a better outside option to national firms and so reduce wages. Looking at where the output per Cournot sector worker is identical for the open economy case and where MNEs are suppressed (where the ratio of MNE to national firm non-production workers is 1.779185) we see that average wages are 0.13 per cent below the average wage for where MNEs are suppressed. This is as the strategic hiring effect is not enough to overcome the advantage of MNEs in bargaining, though it does help to mitigate the decrease. Wages in the competitively traded sector are 0.05 per cent higher however. This is due to the effect of workers being drawn from the competitively traded sector leading to a higher ratio of resources per worker in the competitively traded sector. It can be shown that national income is higher by 0.08 per cent and unemployment is lower by 1.93 per cent when MNEs are permitted and output per Cournot sector worker is kept constant. Output per Cournot sector worker must be at least 1 per cent higher before average wages in the fully open economy case are equal to the case where MNEs are suppressed. For Cournot sector wages in the fully open economy case to be equal to the suppressed MNEs case Cournot sector productivity must be 6.4 per cent higher. It should be remembered that the higher productivity is solely due to scale effects and not to technological differences. In the full model the effect of MNEs on wages depends crucially on the number of non-production workers required in a second plant.

Finally, Table 2.3 helps to show the importance of accounting for the international strategic hiring incentive. In the first column only national firms are permitted. In the second column the international strategic hiring effect is suppressed ($\frac{\partial\ w_h^{M*}}{\partial\ H_h^M} = \frac{\partial\ w_h^M}{\partial\ H_h^{M*}} = 0$). It should be noted that for this column national firms are also suppressed as if they were allowed to enter then national firms

54

Table 2.3: Results with international strategic hiring incentive suppressed

| Ratio of MNE to national firm non-production workers | | 1.779185 |
|---|---|---|
| | MNEs suppressed | MNEs permitted |
| Unemployment rate | 0.0571037 | 0.0584172 |
| Average wage | 0.557616 | 0.53689 |
| Competitively traded good sector wage | 0.557616 | 0.537193 |
| National firm wage | 0.557616 | n/a |
| MNE wage (home plant) | n/a | 0.537829 |
| MNE wage (foreign plant) | n/a | 0.532769 |
| Number of national firms | 1.25388 | n/a |
| Number of MNEs | n/a | 1.0014 |
| National income | 0.420504 | 0.404541 |
| Workers per national firm | 0.0749675 | n/a |
| Workers per MNE (home plant) | n/a | 0.0539568 |
| Workers per MNE (foreign plant) | n/a | 0.0399847 |
| Cournot good consumption | 0.0542863 | 0.0406229 |
| Labour share of income | 0.625171 | 0.624815 |
| Output per Cournot sector worker | 0.577511 | 0.431821 |

would dominate and we would have the same results as the first column. The second column shows the same case as when Cournot sector productivity for the full model is equal to the national firms only model, with the exception of the international strategic hiring effect being suppressed. Unemployment is actually higher than the national firms only case, average Cournot sector productivity is lower, and wages are lower for all workers. Average wages are 3.7 per cent lower than the national firm only case, in contrast with a 0.13 per cent decrease when the international strategic hiring effect is included, showing the importance of this effect in mitigating the effects of international firm mobility on wages.

### 2.4.1 Sensitivity analysis

To examine the robustness of the simulation results a sensitivity analysis was conducted on key parameters. Overall the model was found to be robust to changes in parameter values, though unsurprisingly altering the parameters for workers bargaining power, $\gamma$, and the labour market matching elasticity of vacancies, $1 - \rho$, had the greatest impact. The sensitivity analysis for $s$, $\alpha$, $\rho$ and $\gamma$, are presented below. The effects of changes to $\delta$, $F + G$, $\phi$, and $\tau$, were also performed, and the model was robust to changes in these parameters. The results however are not presented due to reasons of space.

As can be seen in Figures 2.3 and 2.4 the results are robust to changes in the parameter $s$. As can be seen from equation 2.2, an increase in $s$ increases the number of matches in the economy. As would be expected, Figure 2.3 shows a fall in unemployment when there is an increase in the value of
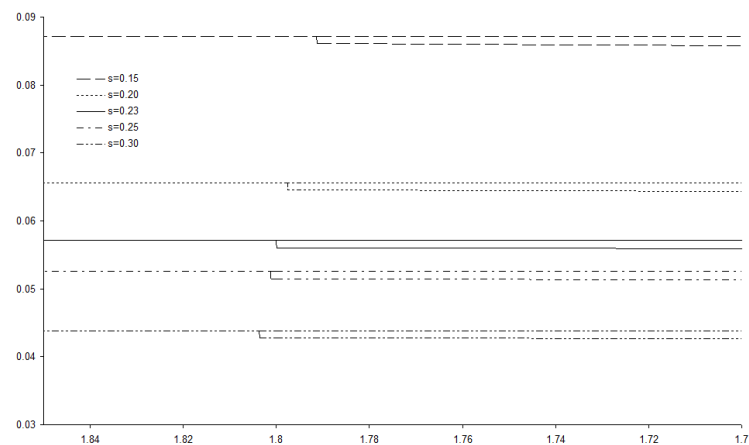
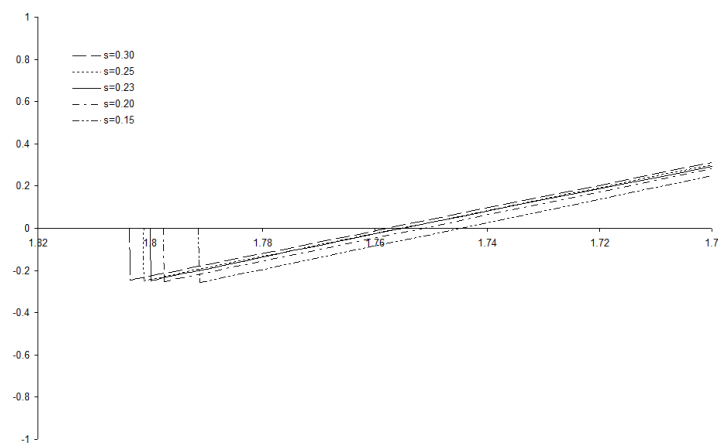Figure 2.3: Sensitivity analysis: Changes in the value of $s$ and unemployment



Figure 2.4: Sensitivity analysis: Changes in value of $s$ and the average wage

56

*s*. Similar to Figure 2.1, the horizontal lines of Figure 2.3 show the level of unemployment when only national firms are permitted, and the kinked lines show where MNEs are allowed to enter. As *s* affects the probability of finding a match, increasing the number of matches lowers unemployment. With a higher value of *s* it is slightly easier for MNEs to compete with national firms, though the effect is small. This is because with lower unemployment there is a bigger market for the Cournot good. As was shown by Markusen and Venables (1998), MNEs benefit more than national firms from a larger market at it is more cost effective to open a new plant to serve a large market than a small market.

Figure 2.5 shows again that the percentage change in wages in very robust to changes in the value of $\alpha$, though for a lower level of $\alpha$ it is easier for MNEs to enter the market. This is due to the role of $\alpha$ in affecting the importance of the specific resource in the model. The higher the value of $\alpha$ the less relevant is the specific resource to the model.

As seen in Figure 2.6, a higher value of $\alpha$ leads to higher unemployment and makes it easier for MNEs to enter the market. A low value of $\alpha$ results in a lower level of productivity in the competitive sector. Therefore competitive sector firms have less incentive to hire workers, and this leads to higher unemployment. With a high value of $\alpha$ national income is higher, which benefits MNEs. However as MNEs need more workers performing headquarter and plant non-productive tasks than national firms, the higher wage bill which spills over from the higher marginal productivity of labour in the competitive sector actually serves to reduce the ability of MNEs to compete with national firms.

The parameter $\rho$ gives the labour market matching elasticity of unemployment. This means that if unemployment increases by one per cent there will be $\rho$ per cent more matches in the economy. $1-\rho$ is the labour market matching elasticity of vacancies. So increasing $\rho$ makes unemployment more important (and the number of vacancies less important) in determining the number of matches in the labour market. As can be seen from Figure 2.8, reducing $\rho$ reduces unemployment, and a lower level of $\rho$ also leads to the strategic hiring effect having a greater impact. This is as increasing the match elasticity of vacancies increases the impact of MNEs posting extra vacancies for strategic reasons. Figure 2.7 also shows that with a low value of $\rho$ the decrease in wages is mitigated by the strategic hiring effect to a greater degree than when $\rho$ is high, the difference is small. It should be noted that in the steady state the number of vacancies posted is just sufficient so as to replace the number of jobs lost in a period. Overall, changes in the value of $\rho$ have a small effect on changes in the average wage.

Figure 2.5: Sensitivity analysis: Changes in the value of $\alpha$ and average wages



Figure 2.6: Sensitivity analysis: Changes in the value of $\alpha$ and unemployment

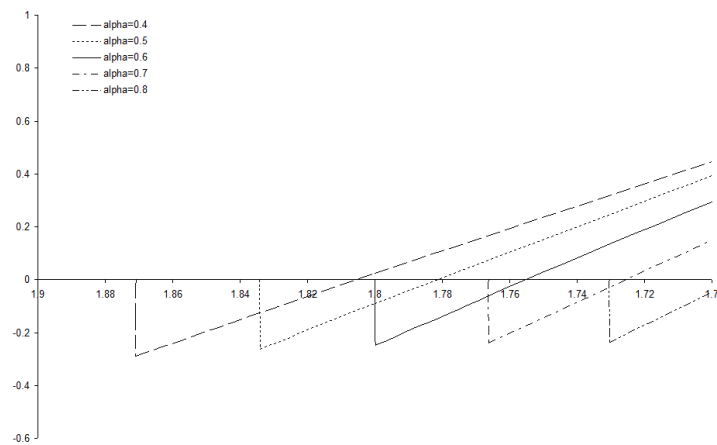Figure 2.7: Sensitivity analysis: Changes in the value of $\rho$ and average wages



