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The State of Wage Convergence in the European Monetary Union

The interdependence of European Manufacturing Wage Growth and its limited impact on competitiveness[*]

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Abstract — Before the introduction of the Euro many observers had expected an increase of inflationary pressures due to a de-coordination-shock to national wage bargaining. However, if anything systematically happened after the introduction of the Euro wage restraint increased (Posen and Gould 2006). A possible explanation for this finding is that a system of pattern bargaining has emerged with Germany figuring as a "centre of gravity" for European wage bargains (Traxler et al. 2008, Traxler and Brandl 2009). This paper studies wage and nominal unit labour cost spill-overs for the EMU for a panel over 13 manufacturing sectors from 1992-2005 and quantifies the effects of different countries. It turns out that there are strong interdependencies across EMU-members with regard to nominal wage growth. Indeed, a leading role accrues to Germany whose wage developments are twice as influential as those of the next important countries. Remarkably, the strong interdependence of wage growth is not reflected with regard to unit labour costs. Here, only the development in a core group composed of Austria, France, Germany and the Netherlands, is bound to each other. The development of nominal unit labour costs in other countries is largely independent from each other and especially from this core group.

Keywords: Wage Spill-Overs, Wage Coordination, Collective Bargaining, EMU

JEL-Classification: L16; J31; J52; F42

The state of wage convergence in EMU

Abstract

Before the introduction of the Euro many observers had expected an increase of inflationary pressures due to a de-coordination-shock to national wage bargaining. However, if anything systematically happened after the introduction of the Euro wage restraint increased (Posen and Gould 2006). A possible explanation for this finding is that a system of pattern bargaining has emerged with Germany figuring as a "centre of gravity" for European wage bargains (Traxler et al. 2008, Traxler and Brandl 2009). This paper studies wage and nominal unit labour cost spill-overs for the EMU for a panel over 13 manufacturing sectors from 1992-2005 and quantifies the effects of different countries. It turns out that there are strong interdependencies across EMU-members with regard to nominal wage growth. Indeed, a leading role accrues to Germany whose wage developments are twice as influential as those of the next important countries. Remarkably, the strong interdependence of wage growth is not reflected with regard to unit labour costs. Here, only the development in a core group composed of Austria, France, Germany and the Netherlands, is bound to each other. The development of nominal unit labour costs in other countries is largely independent from each other and especially from this core group.

Introduction

The moderate rates of inflation in the Eurozone after the introduction of the European

Monetary Union (EMU) came as a major surprise to many observers (De Grauwe 2009). The

broad and distinguished stream of literature on wage bargaining[1] almost unequivocally had

predicted a substantial *release* of wage restraint after the introduction of the EMU. Wage

bargaining systems that formerly where centralized at a national level where thought to be

crushed to a size compared to the level of monetary policy where they still would be able to

cause real effects but where they would be too small to internalize the negative externalities of

their behaviour. However, if the EMU had any impact at all on wage setting behaviour, wage

restraint increased (Posen and Gould 2006). What had happened?

A possible explanation is that – contrary to common perception – the pressure of international

product and labour market competition has led to a convergence of wages and to a multiple

wage restraint scenario. This implies that the key date for wage convergence is not determined

by the introduction of the common currency but by the loss of independent monetary policy as

contained in the Maastricht treaty in 1992. This date marks the loss of the ability of national

authorities to correct for 'wrong' wage developments by manipulation of the exchange rate.

Starting from this consideration it is also possible to argue that with the unification of

Germany – which created one overly dominant economy within the EMS – a key role might

have accrued to German wage policies and their effect on unit labour cost developments

acting as an implicit cost leader (Fitoussi et al. 1993). In the meantime Germany might even

have become Germany the "centre of gravity" of European wage policies (Traxler et al. 2008,

Traxler and Brandl 2009).

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[1] Key contributions include Hall and Franzese (1998), Iversen (1998), Cukiermann and Lippi (2001), Soskice
and Iversen (2001), Hanké and Soskice (2003), Hanké and Iversen (2003) and Coricelli et al. (2006).

Whether this really has happened on a broad scale in the internationally exposed sector of the economy is evaluated on the following pages. We take an in-depth-look at the different influences on wage setting in the EMU-members states during the period of the EMS and the early years of EMU in the manufacturing industry. Contrary to most available investigations this paper does not exclusively rely on aggregate data but uses a sectoral panel. This makes it possible to control for the direct effects between competing sectors of different countries. In particular it will be analysed how competitive pressures influence the process of wage growth across Europe. Further we undertake a first attempt to quantify the impact that wage accords of different countries have on trans-European wage growth.