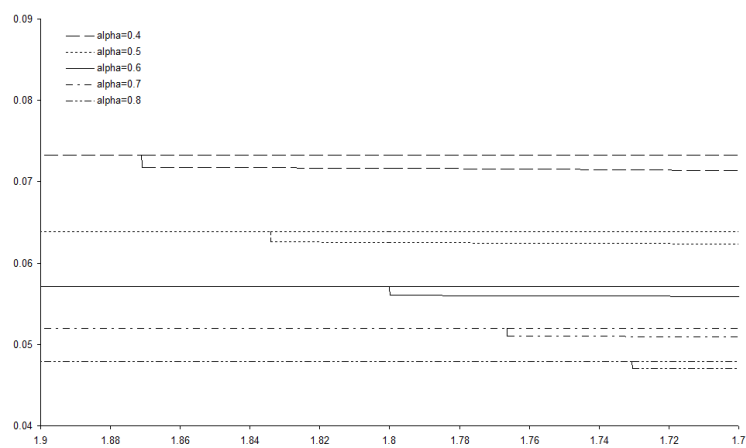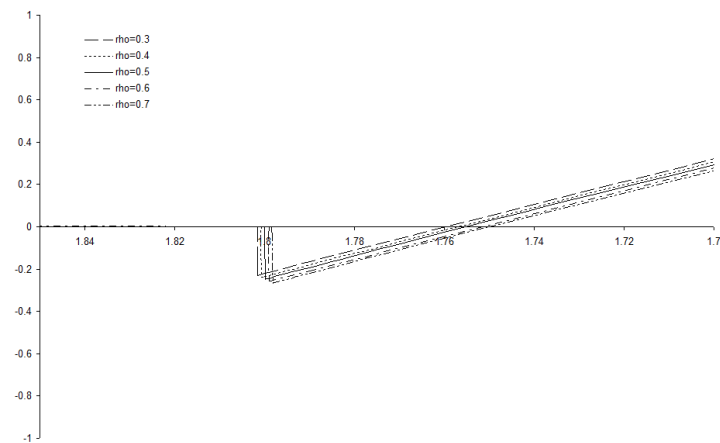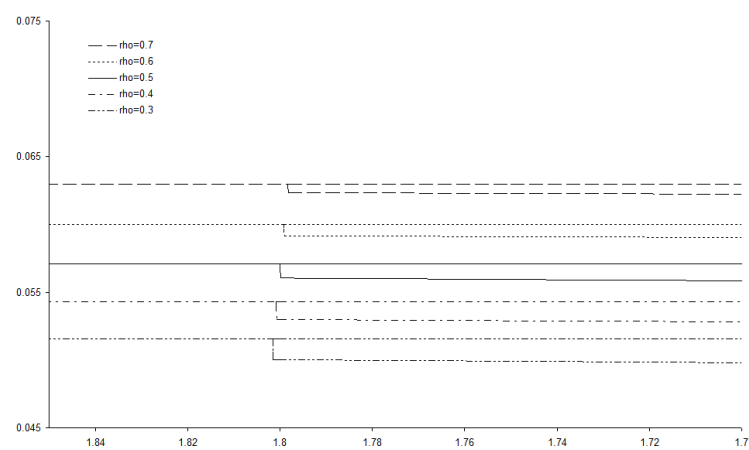Figure 2.8: Sensitivity analysis: Changes in the value of $\rho$ and unemployment
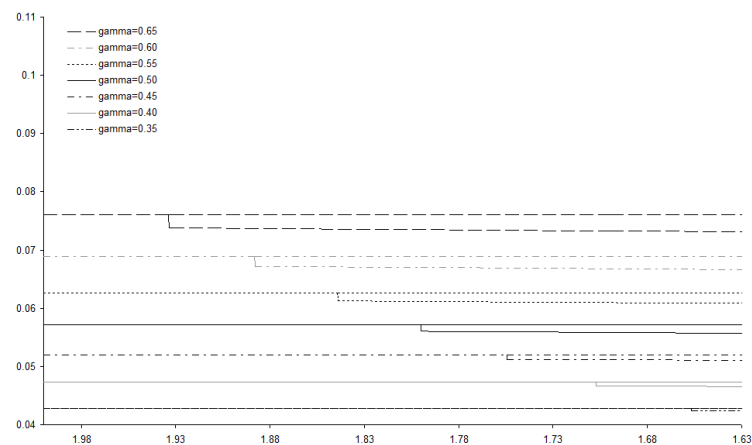
Figure 2.9: Sensitivity analysis: Changes in value of $\gamma$ and unemployment
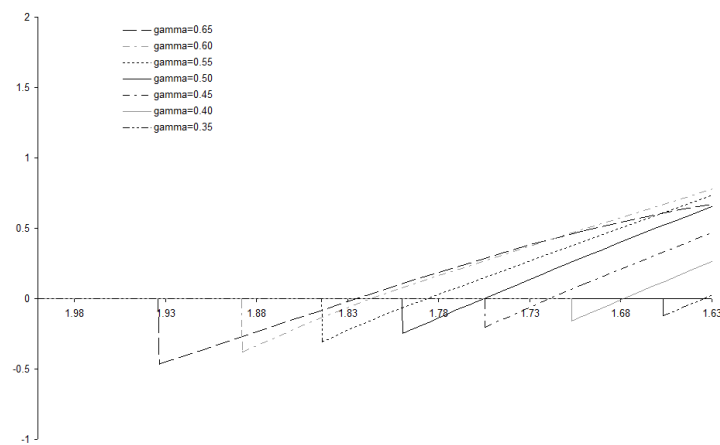


Figure 2.10: Sensitivity analysis: Changes in the value of $\gamma$ and average wages

The parameter which has the greatest effect on the results is $\gamma$. This is not surprising as $\gamma$ determines the bargaining power of labour. With a high value of $\gamma$ MNEs will have a larger advantage in bargaining over national firms than in the case where worker bargaining power is low. As can be seen in Figure 2.10 a high value of $\gamma$ makes it easier for MNEs to operate, due to their advantage in wage negotiations. As can be seen in Figure 2.9 with a high value of $\gamma$ unemployment is higher as firms are less willing to open vacancies. Also the change in unemployment when MNEs enter the market is greater when the value of $\gamma$ is high. This is as MNEs have a greater incentive to hire extra workers, and the strategic hiring effect is greater, when workers' bargaining power is high. As can be seen in Figure 2.10, despite the greater strategic hiring effect, wages decrease by a greater percentage when MNEs enter and $\gamma$ is high. This is due to two reasons. First, when workers' bargaining power is high the MNE effect of dividing bargaining between two countries has a greater negative effect on workers' wages. The second reason is due to the role of non-production workers in affecting productivity and therefore wages. When workers' bargaining power is high, firms are more willing to hire non-production workers abroad so as to reduce their wage bill. This increases the number of non-production workers and reduces productivity and wages. These two negative effects dominate over the positive strategic hiring effect.

## 2.5 Conclusion

In this paper a new mechanism is put forward for how globalisation may affect labour markets. When firms open a plant abroad to improve their outside option in the wage bargain and lower their wage bill, the demand for labour increases. This can cause an increase in wages. In this paper it has been shown that, for symmetric countries, in a simplified model where there are no international trade frictions or extra costs in establishing a foreign plant (so national firms and MNEs face identical cost structures) increased firm mobility can lead to higher wages. This is as MNEs strategically hire extra workers to improve their outside option in the wage bargain. Increased firm mobility leads to an increase in the demand for labour. However using the full model it was found that the number of non-production workers needed for plant operations plays a crucial role with higher plant level fixed costs reducing the benefit of MNEs hiring extra workers. Increased openness leads to lower unemployment. Only where MNEs have such an advantage so that national firms will not enter in equilibrium will openness lead to both lower unemployment and higher wages. This contrasts with Eckel and Egger (2009) where MNEs always have higher productivity which increases the real wage. The decrease in wages due to the improvement in firms outside option during wage bargaining is mitigated by

the international strategic hiring effect. The importance of accounting for the international strategic hiring motive of MNEs is shown by suppressing this effect which leads to lower wages and higher unemployment. The results were found to be robust to changes in key parameters. Overall the effects on wages and unemployment of allowing MNEs were small.

# Chapter 3

# The Effect of International Trade on Trade Union Density

## 3.1 Introduction

Trade unions have declined. Though there have been some exceptions, trade union density has declined across the world. In most countries this decline has slowed and the stabilisation of union densities has been as general as their decline. Unions tend very much to be national organisations, linked to the peculiarities of their respective nations. However, the international parallels in the trends of unionisation have been remarkable, and that these global parallel movements of trade union density should occur at the same time as increasing globalisation suggests a link between the two.

At the same time as the fall in unionisation there has been an increase in the number of countries in trade blocs. The European Union (EU) has expanded from six original members to nine in 1972, to 12 by 1986, 15 in 1995, and by 2007, 27 countries were members of the European Union. The depth of integration can also be charted by looking at the change of names from the European Coal and Steel Community, to the European Economic Community, to the European Community, to the present European Union. Though the EU is perhaps the best example of a trade bloc increasing in size, there are others, such as NAFTA for North America and Mercosur for South America.

Figure 3.1 shows the similarity of trends in union density for six European countries which had been EU members before 1980. There has been a similar movement in trade union density for European countries, despite their having different trade union systems. This pattern takes the form of a peak

63
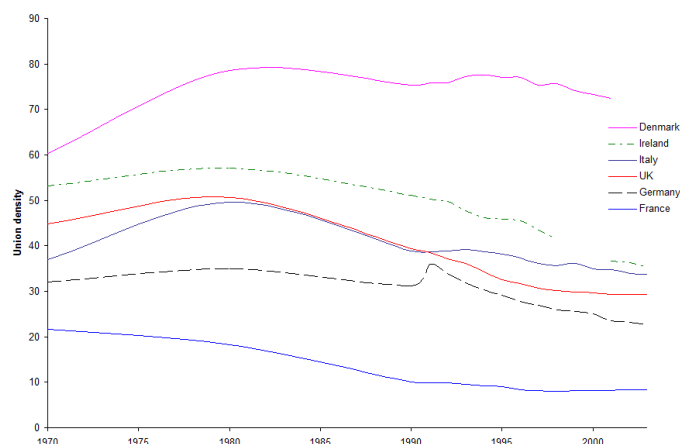
Figure 3.1: Trade union density for selected EU countries. Source: Visser (2003)

in union density around the year 1980. It is also interesting to look at the pattern of unionisation of the Nordic countries. As can be seen from Figure 3.1 and Figure 3.2, though Denmark has a level of unionisation similar to Finland and Sweden, its trend has more in common with countries which were members of the EU by 1973. In contrast, Sweden and Finland which joined the EU at the same time show a similar trend in unionisation.
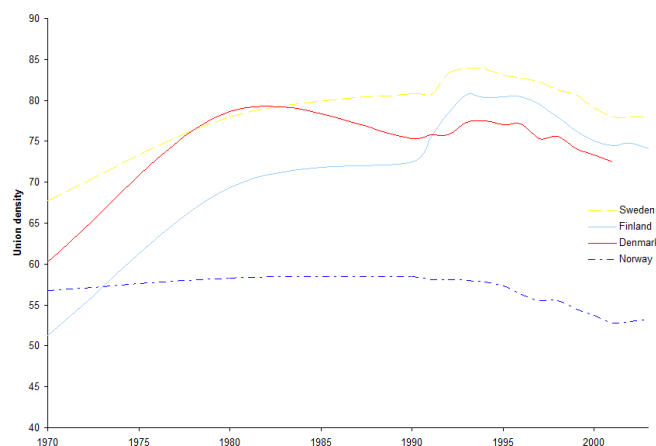


Figure 3.2: Trade union density for Nordic countries. Source: Visser (2003)

The increasing size and depth of trade blocs such as the European Union has been associated with decreasing trade union density. Interestingly, despite the decline in unionisation, there is evidence that the union premium has remained stable. Kaufman (2002) shows some evidence that union wage premiums have remained stable since 1980, while Bratsberg and Ragan (2002) have found that though

64

there were some rises and falls in wage premiums in some sectors, overall they remained stable. Also, union wages performed better than non-union wages in the face of international competition, though unions lost members. In an empirical investigation Slaughter (2007) examined how globalisation can affect trade union density. He found a link between foreign direct investment and falling unionisation (though foreign affiliates actually had higher levels of unionised workers) and did not find a relationship between trade and falling unionisation. However, in his examination he looked at trade flows, rather than the number of countries with which a country trades.

In this paper I ask how does increasing the number of countries in a trade bloc affect trade union density?

Acemoglu et al. (2001) explain the decrease in union density as being the result of skill biased technical change ending alliances between skilled and unskilled workers. I provide an alternative explanation for the decrease in trade union density. I present a general equilibrium model with endogenous trade union formation. I will show that increasing international competition can decrease the rents available to firms for which the union can bargain. This can make union membership less attractive, and so decrease union membership, though wage premiums will remain stable. In order to show the effects of increasing the number of countries in a trade bloc has on union density a general equilibrium model with labour market frictions is presented. The main ingredients of the model are endogenous trade union formation; membership of a trade union is costly; there are many symmetrical countries; the labour market is frictional; there are two homogeneous goods; and entry into the Cournot sector is costly.