The remainder of the paper is structured as follows. First the theoretical arguments that underlie the empirical project will be briefly sketched out. Then an overview over the state of empirical research will be presented. Subsequently the sources and the availability of the data which forms the basis of the econometric section will be provided. Thereafter stylized facts the estimation method and the key independent variable – whose construction and investigation forms the major contribution of this research – will be discussed. Finally the discussion of the results is winded up by a concluding section.

Wage Bargaining under the EURO: Theoretical Considerations

The early discussion of the effects of wage bargaining coordination centred roughly around two dominating arguments. The corporatist hypothesis (Soskice 1990, Iversen 1999, Traxler 2003) maintained that the higher the level of wage bargaining coordination is the stronger the implementation of potential negative externalities into the wage bargains becomes which implies a linearly beneficial relationship between the degree of wage bargaining coordination

3

and economic outcomes. This was disputed by the literature inspired by Calmfors and Driffill's (1988) seminal contribution. This literature (Bleany 1996, Scarpetta 2006, Stockhammer and Onaran 2009) maintained that internalization only takes place at a very high level of aggregation while at a low level of aggregation firm-based unions are eager to prevent loses in their competitive position which prevents excessive wage claims.[2] At a medium level however the goods of the considered sectors no longer can be considered to be close substitutes (i.e. the cross price elasticities are extremely inelastic) which prevents competition to put a break on wage excesses. Still – the argument goes – the level of coordination is yet too small to lead to an internalization of negative externalities (such as high inflation and the according reactions of the central bank). The result is that a hump-shaped relationship between the level of wage bargaining coordination and macroeconomic outcomes such as unemployment and inflation is stated.

This discussion is mirrored in the literature on the effects of the EMU on wage bargaining coordination regimes. The two most important streams of literature[3] strongly reflect theoretical positions that already had been made in the discussion on the national effects of wage bargaining coordination systems throughout the early 1990ies. The first stream will be labelled *transnational Calmfors-Driffill-hypothesis* in the following. This literature (Hall and Franzese 1998, Cukiermann and Lippi 2001, Hanké and Soskice 2003) primarily focuses on the effects of the interaction between wage bargainers and central banks. The main argument is that the relatively high national levels of wage bargaining coordination will be persistent after the introduction of the EMU but degenerate to being only medium levels of coordination

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[2] To fully understand the argument it might be useful bear in mind that a neoclassical labour market and a Stone-Geary (that is, wage bill maximizing) utility function are central to the economic core of these models.
[3] The general scope of the literature is slightly larger especially including Burda's (2001) proposition that wage bargaining systems might become atomized (or Americanized) after the introduction of the Euro. This argument however has found little support in the literature (see for instance Herrmann 2005 or Margisson, Sisson and Arrowsmith 2003 who observe that simultaneously decentralization- as well as Europeanization processes occur).

since the introduction of the European Central Banks moved monetary policy to a higher layer.

However a substantial tension accrues out of this discussion. While the argument of competition and trade is central to the original Calmfors-Driffill argument within a *national* framework its implications are transferred undisputedly to the *transnational* level by the transnational Calmfors-Driffil hypothesis. Hereby a substantial discussion of the implications of international competition on wage bargaining and wage growth is tacitly avoided. This however is problematic since the only reason why a hump emerges in the case of the transnational Calmfors-Driffill hypothesis is the (implicit) assumption that the cross price elasticities between the industries *between* nations are comparably small to the cross price elasticities between different industries *within* a nation. However, while the assumption of close-to-zero cross price elasticities arguably this assumption might be reasonable on a national level it is heroic for the international level. If, though, this assumption does not hold competitive considerations should put a break on overly excessive wage claims and should potentially render national wage bargainers in a prisoners' dilemma situation (comparable to that in which firm-based unions are in the case of low bargaining coordination within a nation) even if isolated national coordination prevailed.

This argument appears to be perfectly compatible (Traxler 2009) with the second stream of thought –here labelled as *transnational wage leader hypothesis* – which maintains that the introduction of the EMU even might have led to the aggregation of wage bargaining to the European level. The basic argument is that a(n implicit) system of Pattern Bargaining with Germany as the pattern setting country might have emerged. The implications of this for appropriate levels of wage growth however are analytically unclear. Soskice and Iversen (2001) maintain that after the introduction of the EMU Germany has lost every incentive to

exert wage restraint. An opposing position is taken by Dullien (2004) whose – Stackleberg-framed – argument is that Germany, being a wage leader, can be competitively exploited by its followers. In a Keynesian setting in which wage increases stimulate growth (Stockhammer et al. 2009) it is argued that a German-led prisoner's dilemma for European wage bargainers has emerged (Chaloupek 2009). The argument that Germany is potentially exploited by followers however is disputed by Traxler et al. (2008) on empirical grounds based on evidence for the German and Austrian metal sector. Together with Traxler and Brandl (2009) this study maintains that Germany has become a traditional pattern setter and internalizes potential negative externalities. The view, that the metal industry is central as a pioneer of European wage coordination again is shared by Schulten (2002).

Whatever the exact theoretical rationale – with the exception of the path-breaking contributions of Traxler et al. (2008) and Traxler and Brandls (2009) who however focus on the metal industry in Austria and the Nordic countries – the *transnational wage leader hypothesis* remains empirically under-evaluated. If this hypothesis was correct we should be able to find a strong convergence of European wage growth and an overwhelming importance of Germany in that process. Whether this actually has occurred is investigated in the remainder of this study.

The convergence of wage growth in the EMU-area: Literature Survey

Before moving to the econometric part this section provides a brief overview over the empirical picture of wage convergence that is provided by the literature thus far. Pichelmann (2001) was the first study to investigate whether wage convergence is taking place. He examines the state of the convergence by calculating cross-country correlation coefficients for nominal wages and nominal unit labour costs (NULC) for two sub-periods ranging from

1970-1985 and from 1986-1999 respectively. While finding that some countries face the risk to depart from the overall development he generally finds a tendency towards stronger nominal and real wage convergence which is mainly triggered by a core group of EU-11 countries. Further he finds and a strong correlation of general wage developments with Germany during the second period of observation.

Similar evidence has been found by the European Commission (2003). This study investigates cross-country coordination on a sectoral level by calculating correlation coefficients and by estimating regressions for selected sectors in selected countries (e.g. textile sector in Italy or fabricated metal sector in Belgium) for the period of 1981-2001. They find significant correlation for a larger number of pairs (between 0.2 and 0.3) in some – especially traded – sectors. However, they conclude that convergence was even stronger in the 1980ies than in the 1990ies.

Mora et al. (2005) test the degree of convergence of wages and productivity in the Euro-area countries. For this purpose they use a data sample from the OECD economic outlook and OECD national accounts. They estimate the β-convergence of unit labour costs, nominal wages, real wages and labour productivity using cross-section and panel data for the period of from 1980-2001. They find robust evidence for the convergence of unit labour cost, nominal wages, and labour productivity. Real wages however converge less strongly. The implication is that higher inflation in poorer and less developed economies fuels the development of unit labour costs.

Arpaia and Pichelmann (2008) estimate FGLS (feasible generalized least squares) estimators for the responsiveness of aggregate wage and unit labour cost growth to productivity, unemployment and the output gap for a cross-country pool of 12 euro-area members for the

period 1980-2005 using AMECO data. They find a significant degree of nominal wage rigidity with regard to inflation and a strong influence of unemployment and productivity. However, they also find significant cross-country heterogeneity and asymmetric adjustments to shocks so their findings indicate that convergence is far from being complete in EMU.

To our best knowledge the only surveys that explicitly tests the pattern bargaining hypotheses econometrically are by Traxler et al. (2008) and Traxler and Brandl (2009). Traxler et al. (2008) test the effectiveness of coordination within the metal industry and to test whether coordination might only be achieved by an 'exploitation of the great by the small' by estimating the impact of German wage increases in the metal industry on wage increases in Austrian wages for two distinct sub-periods. While the first sub-period from 1969/70 to 1979/80 shows no significant results, the second sub-period 1980/81 to 2002/03 shows a significant degree of coordination (based on parallel wage movements) amongst the two sectors. However, the hypothesis of the exploitation of the great by the small is rejected as wage increases in the Austrian metal industry on average are 1.28 higher than those in the German metal industry. Traxler and Brandl (2009) on the other hand focus on the impact of the German metal industry on Nordic countries. They find a statistically and economically significant influence of German standard pay and actual on Nordic standard and actual pay.

Dullien and Fritsche (2008) take an alternate approach and investigate whether divergences of relative nominal unit labour have to be judged as being "harmful". Harmful divergences are defined as divergences bigger than those experienced in historical precedents of what they appear to consider as natural experiments of successful currency unions, namely unified Germany and the US. They find the development of relative nominal unit labour costs to be well in line for most members of the European Currency Union, except for Portugal and Spain.

Summing up we can map out the following table of empirical contributions.

<INSERT TABLE 1>

Data Coverage

We use sectoral data for output, employment, compensation and capital from EU KLEMS.

This data starts in 1970 and ranges to 2005. For bilateral trade we use data from the OECD

STAN Bilateral Trade Database that provides bilateral sectoral import and export data. Time

series here range from 1988 to 2004 a period that due to our choice of the key independent

variable (see below) limits our scope of investigation. Macroeconomic control variables are

taken from the OECD Economic outlook. The countries covered are Austria, Belgium,

Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain. There is

no data on bilateral imports for Luxembourg so this country is excluded from the analysis.