In this paper trade unions provide bargaining services. If the labour revenue product function of a firm is concave (Stole and Zwiebel, 1996), such as with Cournot competition, workers benefit from combining together to bargain wages, as opposed to individual bargaining. Unions can bargain with the firm for the distribution of rents. However trade union membership is costly. Apart from the financial cost in terms of paying union dues each period, there are also costs such as the necessity of union members to take part in union activities such as union meetings or voting at union elections. These activities can occupy the time of workers, leaving less time for other activities. If an increase in the number of countries in a trade bloc reduces the rents available, workers will be less willing to pay the cost of union membership. As wages under union bargaining are a function of the average revenue per worker of the firm (as opposed to marginal revenue which is the case with individual bargaining) union wages are more affected by changes in international competition than non-union wages are. Increased competition reduces the difference between marginal revenue and price, so the difference

between average revenue and marginal revenue is also decreased. Therefore, the increase in the number of countries in a trade bloc can help to explain the decrease in trade union density across the world. Increasing the number of countries in a trade bloc leads to an increase in the number of firms, and this causes an increase in the level of product market competition, reducing rents. Huizinga (1993) shows how greater integration can lead to lower wages due to product market competition, though Naylor (1998) shows that with monopoly unions, integration can lead to higher wages. This is as if a tariff decreases the demand for the firm's product may increase and this can cause an increase in the wage.

I also provide a mechanism by which unionisation can increase when a small number of countries join a trade bloc, but union density eventually decreases as more unions join the trade bloc. In this paper, when countries open to trade there is an incentive for firms to export, as they chase rents in other countries. However, it is costly to transport goods internationally, and this cost is in terms of workers employed to transport the goods. As more workers are employed to transport the good, this means that less workers are available to produce the Cournot good. Production of the Cournot good falls and its price rises. This benefits the unionised workers more than non-union workers. This is as this increase in price increases the average revenue per worker of a firm more than it increases the marginal revenue of the firm. As being a member of a union becomes more attractive, more workers are willing to pay the costs of union membership and join the union. As the number of countries in the trade bloc increases, the effect of increased product market competition becomes stronger than the effect of workers being diverted into transporting the good. After an initial rise in union density, union density declines.

The paper is laid out as follows. In section two a brief review of the literature is given, in section three the model is outlined, in section four the results of the model are given and section five concludes.

## 3.2   Literature review

Though there has been some empirical research on the decline in union density, there has been a lack of theoretical research. Machin (2000) finds the main reason that trade unions have declined in Britain is a failure to organise in new establishments. Empirical research on the effect of globalisation on union density has been undertaken. For European economies Blaschke (2000) finds that trade has a small negative effect on unionisation. Slaughter (2007) investigates the link between globalisation and falling unionisation in the US. Though a link is found between increasing foreign direct investment

and falling unionisation, no link is found with trade. However it was the level of trade, rather than openness to trade which was examined. Using UK data Konings and Walsh (2000) find that employment loss as a result of increased product market competition is higher in non-unionised firms than unionised firms. This is as product market competition reduces the rents that unionised workers can bargain over, thereby reducing the incentive to fire workers. Neumann and Rissman (1984) suggest that unionisation has declined as governments now provide services that were previously provided by unions, thereby reducing the selective incentive of joining a union. However, Waddington and Whiston (1997) find that reasons to do with collective bargaining are the main reasons that people join unions and that union services only play a secondary role. Schnabel and Wagner (2007) find that personal characteristics and the characteristics of the workplace are important in determining who joins a union and social characteristics play a minor role. They also point out that strike pay is a selective incentive and that a cost benefit analysis of union membership ignores the free rider problem.

Although wage bargaining tends to be more centralised in Europe than in the US, firm level wage bargaining is still important. Using Swedish data Granqvist and Regnér (2008) find that local bargaining signficantly raises wages, Plasman et al. (2006) finds that local bargaining raises wages by about four per cent in Belgium, Denmark and Spain. Braun and Scheffel (2007) find that in Germany those covered by a collective firm agreement gain a premium of 5.7 per cent. For Italy, Dell 'Aringa and Lucifora (1994) find a 4.4 per cent premium for blue collar workers and a 7.7 per cent premium for white collar workers who are covered by firm level collective bargaining agreements.

There has been a lack of general equilibrium models with endogenous union membership. Delacroix (2006) presents a model in which some sectors are unionised and others are not. However he does not look at why some firms within a sector are unionised and others are not. Preugschat (2008) presents a model where a centralised union decides how many firms to organise and it is costly to organise a firm. It is found that an increase in the entry and exit rate of firms due to deregulation can lead to a decline in union density.

## 3.3 The model

There are $m$ symmetrical countries, and two homogeneous goods; a good characterised by Cournot competition, $X$, and a competitively traded good, $Y$. Each country is equally endowed with a continuum of two factors, labour ($L$), and resources ($R$). It is useful to think of land as the resource. Labour and resources are used in the competitively traded good sector and only labour is used in the Cournot

sector. Though goods can be transported internationally, factors can not. Competitively traded good sector firms are small and produce in only one country (though they may sell their product in any country). In contrast, firms in the Cournot good sector are large and hire a continuum of workers. Firms can not move internationally. There are no multinational enterprises. The competitively traded good serves as numeraire for the economy. The competitively traded good can be freely traded internationally, though as all countries are symmetrical the competitively traded good is not traded in equilibrium. There are no costs to entering the competitively traded good sector apart from the cost of posting a vacancy. There is a cost (in terms of labour) for transporting the Cournot good internationally. Union formation only occurs in the Cournot sector. In the competitively traded good sector the good is traded competitively and the revenue labour product function is linear. Therefore in the absence of a cost of union membership workers in the competitively traded good sector would be indifferent to being a member of a union. As trade union membership is costly, workers would not wish to join a union.

In presenting the model I shall first outline the labour market and workers value functions. I shall then outline the product market, showing how the utility function leads to product demands and solving the problem of the firm leads to product supply. I then proceed to explain how wages are bargained. Finally for this section, the equilibrium is outlined.

### 3.3.1 Labour market

The labour market is characterised by frictional unemployment. This means that if a firm posts a vacancy this period there is a probability that they shall fill this vacancy and have a worker next period. It is costly to post a vacancy. A frictional labour market provides a framework in which wages are bargainined. Country $i$ has a continuum of measure $L_i$ workers. There is a Cobb-Douglas matching technology $su_i^\rho v_i^{1-\rho}$, which gives the total number of matches between unemployed workers (the mass of workers looking for a job) with vacancies, where $u_i$ is the mass of unemployed workers in country $i$, $v_i$ is simply the total sum of the vacancies posted by the different firms operating in country $i$, $\rho$ is the labour market match elasticity of unemployment (and $1-\rho$ is the match elasticity of vacancies) and $s$ is a parameter that affects the total number of matches between unemployed workers and vacancies. It should be noted that $u_i$ is the mass of unemployed workers and not the rate of unemployment.

Dividing the total number of vacancies by the number of unemployed workers we get labour

market tightness which is written as

$$\theta_i = \frac{v_i}{u_i}, \quad i = 1, 2 ... m. \tag{3.1}$$

Dividing the matching function by $v_i$ we get the intensive matching function

$$q\left(\theta_i\right) = s \left(\frac{u_i}{v_i}\right)^{\rho} = s\theta_i^{-\rho}. \tag{3.2}$$

If a firm posts a vacancy this period, the probability that it will fill the vacancy this period (and so have a worker available to work next period) is given by $q\left(\theta_i\right)$.

### 3.3.1.1 Workers' value functions

It is assumed that all agents in the economy are risk neutral. Workers in a country may work for a firm in the competitively traded good sector or in the Cournot sector. In the Cournot sector they are paid wages which are either negotiated by a union or by individual bargaining. It is only in the Cournot sector that workers will join unions. This is as in the competitively traded good sector firms have a linear revenue labour product function and there is no incentive for these workers to join unions.

Workers do not become members of unions permanently, but each period they choose whether or not to become a member of a union. If the workers of a firm unionise they all unionise. A closed shop agreement operates in unionised firms. The Nash equilibrium for whether workers unionise or not can be that either:

- all firms in the Cournot sector are unionised

- no firm in the Cournot sector is unionised

- or a mixed solution.

The value to a worker of having a job in a unionised firm is denoted as $W_i^U$ and the value to a worker of being employed in a Cournot firm with individual bargaining is denoted as $W_i^I$. Each period Cournot sector workers face a probability $\mu$ of being in a union. If $W_i^U > W_i^I$ then $\mu = 1$, if $W_i^U < W_i^I$ then $\mu = 0$, and if $W_i^U = W_i^I$ then we have a mixed strategy equilibrium and $\mu \in [0, 1]$. So workers will only join a union if the benefit of joining is greater than or equal to the cost.

It is useful to describe how the equilibrium level of union density is arrived at. As shown by Stole and Zwiebel (1996), with imperfect competition (such as Cournot competition) firms in which

wages are negotiated through individual bargaining will hire more workers than firms where wages are negotiated through union bargaining. This is as with individual bargaining, firms negotiate with workers treating each worker as the marginal worker. Firms are aware that if they hire an extra worker, then this will reduce the marginal revenue product of labour and so reduce the wage for all other workers in the firm. Firms with individual bargaining have a strategic incentive to hire more workers than unionised firms. Similarly, when firms face a low probability of becoming unionised they will hire more workers than when firms face a high probability. Suppose that in the economy the rate of union density was below its equilibrium value. This would mean more workers are employed per firm than in equilibrium. For a given level of supply of the good, increasing the number of workers for a firm causes marginal revenue to decrease more than average revenue per worker. As union bargained wages are a function of average revenue, and individually bargained wages are a function of marginal revenue, the increase in the difference between marginal revenue and average revenue causes union membership to be more attractive. Union density will rise, and average level of workers per firm will fall until equilibrium is achieved.

Different types of firms may pay different wages. The value for workers of having a job depends on the type of firm they are working for. The value to a worker of being employed depends on the wage they will receive this period, the discounted value of the their state next period, and whether they face any cost as a result of being a member of a union. The expected value to workers of being employed in the Cournot sector is

$$W_i^X = \mu W_i^U + (1 - \mu) W_i^I,$$

which is the weighted average of being employed in a firm with union bargaining or individual bargaining. The value of being employed with a union contract is

$$W_i^U = w_i^U + \beta \left( \lambda U_i' + (1 - \lambda) W_i^{X\prime} \right) - a P \left( X_{ic}, Y_{ic} \right),$$

where $w_i^U$ is the wage received under union bargaining, $U_i'$ is the value of being unemployed next period, $\beta$ is the discount rate, $\lambda$ is the exogenous probability that the worker will separate from the firm at the end of this period, and $a$ is the real cost of being in a trade union. $a$ can be thought of as union dues or the cost of attending union meetings. The value of unemployment is in nominal terms so it was necessary to multiply $a$ by the price index $P(X_c, Y_c)$. The origin of the index is outlined in the next section. The value to a worker of being employed when wages are determined by individual bargaining is

$$W_i^I = w_i^I + \beta \left( \lambda U_i' + (1 - \lambda) W_i^{X\prime} \right),$$

where $w_i^I$ is the wage under individual bargaining. As can be seen the value this period depends on the discounted probablility of being unemployed next period and the discounted probability of continuing to work in a Cournot sector firm. The worker does not know if the Cournot sector firm will continue to bargain wages individually next period or if it will unionise. In the competitively traded good sector the value of being employed is

$$W_i^Y = w_i^Y + \beta \left( \lambda U_i' + (1 - \lambda) W_i^{Y\prime} \right),$$

where $w_i^Y$ is the wage in the competitively traded good sector.