Due to data availability (the longest range being 1988-2004) the analysis is restrained to a

single period. For economic reasons the starting point is 1992, the year of the Maastricht

Treaty. The key sectors observed are the manufacturing sectors defined by the ISIC

classification system from 15 to 45. For these data on the one and a half digit level is available

which leads to 14 available sectors. Outlier analysis showed that certain attention should be

paid to small sectors. Particularly problematic is sector 30 (Office, accounting and computing

machinery) where wages decline by more than 40% in two successive years in France. This is

untenable by any realistic economic reasoning and is due to the use of different statistical

sources by disaggregation. In general data still should be reliable but particular attention

should be paid to smaller sectors where disaggregation problems tend to be larger.[4] This information combined with the inspection of the residuals leads us to use Heteroscedasticity-consitent estimation methods throughout the econometric analysis. Since sector 30 is extreme, relatively small but in some cases has substantial power we choose to exclude it from the sample which reduces the size of it to 13 sectors (the entire manufacturing sector) over 14 (the period from 1992 to 2005) years for most countries. Except for the case of France results nonetheless prove to be robust to the exclusion of this sector. Austrian trade data only starts in 1995 reducing available years here to 10. This also is the case for sectors 30-33 in Italy and Finland reducing the sample of available sectors here to 10.[5] Union density on the other hand restricts the Portuguese sample to 2004 and CPI data only starts in 1992 in Spain.

Estimation Method and the construction of the Key Independent Variable

Given the specific structure of the sample it is advisable to use fixed effects to account for sectoral peculiarities. However, heteroscedasticity is a problem and OLS cannot be readily applied. Consequently we resort to the use of the fixed effects GLS (FEGLS) model with the (cross-section) fixed effects being considered to account for sectoral peculiarities and the GLS accounting for heteroscedastic disturbances. It can be noted however that the major results are robust as well to the use of OLS estimators with White Heteroscedasticity consistent standard errors and covariances instead of an FEGLS estimator.

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[4] Private correspondence with Mary O'Mahony 26.11.2009.

[5] This only is the case unilaterally. This means no trade data is available e.g. for Austria with Portugal before 1995 but the mirror statistic – that is data for trade between Portugal and Austria – for this period is available. This appears to imply that the statistical authorities – in this case – of Portugal provide data for this period but not the Austrian authorities. Unfortunately for years where data is commonly available significant divergences between say Exports from Portugal to Austria (the "longer" Portuguese time series) and its mirror statistic – that is Imports to Austria from Portugal (the "shorter" Austrian time series) – prevail. This is due to the fact that the export valuation is notated in FOB values while the import valuation includes insurance and freight costs and thus is valued CIF (private correspondence with Agnès Cimper from the OECD, 2.12.2009). Consequently it is impossible to substitute missing values in one series by its mirror statistics. The same applies to the missing sectors in Italy and Finland. However, with reference to our key independent variable (see below) this means that there is no missing data from the partners' point of view.

The main interest of this study is to investigate the effects of competitive forces within the EMU on the convergence of wage growth and unit labour costs. A direct test of the influence of German wage growth would be desirable but such a test is not readily available for econometric reasons. In detail, when testing for the influence of German wage growth on the growth of wages amongst other EMU-members coefficients might be exaggerated or wrong due to a omitted variable bias caused by the possibility of multiple (or different) wage-leaders.[6] Consider for instance the case of Belgium where next (or alternatively) to German wage growth a strong influence might be exerted by the growth of wages in France. Using the wage growth of more than one country as dependent variables to control for this potential effect leads to a major problem. Theoretically an endogeneity problem arises since it is possible (but by no means inevitable) that there might be a direct effect on say Belgium from two countries of which one again might be have wage growth dependent on the second country. Econometrically this problem materializes as a major multicollinearity issue which is strong enough to invert the coefficient of respective wage growth variables. In order to overcome this problem a special variable of Peer-Wages and Peer-Unit Labour Costs is constructed using bilateral trade openness as a weighting factor. The investigation of this variable is one of the major contributions of this paper. The variable is defined as follows:

$$WPH_{i,j}^{Peer} = \sum_{u \neq v}^{k} \frac{x_{v \to u} + m_{v \leftarrow u}}{X_v + M_v} \times WPH_{i,j}^{u} \qquad \text{with} \qquad \sum_{u \neq v}^{k} \frac{x_{v \to u} + m_{v \leftarrow u}}{X_v + M_v} = 1$$

With $x_{v \to u}$ denoting bilateral exports from country v to country u, $m_{v \leftarrow u}$ denoting imports to country v from country u. X_v are aggregate exports from country v to the EMU and M_v are

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[6] A direct test might be advisable in a case where regional path dependencies, geography and anecdotal evidence supports the assumption that Germany figures effectively as an important reference point. However this certainly is not a feasible path for the entire manufacturing sector all over the EMU-members countries.

aggregate imports from the EMU to country v. k is the total number of countries other than v and in our sample is 11 due to the lack of Luxembourg-data. I is an index denoting time and j is an index denoting sectors. v is an index for the respective countries. WPH stands for wages per hours. The sum of the fraction aggregates to one which has the nice property that the weighting factors deliver a readily comparable variable. Put differently the above exercise produces a variable that might be referred to as the wages per hour of the most important trading partners (weighted with their respective interrelatedness to the observed country). As a short-hand we will talk about Peer-Wages in the following. Analogously, using NULC for Unit Labour Costs, Peer-Unit Labour Costs are derived by:

$$NULC_{i,j}^{Peer} = \sum_{u \neq v}^{k} \frac{x_{v \to u} + m_{v \leftarrow u}}{X_v + M_v} \times NULC_{i,j}^{u} \qquad \text{with} \qquad \sum_{u \neq v}^{k} \frac{x_{v \to u} + m_{v \leftarrow u}}{X_v + M_v} = 1$$

Of course the construction of this variable does not entirely come without sacrifice. It delivers a readily interpretable variable based on trade and competitiveness considerations but to construct it the rather strong assumption of a linear relationship between a country's absolute trade position and the wage spill-overs emerging from it has to be imposed. Nonetheless we are convinced that these disadvantages are far less important than those associated with any other method.

Stylized Facts

Before moving to the results of the estimations we want to provide a brief overview over the stylized facts of wage and unit labour cost developments in the EMU-member states over the last decades. To make things easily tractable we have generated two groups of countries, the one referred to as Core includes Austria, Belgium, France, Germany and the Netherlands

while the second group, which is referred to as Fringe includes Greece, Ireland, Italy, Portugal, Spain. The choice of the groups might seem somewhat arbitrary but is made on geographical grounds and is informed by the subsequent econometric analysis[7]. In order to wipe out business cycle effects 10-year moving averages are used. Comparing the two groups reveals the following picture. In general it was possible to observe a substantial moderation of wage growth during of monetary integration observed here. While, of course there are differences within the respective groups, the growth rates of the Fringe – while on average still being 50% higher than those of the Core – have been reduced substantially stronger than those of the Core.

< INSERT GRAPH 1 HERE>

It is interesting to observe that the substantial moderation of wages in the Fringe did not result in a comparably clear picture with regard to the development of NULC-growth. To the contrary after a substantial reduction around the early 1980ies they started to grow again around the early 1990ies with stronger growth rates in the fringe than in the core. During the early 2000s however the two regions started to diverge even more strongly. In particular while average NULC-growth of the Core has become ever more slowly during the last years of the observation period NULC-growth in the Fringe was substantially rising over the last years. This is a strange result since the gap in nominal wage growth narrowed constantly.

< INSERT GRAPH 2 HERE>

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[7] To be sure Belgium does not closely belong to the core group constituted by NULC spill-overs. However, the development of the NULC and wage growth rates is thoroughly in line with those of the core group and the result that NULC-growth in Belgium does *not* react on NULC-growth abroad is one of the few not totally robust results of the analysis below.

The Interdependence of European Wage Growth: Evidence of Competition-led Wage Bargains

In this section the effect of the growth of Peer-Wages on the growth of national wages or to be more precise the impact of the relation of national to Peer-Wages will be tested. To do this the following regression is estimated for each of the eleven observed countries separately.

$$d\log(WPH_{i,j}^{v}) = \beta_1 + \beta_2 \Delta CPI_j^{v} + \beta_3 UD_j^{v} + \beta_4 \Delta UR_j^{v} + \beta_5 d\log(PROD_{i,j}^{v}) + \beta_6 \left. WPH_{i,j-1}^{v} \middle/ WPH_{i,j-1}^{peer} \right. + \varepsilon_{i,j}$$

Hereby ΔCPI is the change of the consumer price index which is thought to control for inflationary pressure on wage accords. UD is union density to control for the bargaining power of workers. ΔUR is the change of the unemployment rate to control for business cycle effect. Dlog(PROD) is productivity growth. $\left. WPH_{i,j-1}^{v} \middle/ WPH_{i,j-1}^{peer} \right.$ is the lagged ratio of national over Peer Wages.[8] ΔCPI and UD are expected to have a positive sign since both, inflation and union density are expected to increase labours' wage pressure. A negative sing for ΔUR is expected since an adverse economic situation increases the firing threat which induces wage pressure. $\left. WPH_{i,j-1}^{v} \middle/ WPH_{i,j-1}^{peer} \right.$ finally controls for the effect of the relative position of national wages per hour to peer-wages per hour. This is the key variable which controls if wage-competition is important. If a deterioration of the national wage position compared to that of the most important partners is relevant a negative sign is expected.