If a worker is unemployed he does not participate in the product market. They do gain some utility, $z$, which is the income a worker receives from non-market activities. This can be considered home production which the agent does not sell on the market. The value of unemployment is

$$U_i = zP\left(X_{ic}, Y_{ic}\right) + \beta \left( (1 - \theta_i q(\theta_i)) U_i' + \theta_i q(\theta_i) E\left(W_i'\right) \right). \tag{3.3}$$

$\theta_i q(\theta_i)$ is the probability that a worker finds a job this period. The value of unemployment is in nominal terms so it was necessary to multiply $z$ by the price index $P\left(X_{ic}, Y_{ic}\right)$. As a worker does not know what type of firm he will work for next, $E\left(W_i'\right)$ is simply a weighted average of the values of being employed in the various types of firms and is given by

$$E\left(W_i'\right) = \frac{\bar{v}_i^Y}{v_i} W_i^{Y\prime} + \frac{\bar{v}_i^X}{v_i} W_i^{X\prime},$$

where $v_i$ is the total number of vacancies in country $i$, $\bar{v}_i^Y$ are the total number of vacancies posted in country $i$ in the $Y$ sector and $\bar{v}_i^X$ is the total number of vacancies posted by firms in the $X$ sector.

### 3.3.2 Product market

Two homogeneous goods, $X$ and $Y$, are produced in the economy. Good $Y$ is the numeraire competitively traded good and is internationally mobile without any cost of transportation. Due to the symmetry of the countries good $Y$ will not be traded in equilibrium. The $X$ sector is characterised by Cournot competition. There are transportation costs if the Cournot good is shipped internationally. In the Cournot sector a firm negotiates with workers when bargaining wages either individually or collectively. Labour is used in production in both sectors, however resources are only used in the competitively traded good sector. It is useful to think of $Y$ as a good which uses the resource land. The utility of the representative consumer is shown by the Cobb-Douglas function $U_i = X_{ic}^{\delta} Y_{ic}^{1-\delta}$, where $X_{ic}$ is the total amount of good $X$ consumed in country $i$, and

$$X_{ic} = nX_{i,i} + n\sum_{\substack{j=1 \\ j \neq i}}^{m} X_{j,i}, \tag{3.4}$$

71

where $n$ is the number of national firms based in each country. $X_{i,i}$ is the amount of the Cournot good produced by a country $i$ based national firm for the the market of country $i$. The first subscript index is for the country of origin of the firm, and the second is for where the good is sold. Therefore $X_{j,i}$ is the amount of $X$ produced by a country $j$ based firm and exported to country $i$.

It is assumed that unemployed workers do not participate in the goods market. Using the budget constraint that national income equals national expenditure, $M_i = P(X_{ic}) X_{ic} + Y_{ic}$, where $P(X_{ic})$ is the price of the Cournot good in country $i$ and $M_i$ is national income of country $i$, we get the product demands

$$X_{ic} = \frac{\delta M_i}{P(X_{ic})}, \ Y_{ic} = (1 - \delta) M_i. \tag{3.5}$$

The indirect demand equation for $X_{ic}$ is given by

$$P(X_{ic}) = \frac{\delta M_i}{X_{ic}}. \tag{3.6}$$

By definition as numeraire, the price of good $Y$ is equal to 1. The price index for the economy is defined as

$$P(X_{ic}, Y_{ic}) = P(X_{ic})^{\delta}.$$

This was calculated by inserting equation (3.5) into the utility function, which gave an indirect utility function in terms of prices and nominal income, and then rescaling.

### 3.3.2.1 Competitively traded good sector firms

In the competitively traded good sector firms are small, with one worker per firm. Therefore the mass of workers, $L_i^Y$ , and the mass of firms in the competitively traded good sector are identical. Competitively traded good sector firms consider themselves too small to affect the market. The firms use resources and one unit of labour. The amount of resources used by an individual firm is given by $\hat{R}_i$. As the resource is freely traded and not subject to any frictions, all the resource will be used each period, so $R_i = L_{iY} \hat{R}_i$ . It is free to trade the competitively traded good internationally. Competitively traded good sector firms only have one worker. There are no competitively traded good sector MNEs. The value this period of a filled job to an entrepreneur in the competitively traded good sector is given as

$$J_i^Y = y_i - w_i^Y - r_i \hat{R}_i + \beta (1 - \lambda) J_i^{Y\prime}, \tag{3.7}$$

where we have the production technology $y_i = \hat{R}_i^{1-\alpha}$, and $r_i$ is the rental rate of resources in country $i$, $w_i^Y$ is the wage and $\lambda$ is the exogenous probability that the job-worker pair will separate. As firms in this sector are price takers the revenue labour product function is linear. Maximising the above for

$\hat{R}_i$ and using the fact that all firms in the competitively traded good sector act symmetrically, we get that

$$r_i = (1 - \alpha) \left( \frac{L_i^Y}{R_i} \right)^{\alpha}. \tag{3.8}$$

Similarly, the total amount of the competitively traded good produced in the economy can be given as

$$Y_i = \left( L_i^Y \right)^{\alpha} R_i^{1-\alpha}. \tag{3.9}$$

The value of posting a vacancy in the competitively traded good sector is

$$V_i^Y = -\phi P \left( X_{ic}, Y_{ic} \right) + (1 - \eta) \beta \left( q \left( \theta_i \right) J_i^{Y\prime} + (1 - q \left( \theta_i \right)) V_i^{\prime} \right), \tag{3.10}$$

where $\phi$ is the cost of posting a vacancy and $q \left( \theta_i \right)$ is the probability that the firm will fill the vacancy. When a firm decides to post a vacancy they take $\theta_i$ as given. $\eta$ is the exogenous probability that the firm will cease to exist. As a firm is deemed to exist from the moment it posts a vacancy there is a possibility that the firm will expire before it even manages to hire a worker.

Due to the free entry condition $V_i^Y \leq 0$. In the steady state this holds with equality where there is a positive number of competitively traded good sector firms operating in country $i$. Due to the nature of the Cobb-Douglas production function, in the steady state there will always be a positive number of $Y$ sector firms operating in country $i$ whenever $R_i > 0$. This, combined with equation (3.10) leads to

$$J_i^{Y\,\prime} \leq \frac{\phi P \left( X_{ic}, Y_{ic} \right)}{(1 - \eta) \beta q \left( \theta_i \right)} \tag{3.11}$$

with equality in the steady state if $R_i > 0$. This is simply the cost of filling a vacancy divided by the discount factor and probability that the firm will continue to exist next period. Firms have a value due to the barrier to entry caused by labour market frictions.

### 3.3.2.2 Cournot sector firms

Good $X$ is a homogeneous good and firms producing good $X$ act according to Cournot competition, taking the competitively traded good as numeraire. Cournot sector firms are aware of their effect on the price of $X$ but take the actions of the other firms as given. It is costly for Cournot firms to enter the market. Firms must pay for a production licence, $b$, which is paid to some members of the economy (how it is distributed is irrelevant as agents are risk neutral). There is a cost $\tau$ associated with transporting Cournot good internationally. Technology in the Cournot sector is constant returns to scale. It takes one worker to produce each unit of the good. Firms in the Cournot sector are large and hire a continuum of workers. As a continuum of workers is hired we can use the law of large

numbers. Therefore the probability that a worker separates from the firm can be interpreted as the proportion of workers separating from the firm at the end of the period. Though Cournot sector firms consider they are large enough to affect the price of the Cournot good, they do not account for any effect they may have on the labour market, on national income or the price index of the economy as a whole. Firms in the Cournot sector will negotiate wages according to either union bargaining or individual bargaining. Firms do not know if next period they will face union bargaining or individual bargaining. They only know the probability $\mu'$ that union bargaining will take place. When firms become aware that they face union bargaining it may be optimal for them to lay off some workers. To avoid this complication it is assumed that firms cannot adjust the number of workers downward until the next period. This is realistic if one assumes that firms must give a minimum notice of one period before laying off workers.

The timing of activities in the Cournot sector is as follows. Due to labour market frictions the firm must search for workers to fill its vacancies. This is done in the period before they start to work for the firm. The firm does not know if next period these workers will form a trade union but it does know the probability that this will happen. If the value of being a member of a union is greater than the value of bargaining individually then the probability will be one. If the value of joining a union is less than that of bargaining individually then the value will be zero. If however the value of being a union member is equal to the value of bargaining individually then the probability will be a mixed strategy Nash equilibrium. If workers form into a union all the workers in the firm join. Workers have some means, such as a closed shop agreement, to ensure there is no free riding of trade union membership. Firms have an optimal number of hirings which depends on the probability that workers will unionise. At the beginning of the next period the workers either unionise or do not. They will only unionise if the value of trade union membership is greater than or equal to the value of bargaining individually with the firm. Wage negotiations then follow. If workers bargain individually then during negotiations the worker can only threaten to withdraw his labour. The firm can treat each worker as the marginal worker. The firm can threaten to sack the worker and production can continue with the other workers. However, if workers form into a union then they can threaten to all withdraw their labour simultaneously. In this case the firm will sack all the workers and no production will take place this period. The firm does not expire completely however. It has already paid some set up cost and will not wish to lose the value of this. The firm will post vacancies to hire more workers for the next period. Assuming wage bargaining has been successful (which in equilibrium it always is) the firm produces the good and decides the level of vacancies to be filled for the next period, taking into account the probability that next period the workers may form a trade union.

74

I will now outline the problem facing Cournot sector firms. The value of a firm in the Cournot sector is

$$V\left(H_i\right) = \max_{v,X_{ij}} \left\{ \begin{array}{c} P\left(X_{ic}\right)X_{i,i} + \sum_{\substack{j=1 \\ j \neq i}}^{m} P\left(X_{jc}\right)X_{i,j} - \left(\mu w_i^U\left(H_i\right) + \left(1-\mu\right)w_i^I\left(H_i\right)\right)H_i \\ -\phi P\left(X_{ic},Y_{ic}\right)v^X + \left(1-\eta\right)\beta V\left(H_i'\right) \end{array} \right\}, \quad (3.12)$$

subject to the price of the good

$$P\left(X_{ic}\right) = \frac{\delta M_i}{X_{ic}}, \ i = 1,2,...m,$$

the law of motion for hiring workers

$$H_i' = \left(1 - \widetilde{\lambda}\right)H_i + q\left(\theta_i\right)v, \quad (3.13)$$

and that production is constrained by the number of workers presently hired by the firm

$$H_i = X_{i,i} + \left(1 + \tau\right)\sum_{\substack{j=1 \\ j \neq i}}^{m} X_{i,j}, \quad (3.14)$$

where $w_i^U\left(H_i\right)$ is the wage if union bargaining takes place and $w_i^I\left(H_i\right)$ is the wage if wage bargaining takes place, $v$ is the mass of vacancies posted by the firm, $X_{i,i}$ is the amount of the Cournot good supplied by the firm in its home country and $X_{i,j}$ is the amount of the Cournot good supplied to country $j$. At the beginning of the period the firm does not know whether or not a union will form, it only knows the probability $\mu$ that a union will form. So the value of a firm at the beginning of the period is simply the revenue of this period minus the expected wage and cost of posting vacancies plus the discounted value of the firm next period. The constraint shown in equation (3.14) shows workers either produce for the home market or are engaged in the production and transport of the good to the foreign market. The first order conditions for $X_{i,i}$ and $X_{i,j}$ lead to

$$\frac{\delta M_i \left(X_{ic} - X_{i,i}\right)}{X_{ic}^2} = \frac{\delta M_j \left(X_{jc} - X_{i,j}\right)}{\left(1+\tau\right)X_{jc}^2}. \quad (3.15)$$

which is also marginal revenue per worker. Using the first order conditions, equation (3.4), and the fact that all countries are symmetric we get the amount that the firms supplies to their domestic market as

$$X_{i,i} = \frac{H_i\left(1 + \tau n\left(m-1\right)\right)}{1 + \left(m-1\right)\left(\left(1+\tau\right)^2 - n\tau^2\right)},$$

and to each foreign country as

$$X_{i,j} = \frac{H_i\left(1 - \tau\left(n-1\right)\right)}{1 + \left(m-1\right)\left(\left(1+\tau\right)^2 - n\tau^2\right)}.$$

75

Whenever transport costs are positive (and the number of Cournot firms are not less than one) firms will supply more to their home market than to the market of any other country.