< INSERT TABLE 2 HERE>

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[8] Conceptional endogeneity problems prevent the use of contemporary variables here since this would imply that contemporary national wage growth would appear as an independent variable in 10 out of the 11 regressions while being the dependent variable in one regression. The variable has been tested directly as well but the ratio appears to be the relevant variable in this respect.

Our key independent variable $WPH_{i,j-1}^{v} / WPH_{i,j-1}^{peer}$ is statistically and (to varying degrees)

economically significant in all observed countries. These results indicate that over the

observed period a strong influence on national wage growth has been exerted by the relation

between national and Peer-Wages. Consequently it is possible to say that considerations about

the competitiveness of the domestic labour market have become important in national wage

bargains within the EMU irrespective of the specific for of the national wage bargaining

system. It even might be possible to characterise the European wage bargaining structure as

being competition-led.[9] The results for most of the control variable show the expected signs.

An exception is ΔCPI which is negative in Austria, Belgium and Spain but is economically

insignificant in Spain and not overly important in the former countries. UD also is negative in

several countries but hardly ever is economically significant.[10] In the two cases where ΔUR

turns positive (Finland and Ireland) the economic significance is negligible.

This result is contradictory to the transnational Calmfors-Driffill hypothesis according to

which competitive considerations only play an important role if wage bargaining takes place

at the firm level (which hardly anywhere is the case in the EMU). However, it is not

necessarily a strong contradiction to the transnational wage leader hypothesis which assigns

an important role to Germany. To demonstrate this we distil the individual effects of the

respective countries. This is done by recalculating the effects by weighing the coefficients of

the respective countries with the average country share in bilateral trade of each other country

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[9] Note that we deliberately use the term competition-led instead of competition-dominated in order to point at the fact that considerations concerning competition and trade are very important but by no means exclusive forces that influence wage growth.

[10] Particularly in the (statistically non-significant) cases of Belgium and Finland the unexpected sign might be due to the fact that these countries belong to the Ghent System where unemployment compensation is organized around union membership and where for this union density and unemployment rates probably correlate to strongly to use union density as a proxy for bargaining power (Stockhammer 2009). However, it should be noted that the major results turn out to be robust to the usage of unemployment instead of union density.

$(coef * \sum_{u \neq v}^{k} \frac{x_{v \rightarrow u} + m_{v \leftarrow u}}{X_v + M_v})$ and by calculating the effect that a one percent reduction in growth of a country would have had on the wage growth of other countries on average over the observed period. Of course this only delivers a rough estimate since – as already stated – our above analysis is based on the assumption of a linear effect of the absolute size of foreign trade on wage growth spill overs. It might be argued that the more important a country's trade position becomes the more strongly its wages will be implemented into national wage accords. Econometrically this would imply a different weighting factor such as the squares of bilateral trade openness but this would render the coefficient hardly interpretable. Using our approach on the other hand delivers readily interpretable coefficients but – if the above argument applies – tends to underestimate the economic effects of large countries while overestimating the effect of smaller countries. Nonetheless we are able to give a relational picture of the influence of each individual country.

<INSERT TABLE 3 HERE>

As can be seen from table 2 Germany has had by far the strongest influence on national wage growth of EMU-member-states. Its influence is almost twice as large as that of the next important countries (France and Italy) implying that on average more than 10% of a 1 percent reduction in German wage growth are passed though to other EMU-members. This might not appear to be a very large effect on first inspection but the reader should be aware that this effect is still substantially larger than the effect observed for national inflation, union density or the unemployment rate. Only productivity developments overreach the importance of Germany as an influential factor of wage growth. Further as we have argued – there exists a strong likelihood that – these percentages even underestimate the leading role of Germany. Consequently the analysis puts us into a position where we can identify Germany as a key

player in transnational wage bargaining. Given the lag structure of our analysis it is not too exaggerated to argue that German wage bargains to some extent lead wage bargains its fellow-EMU-members.

Of course the fact that wage bargainers tied national wage accords (irresepective whether this has been done implicitly or explicitly) to the development of wages of their most important trading partners implicates that this has been done in an effort to link productivity growth to competitors. Consequently a strong connection of wages leads to the expectation of a strong connection of unit labour costs. But has this actually been achieved in reality?