Also, combining the envelope condition and the first order condition for vacancies we get

$$\frac{\delta\left(X_{ic} - X_{i,i}\right)M_i}{X_{ic}^2} + \phi P\left(X_{ic}, Y_{ic}\right)\frac{\left(1 - \widetilde{\lambda}\right)}{q\left(\theta_i\right)} - \mu\left(w_i^U\left(H_i\right) + H\frac{\partial w_i^U\left(H_i\right)}{\partial H_i}\right)$$
$$- \left(1 - \mu\right)\left(w_i^I\left(H_i\right) + H_i\frac{\partial w_i^I\left(H_i\right)}{\partial H_i}\right) = \frac{\phi P\left(X_{ic}, Y_{ic}\right)}{q\left(\theta_i\right)\beta\left(1 - \eta\right)}$$

where $\frac{\delta(X_{ic} - X_{i,i})M_i}{X_{ic}^2}$ is the marginal revenue gained by hiring one extra worker. $\frac{\phi P(X_{ic}, Y_{ic})}{q(\theta_i)}$ is the cost of replacing an existing worker and $\widetilde{\lambda}$ is the exogenous probability that this worker will separate from the firm. $\frac{\partial w_i^U(H_i)}{\partial H_i}$ and $\frac{\partial w_i^I(H_i)}{\partial H_i}$ are the strategic hiring effects. Due to the nature of Cournot competition, hiring one extra worker will lower the wage for all other workers. As with individual bargaining the wage is a function of marginal rather than average revenue, the strategic hiring effect is stronger when a firm faces individual bargaining. As the firm does not know whether a union will form next period the firm chooses the level of workers such that the cost of hiring workers is equal to the discounted revenue minus expect wage and expected strategic hiring effect.

It is costly for Cournot sector firms to enter the market. There is a set up cost $b$. The value of entering the market is

$$V\left(0\right) = \max_v\left\{-\phi P\left(X_{ic}, Y_{ic}\right)v + \left(1 - \eta\right)\beta V\left(H_i'\right)\right\} - bP\left(X_{ic}, Y_{ic}\right), \tag{3.16}$$

subject to the law of motion for hiring workers

$$H' = q\left(\theta_i\right)v.$$

Due to the free entry condition $V\left(0\right) = 0$. From this we can get the steady state value of a firm in the $X$ sector as

$$V\left(H_i'\right) = \frac{\phi P\left(X_{ic}, Y_{ic}\right)H_i'}{q\left(\theta_i\right)\beta\left(1 - \eta\right)} + \frac{bP\left(X_{ic}, Y_{ic}\right)}{\beta\left(1 - \eta\right)}.$$

The firm has a value due to the barrier to entry caused by labour market frictions, and also due to the cost of a production licence, $b$.

### 3.3.3 Wage bargaining

When bargaining wages, workers would like to maximise their surplus of being employed $W_i^k - U_i$, $k = Y, I, U$. Due to the cumbersome nature of the equations, it is useful to substitute out all

the elements agents take as give during the wage bargain. These are taken as given as agents either consider themselves too small to affect these variables or can not commit to future variables. Setting $W_i^k = U_i$, and rearranging for wages, we get a variable that only includes variables taken as given by agents. $\omega_i^k$ can be defined as a reservation wage which summarises the labour market effects on the wage bargain. As wages are renegotiated each period it can be benefitial for a worker to accept a low wage this period in anticipation of bargaining a higher wage next period (though this never happens in equilibrium). Thus for the competitively traded good sector we define

$$\omega_i^Y = zP\left(X_{ic}, Y_{ic}\right) + \beta\left(\left(1 - \theta_i q(\theta_i) - \lambda\right) U_i' + \theta_i q(\theta_i) E\left(W_i'\right) - (1 - \lambda)W_i^{Y'}\right), \qquad (3.17)$$

for $X$ sector firms with individual bargaining as

$$\omega_i^I = zP\left(X_{ic}, Y_{ic}\right) + \beta\left(\left(1 - \theta_i q(\theta_i) - \lambda\right) U_i' + \theta_i q(\theta_i) E\left(W_i'\right) - (1 - \lambda)W_i^{X'}\right), \qquad (3.18)$$

and for firms with union bargaining as

$$\omega_i^U = zP\left(X_{ic}, Y_{ic}\right) + \beta\left(\left(1 - \theta_i q(\theta_i) - \lambda\right) U_i' + \theta_i q(\theta_i) E\left(W_i'\right) - (1 - \lambda)W_i^{X'}\right) \qquad (3.19)$$

$$+ aP\left(X_{ic}, Y_{ic}\right). \qquad (3.20)$$

As can be seen equation (3.17) and equation (3.18) are quite similar. The reservation wage for all workers is increasing in the value of unemployment and the average wage for the economy. However it is decreasing in the value of working in the same job next period. This is due to workers being willing to accept a low wage this period in anticipation of gaining a higher wage next period. The reservation wage for unionsied workers equation (3.19) is identical to that of workers who bargain individually with the exception of the term for union dues, $aP\left(X_{ic}, Y_{ic}\right)$. This is as union members are interested in their wage net of union dues rather than their gross wage. As there are no frictions in joining a union unionised workers and workers who bargain their wage individually actually both receive the same wage net of union dues. From the reservation wage equations it is easy to show that

$$W_i^k - U_i = w_i^k - \omega_i^k, \; k = Y, I, U. \qquad (3.21)$$

Using this substitution is useful, though it in no away affects the results of the model.

### 3.3.3.1 Bargaining in the competitively traded good sector

As is standard in the literature wages are negotiated through Nash bargaining. The Nash product takes the form

$$\max_{w_i^Y}\left\{\left[W_i^Y - U_i\right]^\gamma \left[J_i^Y\right]^{1-\gamma}\right\},$$

where $\gamma$ is the bargaining power of workers. This leads to

$$\gamma J_i^Y = (1 - \gamma) \left[ W_i^Y - U_i \right]. \tag{3.22}$$

Using equations (3.7), (3.11), and (3.21) we get the wage for the $Y$ sector,

$$w_i^Y = \gamma \left( \alpha \left( \frac{R_i}{L_i^Y} \right)^{1-\alpha} + \phi P \left( X_{ic}, Y_{ic} \right) \frac{\left( 1 - \tilde{\lambda} \right)}{q \left( \theta_i \right)} \right) + (1 - \gamma) \omega_i^Y. \tag{3.23}$$

This is simply a weighted average of the production of the worker plus the cost of replacing the worker, and the reservation wage.

### 3.3.3.2 Bargaining in Cournot sector firms

Cournot sector firms are large, and bargaining is either conducted by a union representing the workers or wages are bargained by each worker individually. I will first outline the case of union bargaining. If negotiations break down all the workers are sacked, which combined with the free entry condition, means that the outside option for the firm is zero. The union wishes to maximise the surplus of the value of employment over unemployment for the members of the union. If negotiations break down the firm does not shut down completely (then it would lose the money it spent on a set up cost). Wages are found by maximising the Nash product

$$\max_{w_i^U} \left\{ \left[ H_i \left( W_i^U - U_i \right) \right]^{\gamma} \left[ V \left( H_i \right) - V \left( 0 \right) \right]^{1-\gamma} \right\},$$

which leads to

$$H_i \left( 1 - \gamma \right) \left[ W_i^U - U_i \right] = \gamma \left( V \left( H_i \right) - V \left( 0 \right) \right). \tag{3.24}$$

Defining $REV_i = P \left( X_{ic} \right) X_{i,i} + \sum_{\substack{j=1 \\ j \neq i}}^{m} P \left( X_{jc} \right) X_{i,j}$, and substituting in equations (3.12) and (3.21) into equation (3.24) we get

$$w_i^U = \gamma \left( \frac{REV_i}{H_i} + \phi P \left( X_{ic}, Y_{ic} \right) \frac{\left( 1 - \tilde{\lambda} \right)}{q \left( \theta_i \right)} \right) + (1 - \gamma) \omega_i^U. \tag{3.25}$$

To get the wage net of union dues, this wage equation can be rewritten as

$$w_i^U - aP \left( X_{ic}, Y_{ic} \right) = \gamma \left( \frac{REV_i}{H_i} + \phi P \left( X_{ic}, Y_{ic} \right) \frac{\left( 1 - \tilde{\lambda} \right)}{q \left( \theta_i \right)} \right) + (1 - \gamma) \omega_i^I.$$

It is useful at this point to know that from this we get

$$\frac{\partial \, w_i^U}{\partial \, H_i} = \frac{\gamma}{H_i^2} \left[ -REV_i + H_i \frac{\partial \, REV_i}{\partial \, H_i} \right], \tag{3.26}$$

78

which is used in the envelope condition for $X$ sector firms.

Calculating wages in the case of individual bargaining is slightly more complicated. During wage bargaining the firm negotiates with the marginal worker, so the marginal value of a worker is

$$\frac{\partial V\left(H_i\right)}{\partial H_i} = \frac{\partial\ REV_i}{\partial\ H_i} + \frac{\left(1 - \widetilde{\lambda}\right)}{q\left(\theta_i\right)} - \left(w_i^I\left(H_i\right) + H_i \frac{\partial w_i^I\left(H_i\right)}{\partial H_i}\right).$$

The term $\frac{\partial w_i^I(H_i)}{\partial H_i}$ appears as non-simultaneous bargaining is used (similar to Stole and Zwiebel, 1996). If bargaining breaks down and the worker separates from the firm, then the wage is renegotiated with all the other workers. This term does not appear in the case of union bargaining as if negotiations break down all the workers separate from the firm, and there are no workers left with which to renegotiate wages with.