Unit Labour Cost Developments in the EMU and the competitive position of individual countries

This section investigates the development of nominal unit labour costs (NULC) in the EMU since their development is the ultimate aim of national wage policies. To do this the following regression is estimated for each of the observed countries:

$$d \log(NULC_{i,j}^{v}) = \beta_1 + \beta_2 \Delta CPI_j^{v} + \beta_3 UD_j^{v} + + \beta_5 d \log(EMP_{i,j}^{v}) + \beta_6 d \log(ULC_{i,j-1}^{peer}) + \varepsilon_{i,j}$$

Variables are defined as above with the same expected signs. Instead of ΔUR, EMP – the number of hours worked – is used since this also accounts for different sectoral effects of business cycles.[11] ulc^{Peer} are Peer-NULC. The model that works best in the case of NULC is the one described above. This means that the inclusion of the variable directly and not as ratio

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[11] Since the independent variable is constructed by using EMP it is not used in the wage regression.

appears to be the better model in the case of unit labour costs. The results can be seen in table 2.

<INSERT TABLE 4 HERE>

The most interesting countries for our purposes are the group composed of Austria, France, Germany and the Netherlands which are bold. Here, ulc^{Peer} turns statistically and economically significant. This again reflects the impression that already emerged from the stylized facts discussed above. With the notable exception of Belgium, the group define as core above displays an increasing interdependence of their NULC developments. Again there is an unexpected result of ΔCPI for the case of Austria and Portugal. This for Austria again is the case for UD as well which however is not economically significant. All other control variables either show the expected sign or are statistically insignificant.

Robustness

As occasionally indicated the above analysis underwent a series of robustness tests. In particular the structure of control variables has been modified also accounting for changes in the stock of capital and ICT-capital and subtracting individual control variables. The sectoral sample has been aggregated to the one digit level to wipe out potential effects of small sectors. Dummies have been added for the EMU-crises (1992) and for the introduction of the Euro as book currencies (1999) and as legal tender (2002). Also different estimators have been used such as white heteroscedasticity consistent standard errors and covariances.

In Belgium and Portugal Peer-Nulc become significant when including a dummy for 2002 with a significant time dummy but signs turn out to be negative. This is counterintuitive since the introduction of the Euro might have led to upward price pressure in some highly

18

competitive markets with a low price elasticity of demand (with the introduction of Euro-currency being considered to have resolved a strategic prisoner's dilemma on these markets, De Grauwe 2009). This however rather should have increased NULC through increased wage pressure. Further a stronger sectoral aggregation has slight effects on statistical significance but notably not on the economic intuition of the results. Capital stock growth remained surprisingly insignificant in most observed countries. Apart from these rather negligible effects all results are robust statistically and economically to all of the mentioned estimation variations.

Conclusion

This paper has analysed the interdependence of European wage and unit labour cost growth. It has been ascertained that a strong interdependence of wage growth within the EMU exists. The growth of German wages hereby plays a leading role and is – aside from productivity-growth – by far the most important influence on European wage growth. This provides additional empirical support for the transnational wage leader hypothesis as proposed by Traxler et al. (2008). However, the interdependence identified above is due to competitive effects and is based on trade considerations. It still is possible that the convergence of wages is actually due to a prisoners' dilemma situation for wage bargainers in which strong wage increases are prevented by the fear that this could provide a basis for competitors to bid away market shares. Put differently while German wage restraint might be passed on this does not necessarily imply that German wage hikes would be passed on as well.

This view is supported by the second key result of this survey. The strong spill-overs of wage growth that where identified did *not* fully materialize in the form of NULC spill-overs. That is, wages have become increasingly interdependent but with regard to NULC a group –

composed of Austria, the Netherlands, Germany and France – exists where interrelations already exist. The NULC-growth of other countries however has been largely independent of the development of NULC-growth abroad, despite the fact that we have been able to identify – partly very strong – connections to wage growth abroad that the spill-overs of wage moderation might have been even too small. It is unlikely that the difference between the fringe and the core reflects a healthy readjustment process (since this was to imply that the core-countries needed to correct for competitive disadvantages compared to the fringe). If this argument holds true, the danger of a replication of the East German deindustrialisation experience is imminent for the fringe of the EMU implying far stronger centrifugal forces for the second decade of the EMU than for the first. If however wage policy of the fringe alone was to narrow the gap this would first require a detachment of German wage policies and second close to zero growth rates of wages leading to a deflationary scenario for the EMU (in particular when accounting for reactions of the core). It might be less painful altogether to allow for higher wage growth in the core to open up room for readjustments. This however would require a more explicit set of European wage coordination as proposed by Schulten (2002).