The Nash product for individual bargaining is

$$\max_{w_i^I} \left\{ \left[W_i^I - U_i\right]^\gamma \left[\frac{\partial V\left(H_i\right)}{\partial H_i}\right]^{1-\gamma} \right\},$$

which leads to

$$w_i^I\left(H_i\right) = \gamma \left( -H_i \frac{\partial w^I\left(H_i\right)}{\partial H_i} + \frac{\partial\ REV_i}{\partial\ H_i} + \phi P\left(X_{ic}, Y_{ic}\right) \frac{\left(1 - \tilde{\lambda}\right)}{q\left(\theta_i\right)} \right) + \left(1 - \gamma\right)\omega_i^I.$$

This wage is a weighted average of the net benefit of the match and the reservation wage. The net benefit of the match is the strategic effect of having an extra worker when negotiating wages with the other workers at the firm, the marginal revenue of the worker, and the cost of replacing the worker. Solving this differential equation and substitution for $\frac{\partial\ REV_i}{\partial\ H_i}$ we get

$$w_i^I\left(H_i\right) = H_i^{-\frac{1}{\gamma}} \int H_i^{\frac{1-\gamma}{\gamma}} \frac{\delta M_i\left(X_{ic} - X_{i,i}\right)}{X_{ic}^2} dH_i + \gamma\phi P\left(X_{ic}, Y_{ic}\right) \frac{\left(1 - \tilde{\lambda}\right)}{q\left(\theta_i\right)} + \left(1 - \gamma\right)\omega_i^I.$$

When we integrate we must remember that $H_i$ has an affect on $X_{ic}$. We can rewrite $X_{ic}$ as $X_{ic} = \left(X_{ic} - X_{i,i}\right) + X_{i,i}$. Due to the assumptions of Cournot competition, the firm takes $\left(X_{ic} - X_{i,i}\right)$ as given. Using this, equation (3.14), equation (3.15) and the fact that countries are symmetrical, we can write

$$w^I\left(H\right) = H_i^{-\frac{1}{\gamma}} \int \frac{H_i^{\frac{1-\gamma}{\gamma}} \delta M_i\left(X_{ic} - X_{i,i}\right)}{\left(X_{ic} - X_{i,i} + \frac{H_i - (1+\tau)(m-1)(X_{ic} - X_{i,i} - (X_{jc} - X_{i,j}))}{1 + (1+\tau)(m-1)}\right)^2} dH_i$$

$$+ \gamma\phi P\left(X_{ic}, Y_{ic}\right) \frac{\left(1 - \tilde{\lambda}\right)}{q\left(\theta_i\right)} + \left(1 - \gamma\right)\omega_i^I.$$

It is also useful to show $\frac{\partial w_i^I(H_i)}{\partial H_i} = -\frac{H_i^{-\frac{(1+\gamma)}{\gamma}}}{\gamma} \int \frac{H_i^{\frac{1-\gamma}{\gamma}} \delta M_i(X_{ic}-X_{i,i})}{\left(X_{ic}-X_{i,i}+\frac{H_i-(1+\tau)(m-1)(X_{ic}-X_{i,i}-(X_{jc}-X_{i,j}))}{1+(1+\tau)(m-1)}\right)^2} dH_i +$

$\frac{\delta M_i(X_{ic}-X_{i,i})}{HcX_{ic}^2}$.

### 3.3.4 Equilibrium

In this section the equilibrium is outlined. The model is solved for the steady state. It should be noted that the model must be solved numerically. In the steady state the number of workers working for each type of firm is constant. As the probability that a worker will lose a job is $\lambda$, each period $\lambda\left(nH_i + L_i^Y\right)$ jobs must be replaced. As the probability that a firm will fill a vacancy this period is $q\left(\theta_i\right)$ we get the total number of vacancies posted this period as

$$v_i = \frac{\lambda\left(nH_i + L_i^Y\right)}{q\left(\theta_i\right)}. \tag{3.27}$$

As $nH_i + L_i^Y$ is simply employment, the level of unemployment is given by

$$u_i = L_i - \left(nH_i + L_i^Y\right) \tag{3.28}$$

Rearranging equation (3.27) and then inserting this and equation (3.28) into equation (3.2) we get

$$\theta_i = \left(\frac{\lambda\left(L_i^Y + nH_i\right)}{s\left(L_i - \left(L_i^Y + nH_i\right)\right)}\right)^{\frac{1}{(1-\rho)}}. \tag{3.29}$$

Using equations (3.1), (3.28), and (3.29) we can write

$$v_i = \theta_i\left(L_i - \left(nH_i + L_i^Y\right)\right).$$

National income is given by

$$M_i = R_i^{1-\alpha}\left(L_i^Y\right)^\alpha + nREV_i, \tag{3.30}$$

which is the sum of the competitively traded good produced, and the total output of the Cournot sector firms in country $i$. It is assumed that the costs of posting a vacancy are part of the national income of the country where the firm is located, so there is no need to subtract this from these firms' revenues in order to calculate national income.

## 3.4 Results

Due to the heterogeneity of nations in trade blocs a calibration of the model is not appropriate. Instead a simulation was undertaken, targeting some key variables of the European economies. A

table of the parameters used is given in Table 3.1. The wages in the model are presented in terms of the competitively traded good. It must be remembered however that the price of the Cournot good may vary. In order to make a valid comparison of wages all nominal values have been divided by the price index $P(X_{ic}, Y_{ic})$. Figure 3.3 helps to summarise the results of the model.

Table 3.1: Parameter values

| $L$ | $R$ | $\alpha$ | $\beta$ | $\gamma$ | $\delta$ | $\eta$ | $\tilde{\lambda}$ | $\rho$ | $\phi$ | $s$ | $z$ | $a$ | $b$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $1,000,000$ | $4,500,000$ | $0.5$ | $\frac{10000}{10033}$ | $.5$ | $0.5$ | $.008$ | $.01$ | $.5$ | $.25$ | $.18$ | $0.3$ | $0.15$ | $2,500,000$ |
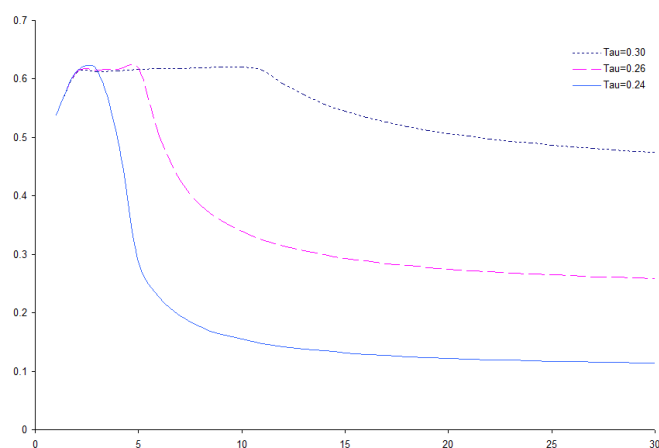


Figure 3.3: Results: Trade union density for an increasing size of trade bloc.

Comparing Figure 3.3 to Figure 3.1 shows how increasing the number of countries in a trade bloc can first increase union density and then it decreases as competition intensifies. It should be noted however that the $X$ axis in Figure 3.1 shows years, while the $X$ axis in Figure 3.3 shows the number of countries in the trade bloc. For $\tau = .24$, with the number of countries in a trade bloc being two or three, all workers in the Cournot sector are unionised. A mixed strategy Nash equilibrium was found for the other solutions. For $\tau = .26$, with the number of countries in a trade bloc between two and five, all workers in the Cournot sector are unionised, and for $\tau = .30$, with the number of countries in a trade bloc between two and ten, all workers in the Cournot sector are unionised. As can be seen, when a country moves from autarky to trading with one other country there is an initial jump in union density. This is due to workers moving from producing the Cournot good to transporting the Cournot good. Due to rent chasing by Cournot firms the output of the Cournot good actually decreases as workers are diverted to transportation. This causes the difference between average revenue and marginal revenue to increase, leading to an increase in unionisation. In this

81

model trade union density will never reach 100 per cent as there is never an incentive for workers in the one worker per firm competitively traded good sector to join a union. As the number of countries in the trade bloc increases the increase in competition leads to a fall in the difference between average revenue and marginal revenue for Cournot firms. This causes a decrease in union density. As the number of countries goes to infinity the marginal effect of an increase in the size of the trade bloc on union density goes to zero. Transport costs have an effect on union density. It would be expected that higher transport costs protect firms from international competition, which leads to higher union density, and this has been found to be the case. The continuing increase in density after moving from autarky to more countries in the trade bloc is due to increased employment by Cournot firms of both transport and production workers.
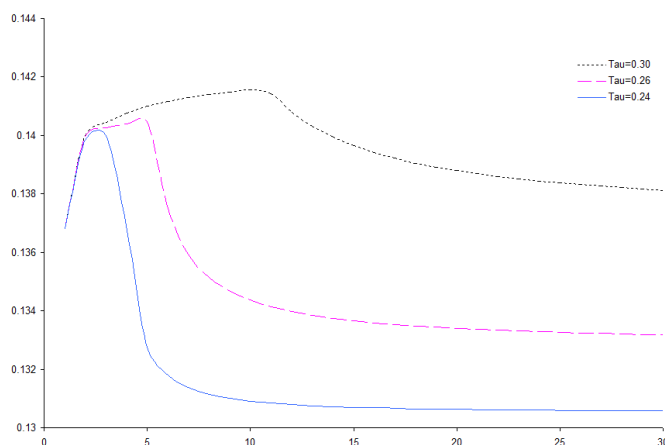


Figure 3.4: Results: Trade union premium for an increasing size of trade bloc

As can be seen from Figure 3.4 the wage premium has remained largely stable, though it has decreased slightly. The value of the wage premium is within the range of estimates in the literature. The value of the wage premium is determined largely by the cost of union membership, $a$. The decrease is due to the differing fortunes of firms in the Cournot sector and competitively traded good sector. Though the difference between union wages and non-union wages in the Cournot sector is constant, the increase in competition affects the Cournot sector more than the competitively traded good sector. This leads to a small relative improvement to wages in the competitively traded good sector, and it is this which causes the small decline in the union wage premium.

The model also explains why the direction of union wages need not be linked to the direction of union density. Comparing Figure 3.5 with Figure 3.3 and Figure 3.4 shows how the union real wage

82

can move in the opposite direction to union density and the union wage premium. When there is a low number of countries in the trade bloc the real wage falls. This is as workers are being diverted to transporting the Cournot good rather than producing the Cournot good, causing the price to rise. This lowers the real wage. As more countries join the trade bloc the effect of greater competition dominates over the effect of diverting workers to transporting the good. The real wage is increasing due to a decline in markups in the Cournot sector as competition causes the average revenue and marginal revenue of firms to converge. However this same convergence of average and marginal revenue is what causes the decline in trade union density.

As can be seen from Figure 3.6 the model also partially replicates the rise and fall of the labour share of income as seen in the data (European Communities, 2007). This rise and decline coincides with the movements in trade union density. Also, diverting workers from the competitively traded sector increases the resource labour ratio, which serves to lower the share of income that goes to the owner of the resource. Though the model matches the data qualitatively it can account only partially for the decrease in the labour share of income. This is only to be expected from the model that does not include capital as a factor of production. Finally, the simulated results for unemployment are shown in Figure 3.7. It is found that increasing international openness leads to an decrease in unemployment. This is partially due to employers being willing to employ more workers if there is a smaller probability of workers forming a union. This model does not capture the unemployment dynamics of the European economics. This is due to the model being solved for the steady state. Any unemployment caused by the economy moving from one steady state to another is not captured.

## 3.5   Conclusion

Given the international decline in trade union density, it is possible that the cause of the decline is increasing internationalisation. In this paper, international product market competition is put forward as a cause for the decrease in union density. This is as the narrowing of the difference between average revenue and marginal revenue which is caused by increased competition reduces the advantage of being a trade union member, as trade union wages are a function of average revenue. It is found that increasing the number of countries in a trade bloc initially increases but then decreases the level of trade union density. This initial increase is caused by rent seeking firms transferring workers to transporting rather than producing the good, causing an initial fall in production, and therefore competition, of the good. It is also found that movements in the union wage can be in the opposite direction to trade union density and the trade union wage premium.
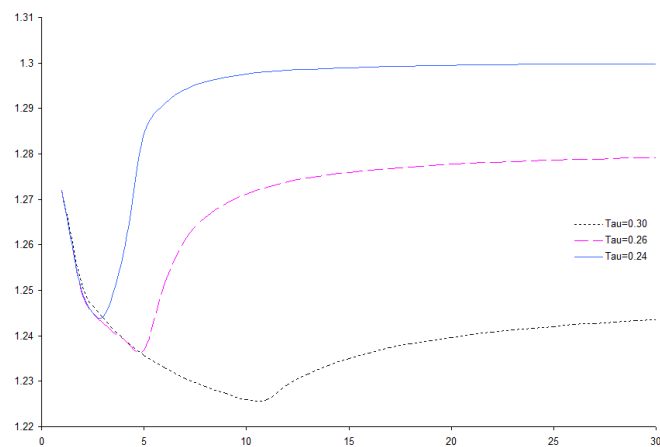
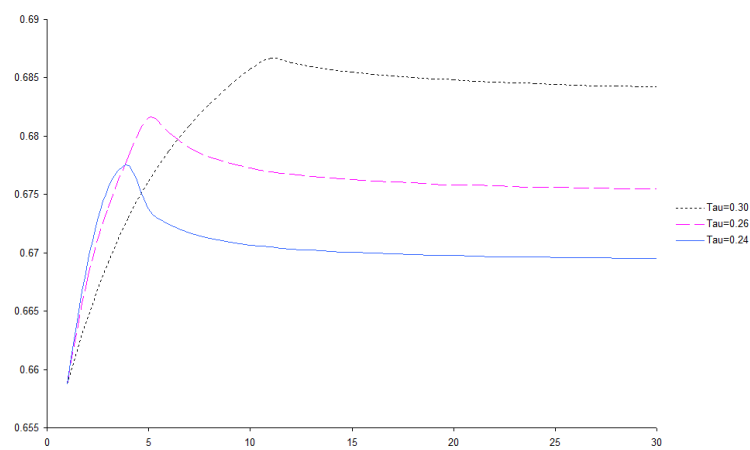Figure 3.5: Results: Real wage of trade union members for an increasing size of trade bloc.



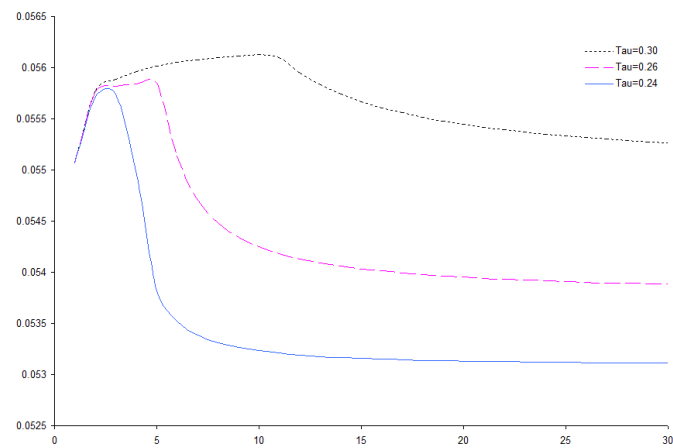Figure 3.6: Results: Labour share of income for an increasing size of trade bloc.

Figure 3.7: Results: Unemployment rate for an increasing size of trade bloc.

85

# Appendix A

## A.1 Outside option of MNE when negotiating with workers in the foreign plant

In this appendix I show how the outside option of a MNE is calculated when negotiating with workers in its foreign plant. If bargaining breaks down in the foreign plant the firm only produces in the home plant. The value function of a MNE that is temporarily only producing in one country is very similar to the value function of a national firm, with the exception that vacancies will be posted for the plants in both countries. By assumption a MNE can not decide to operate as a national firm. A hat over a variable signifies its value if negotiations break down with workers in the foreign plant. The outside option of the firm is given as

$$V^M\left(H_h^M, 0\right) = \max_{\hat{v}_h^M, \hat{v}_h^{M*}, \hat{X}_h^M, \hat{X}_h^{M*}} \left\{ \begin{array}{c} \widehat{REV}_h^M - w_h^M H_h^M - \phi P\left(X_c, Y_c\right)\left(\hat{v}_h^M + \hat{v}_h^{M*}\right) \\ + (1 - \eta)\beta V^M\left(H_h^{M\prime}, H_h^{M*\prime}\right) \end{array} \right\}, \qquad \text{(A.1)}$$

subject to

$$H_h^{M\prime} = \left(1 - \widetilde{\lambda}\right) H_h^M + q\left(\theta\right) \hat{v}_h^M,$$

$$H_h^{M*\prime} = q\left(\theta^*\right) \hat{v}_h^{M*},$$

and

$$H_h^M = F + G + \hat{X}_h^M + (1 + \tau)\hat{X}_h^{M*}.$$

For convenience we can write $\widehat{REV}_h^M = P\left(\hat{X}_c\right)\hat{X}_h^M + P\left(\hat{X}_c^*\right)\hat{X}_h^{M*}$. The firm will try to maximise its profits for the number of workers it still has available. The first order conditions of $V^M\left(H_h^M, 0\right)$ for $\hat{X}_h^M$ and $\hat{X}_h^{M*}$ lead to $\frac{(1+\tau)M\left(\hat{X}_c - \hat{X}_h^M\right)}{\left(\hat{X}_c\right)^2} = \frac{M^*\left(\hat{X}_c^* - \hat{X}_h^{M*}\right)}{\left(\hat{X}_c^*\right)^2}$, which using equation (2.30) we get

$$\hat{X}_c^* = \frac{X_c + (1 + \tau)\left(X_c^* - X_h^{M*}\right)}{\left\{\left[\frac{M(1+\tau)\left(X_c - X_h^M\right)}{M^*\left(X_c^* - X_h^{M*}\right)}\right]^{1/2} + (1 + \tau)\right\}}. \qquad \text{(A.2)}$$

Similar to the case of the national firm we can get $\widehat{REV}_h^M$ and combining with equation (A.2) we get

$$\widehat{REV}_h^M = \delta \frac{\left[\left((1+\tau)M\left(X_c^* - X_h^{M*}\right)\right)^{1/2} - \left(M^*\left(X_c - X_h^M\right)\right)^{1/2}\right]^2}{(1+\tau)\left(X_c^* - X_h^{M*}\right) + \left(X_c - X_h^M\right)} +$$
$$\delta \frac{\left(H_h^M - F - G\right)\left[\left(M\left(X_c - X_h^M\right)\right)^{1/2} + \left((1+\tau)M^*\left(X_c^* - X_h^{M*}\right)\right)^{1/2}\right]^2}{\left\{(1+\tau)\left(X_c^* - X_h^{M*}\right) + \left(X_c - X_h^M\right)\right\}\left\{H_h^M - F - G + \left(X_c - X_h^M\right) + (1+\tau)\left(X_c^* - X_h^{M*}\right)\right\}}.$$

It is also useful at this point to show

$$\frac{\partial \widehat{REV}_h^M}{\partial H_h^M} = \delta \left(\frac{\left(M\left(X_c - X_h^M\right)\right)^{1/2} + \left((1+\tau)M^*\left(X_c^* - X_h^{M*}\right)\right)^{1/2}}{H_h^M - F - G + \left(X_c - X_h^M\right) + (1+\tau)\left(X_c^* - X_h^{M*}\right)}\right)^2,$$

which is positive if the firm is not operating as a monopoly, and

$$\frac{\partial \widehat{REV}_h^M}{\partial H_h^{M*}} = 0.$$

Subtracting equation (A.1) from equation (2.17) we get the marginal value of the foreign plant as

$$V^M\left(H_h^M, H_h^{M*}\right) - V^M\left(H_h^M, 0\right) = REV_h^M - \widehat{REV}_h^M - w_h^{M*}H_h^{M*} + \phi P\left(X_c, Y_c\right)\frac{\left(1 - \tilde{\lambda}\right)H_h^{M*}}{q\left(\theta^*\right)}, \quad \text{(A.3)}$$

where $REV_h^M = P\left(X_c\right)X_h^M + P\left(X_c^*\right)X_h^{M*}$. This is simply the marginal value of the foreign plant plus the value of not needing to replace the workers in the foreign plant, minus the wage bill of the foreign plant. The first order condition of equation (2.29) leads to

$$H_h^{M*}\left(1 - \gamma\right)\left[W_h^{M*} - U^*\right] = \gamma\left(V^M\left(H_h^M, H_h^{M*}\right) - V^M\left(H_h^M, 0\right)\right). \quad \text{(A.4)}$$

Combining equations (2.26), (A.4), and (A.3), and rearranging we get

$$w_h^{M*} = \gamma \left(\frac{REV_h^M - \widehat{REV}_h^M}{H_h^{M*}} + \phi P\left(X_c, Y_c\right)\frac{\left(1 - \tilde{\lambda}\right)}{q\left(\theta^*\right)}\right) + (1 - \gamma)\omega_h^{M*}.$$

## A.2 Outside option of MNE when negotiating with workers in the home plant

In this appendix I show how the outside option of a MNE is calculated when negotiating with workers in its home plant. A tilde over a variable signifies its value if negotiations break down with workers in the home plant. The value of the firm if negotiations break down with workers in the home plant is given as

$$V^M\left(0, H_h^{M*}\right) = \max_{\tilde{v}_h^M, \tilde{v}_h^{M*}, \tilde{X}_h^M, \tilde{X}_h^{M*}} \left\{ \begin{array}{c} \widetilde{REV}_h^M - w_h^{M*}H_h^{M*} - \phi P\left(X_c, Y_c\right)\left(\tilde{v}_h^M + \tilde{v}_h^{M*}\right) \\ + (1 - \eta)\beta V\left(H_h^{M\prime}, H_h^{M*\prime}\right) \end{array} \right\}, \quad \text{(A.5)}$$

subject to

$$H_h^{M\prime} = q\left(\theta\right) v_h^M,$$

$$H_h^{M*\prime} = \left(1 - \widetilde{\lambda}\right) H_h^{M*} + q\left(\theta^*\right) v_h^{M*},$$

and

$$H_h^{M*} = F + G + X_h^M + \left(1 + \tau\right) X_h^{M*}.$$

Special note should be taken of the final constraint. It is necessary for the firm to perform its headquarter functions in the foreign country. This means there will be $F$ less workers to produce, so if $F$ is very large then the outside option of the multinational may actually be negative. However, in the simulation conducted in this paper $H_h^{M*} > F + G$. As wages are bargained simultaneously the firm cannot simply refuse to pay these wages if its outside option is negative. The revenue of the firm if negotiations break down in the home plant is given as $\widetilde{REV}_h^M = P\left(\widetilde{X}_c\right) \widetilde{X}_h^M + P\left(\widetilde{X}_c^*\right) \widetilde{X}_h^{M*}$.

**Case a**   If $H_h^{M*} \leq F + G$, $\widetilde{REV}_h^M = 0$, $\frac{\partial\ \widetilde{REV}_h^M}{\partial\ H_h^{M*}} = 0$ and $\frac{\partial\ \widetilde{REV}_h^M}{\partial\ H_h^M} = 0$.

**Case b**   If $H_h^{M*} > F + G$ the firm can operate this period similarly to a national firm. Similar to the situation of negotiating wages in the foreign plant due to Cournot competition the firm assumes that other firms will not react to changes in its production, so

$$\widetilde{X}_c^* - \widetilde{X}_h^{M*} = X_c^* - X_h^{M*}.$$

The first order conditions for $\widetilde{X}_h^M$ and $\widetilde{X}_h^{M*}$ lead to

$$\widetilde{REV}_h^M = \delta \frac{\left[\left(\left(1+\tau\right)M^*\left(X_c - X_h^M\right)\right)^{1/2} - \left(M\left(X_c^* - X_h^{M*}\right)\right)^{1/2}\right]^2}{\left(1+\tau\right)\left(X_c^* - X_h^{M*}\right) + \left(X_c - X_h^M\right)} + $$
$$\delta \frac{\left(H_h^{M*} - F - G\right)\left[\left(M^*\left(X_c^* - X_h^{M*}\right)\right)^{1/2} + \left(\left(1+\tau\right)M\left(X_c - X_h^M\right)\right)^{1/2}\right]^2}{\left\{\left(X_c^* - X_h^{M*}\right) + \left(1+\tau\right)\left(X_c - X_h^M\right)\right\}\left\{H_h^{M*} - F - G + \left(1+\tau\right)\left(X_c - X_h^M\right) + \left(X_c^* - X_h^{M*}\right)\right\}}.$$

It is also useful to note

$$\frac{\partial\ \widetilde{REV}_h^M}{\partial\ H_h^{M*}} = \delta \left(\frac{\left(M^*\left(X_c^* - X_h^{M*}\right)\right)^{1/2} + \left(\left(1+\tau\right)M\left(X_c - X_h^M\right)\right)^{1/2}}{H_h^{M*} - F - G + \left(1+\tau\right)\left(X_c - X_h^M\right) + \left(X_c^* - X_h^{M*}\right)}\right)^2,$$

which is strictly positive, and

$$\frac{\partial\ \widetilde{REV}_h^M}{\partial\ H_h^M} = 0.$$

Using the first order condition (2.31) and substituting in equations (2.17), (2.26), and (A.5) we get the wage

$$w_h^M = \gamma \left(\frac{REV_h^M - \widetilde{REV}_h^M}{H_h^M} + \phi P\left(X_c, Y_c\right) \frac{\left(1 - \widetilde{\lambda}\right)}{q\left(\theta\right)}\right) + \left(1 - \gamma\right) \omega_h^M.$$

88

## A.3   Wage equations

In this appendix I show the value of wages in the steady state. It is not possible to get analytical solutions. Using the wage equations and equations (2.2), (2.24),and (2.34), and solving for the steady state, it can be shown that

$$
E\left(w\right) = \frac{\gamma\left(1-\beta\left(1-\lambda\frac{L}{u}\right)\right)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)} \left\{ \phi P\left(X_c, Y_c\right) \frac{\left(1-\tilde{\lambda}\right)}{q(\theta)} + \frac{nREV^N + m\left(REV_h^M - R\widetilde{EV}_h^M\right) + m^*\left(REV_f^M - R\widehat{EV}_f^M\right) + \alpha Y}{L-u} \right\}
$$
$$
+ \frac{(1-\gamma)zP(X_c, Y_c)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)},
$$

$$
w^Y = \alpha\frac{Y}{L^Y}\frac{\gamma(1-\beta(1-\lambda))}{1-\gamma\beta(1-\lambda)} + \frac{(1-\gamma)\beta\lambda\gamma\left(nREV^N + m\left(REV_h^M - R\widetilde{EV}_h^M\right) + m^*\left(REV_f^M - R\widehat{EV}_f^M\right) + \alpha Y\right)}{(1-\gamma\beta(1-\lambda))\left(1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)\right)u}
$$
$$
+ \phi P\left(X_c, Y_c\right) \frac{\left(1-\tilde{\lambda}\right)}{q(\theta)} \left( \frac{\gamma\left(1-\beta\left(1-\lambda\frac{L}{u}\right)\right)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)} \right) + \frac{zP(X_c, Y_c)(1-\gamma)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)},
$$

$$
w^N = \frac{REV^N}{H^N}\frac{\gamma(1-\beta(1-\lambda))}{1-\gamma\beta(1-\lambda)} + \frac{(1-\gamma)\beta\lambda\gamma\left(nREV^N + m\left(REV_h^M - R\widetilde{EV}_h^M\right) + m^*\left(REV_f^M - R\widehat{EV}_f^M\right) + \alpha Y\right)}{(1-\gamma\beta(1-\lambda))\left(1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)\right)u}
$$
$$
+ \phi P\left(X_c, Y_c\right) \frac{\left(1-\tilde{\lambda}\right)}{q(\theta)} \left( \frac{\gamma\left(1-\beta\left(1-\lambda\frac{L}{u}\right)\right)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)} \right) + \frac{zP(X_c, Y_c)(1-\gamma)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)},
$$

$$
w_h^M = \frac{REV_h^M - R\widetilde{EV}_h^M}{H_h^M}\frac{\gamma(1-\beta(1-\lambda))}{1-\gamma\beta(1-\lambda)} + \frac{(1-\gamma)\beta\lambda\gamma\left(nREV^N + m\left(REV_h^M - R\widetilde{EV}^M\right) + m^*\left(REV_f^M - R\widehat{EV}_f^M\right) + \alpha Y\right)}{(1-\gamma\beta(1-\lambda))\left(1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)\right)u}
$$
$$
+ \phi P\left(X_c, Y_c\right) \frac{\left(1-\tilde{\lambda}\right)}{q(\theta)} \left( \frac{\gamma\left(1-\beta\left(1-\lambda\frac{L}{u}\right)\right)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)} \right) + \frac{zP(X_c, Y_c)(1-\gamma)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)},
$$

and

$$
w_f^M = \frac{REV_f^M - R\widehat{EV}_f^M}{H_f^M}\frac{\gamma(1-\beta(1-\lambda))}{1-\gamma\beta(1-\lambda)} + \frac{(1-\gamma)\beta\lambda\gamma\left(nREV^N + m\left(REV_h^M - R\widetilde{EV}_h^M\right) + m^*\left(REV_f^M - R\widehat{EV}_f^M\right) + \alpha Y\right)}{(1-\gamma\beta(1-\lambda))\left(1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)\right)u}
$$
$$
+ \phi P\left(X_c, Y_c\right) \frac{\left(1-\tilde{\lambda}\right)}{q(\theta)} \left( \frac{\gamma\left(1-\beta\left(1-\lambda\frac{L}{u}\right)\right)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)} \right) + \frac{zP(X_c, Y_c)(1-\gamma)}{1-\gamma\beta\left(1-\lambda\frac{L}{u}\right)}.
$$

## A.4   Firm exit

In this appendix I explain why exogenous firm exit is assumed. To see why exogenous firm exit is necessary it is worthwhile making the distinction between job separation and firm exit. In the most simple of frictional labour market models there is one job per firm, and worker job separation is exogenous. In the simple model, (which is similar to how competitively traded good sector firms behave in my model) firm exit and separation of a job-worker pair are equivalent, as when there is only one worker per firm both scenarios amount to the end of the firm and the end of the job-worker

pair. When firms have more than one worker this is no longer the case. If a firm exits, then all the workers separate from the firm (as in the simple model). However, if a single worker separates from the firm, this does not mean the end of the firm as there are other workers still employed by the firm. In this model the probability that a firm exits is $\eta$, and the probability that a worker separates from the firm is $\widetilde{\lambda}$. As stated before, the probability that a worker who has a job will still have it the next period is given by $(1 - \lambda)$. So $(1 - \lambda) = (1 - \eta)\left(1 - \widetilde{\lambda}\right)$, or $\lambda = \eta + \widetilde{\lambda} - \widetilde{\lambda}\eta$. Ebell and Haefke (2006) justify including firm exit for quantitative reasons, in order that the rate of firm exit in their model is more similar to that seen in the data. I use it for different reasons.

Exogenous firm exit is necessary to prevent an infinite number of solutions to the model. I will provide an example to show why this is the case. Imagine an economy where firms are large (that is, there is more than one worker per firm), firms are infinitely lived, and there are labour market matching frictions. Due to the free entry condition, the value of opening a firm (which has no employees as it must first post vacancies) is less than or equal to zero, which can be written as $V(0) \leq 0$. Firms will wish to continue to exist if they have a positive value, so we can write a free exit condition for firms that are operating normally and have employees working in the firm as $V(H) \geq 0$. The value of an operating firm should be higher than the value of a new entrant as the operating firm has the value of filled vacancies, so $V(H) \geq V(0)$. We denote the number of firms in the economy as $k$. We can assume that the value of establishing a new firm, and the value of an operating firm is decreasing in $k$, so $\frac{\partial V(0)}{\partial k} \leq 0$, and $\frac{\partial V(H)}{\partial k} \leq 0$. This is plausible as increasing the number of firms will increase product market competition, and so decrease the value of both operating firms and new firms. Denote the value of $k$ such that $V(0) = 0$ as $k_0$ and the value of $k$ such that $V(H) = 0$ as $k_1$. At $k_0$ there is no incentive for any new firms to enter, and at $k_1$ there is no incentive for firms to exit. As $V(H) \geq V(0)$ and as the value of firms decreases with $k$ any value of $k \in [k_0, k_1]$ will be a Nash equilibrium, as no firm will wish to enter or leave the market and there will be no deviations. There will be an infinite number of solutions.

However, if we impose the assumption that firms exit with the exogenous probability $\eta \in (0, 1]$ then if $k > k_0$ over time the number of firms will be reduced to $k_0$. In the steady state the only solution to the number of firms will be $k_0$. It will be maintained at this level by the entry of new firms each period.

## A.5  Timing for vacancies

In this appendix I explain how vacancies are dealt with in a situation of large firms and exogenous firm exit. The question arises, if some firms exit at the end of the period, what happens to the vacancies they posted this period? It is best to consider the timing as follows. Firms decide the number of vacancies they wish to post at the beginning of the period and pay a posting cost to some form of jobs agency. In the middle of the period the firm carries out its function of producing and selling. Near the end of the period some firms exit. The vacancies they posted are withdrawn from the market. At the very end of the period the match is made between unemployed workers and vacancies posted by surviving firms. As agents are aware that at the end of each period some firms will be destroyed they can anticipate the number of vacancies that will be there when labour market matching takes place. All vacancies mentioned in the model of this paper refer to the surviving vacancies available at the end of the period.

In this model firms are deemed to exist from the first period that they post a vacancy. The dynamics of firms in the steady state is as follows. Dealing first with competitively traded good sector firms, at the beginning of the period there are $L^Y$ competitively traded good sector firms in operation. Agents anticipate that $\lambda$ of these will exit at the beginning of the period due to either the worker separating from the firm, the firm exiting, or both. During the period a total of $\frac{\lambda L^Y}{(1-\eta)q(\theta)}$ vacancies are posted by new firms. However, as $\eta$ of these new firms are destroyed at the end of the period we are left with $\frac{\lambda L^Y}{q(\theta)}$ vacancies for jobs in the competitively traded sector at the end of the period.

For Cournot sector firms again the proportion $\lambda$ of jobs are destroyed at the end of the period. Suppose there are $k$ of each firm type, where $k = m, n$. There will be $\frac{\eta k}{(1-\eta)}$ new firms enter at the beginning of the period. When new firms enter they have no employees. As was shown in the paper, next period new firms will have the same number of workers as the established firms, so they must post $\frac{H}{q(\theta)}$ vacancies. As firms that are established already have some workers, they need only post $\frac{\widetilde{\lambda} H}{q(\theta)}$ to maintain the optimal number of employees. So in total $\frac{\eta k H}{(1-\eta)q(\theta)} + \frac{k \widetilde{\lambda} H}{q(\theta)}$ vacancies are posted, of which only the fraction $(1-\eta)$ become effective. So, at the end of the period there are $\frac{\lambda k H}{q(\theta)}$ vacancies for each type of job in the Cournot sector.

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