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Tables and Graphs:

Table 1

<table>
<tr><td colspan="5" align="center">State of the Field: Empirics</td></tr>
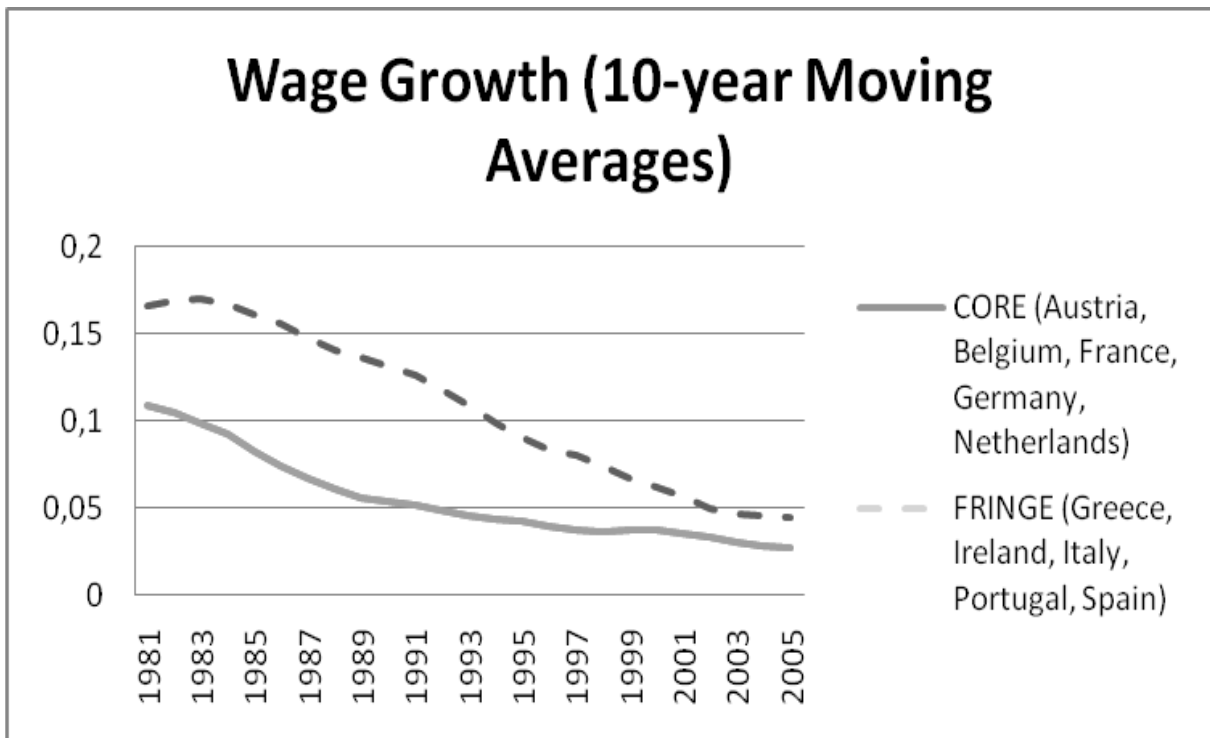<tr><td>Source</td><td>Countries, Aggregation and Year</td><td>Variable</td><td>Method</td><td>Key Finding</td></tr>
<tr><td>Pichelmann (2001)</td><td>EU-Members, Aggregate Data, 1970-1999</td><td>Nominal Wages Growth and Nominal Unit Labour Cost Growth</td><td>Correlation Coefficients</td><td>Convergence for all observed variables</td></tr>
<tr><td>European Commission (2003)</td><td>EU-Members, Sectoral Data, Selected Sectoral Case Studies, 1981-2001</td><td>Nominal Wages Levels and Nominal Unit Labour Cost Levels</td><td>Correlation Coefficients</td><td>Convergence for all observed variables</td></tr>
<tr><td>Mora et al. (2005)</td><td>EMU-Members, Aggregate Data, 1980-2001</td><td>Levels of Unit Labour Costs, Nominal and Real Wages</td><td>β-convergence</td><td>Convergence of Wages and Nominal Unit Labour Costs</td></tr>
<tr><td>Arpaia and Pichelmann (2007)</td><td>EMU-Members, Aggregate Data, 1980-2005</td><td>Nominal wage and Unit Labour Costs Growth</td><td>Indirect test of the responsiveness to key variables using Feasible LS</td><td>Significant Difference in Wage Formation</td></tr>
<tr><td>Traxler et al. (2008)</td><td>Austrian and German Metal Sector, 1970-2003</td><td>Nominal Wage Growth</td><td>OLS</td><td>German Leadership</td></tr>
<tr><td>Traxler and Brandl (2009)</td><td>Nordic and German Metal Sector 1973-2004</td><td>Nominal Wage Growth</td><td>OLS</td><td>German Leadership</td></tr>
<tr><td>Dullien and Fritsche (2008)</td><td>EMU-Members, Aggregate Data</td><td>Relative nominal Unit Labour Costs</td><td>Comparison</td><td>Convergence for a core</td></tr>
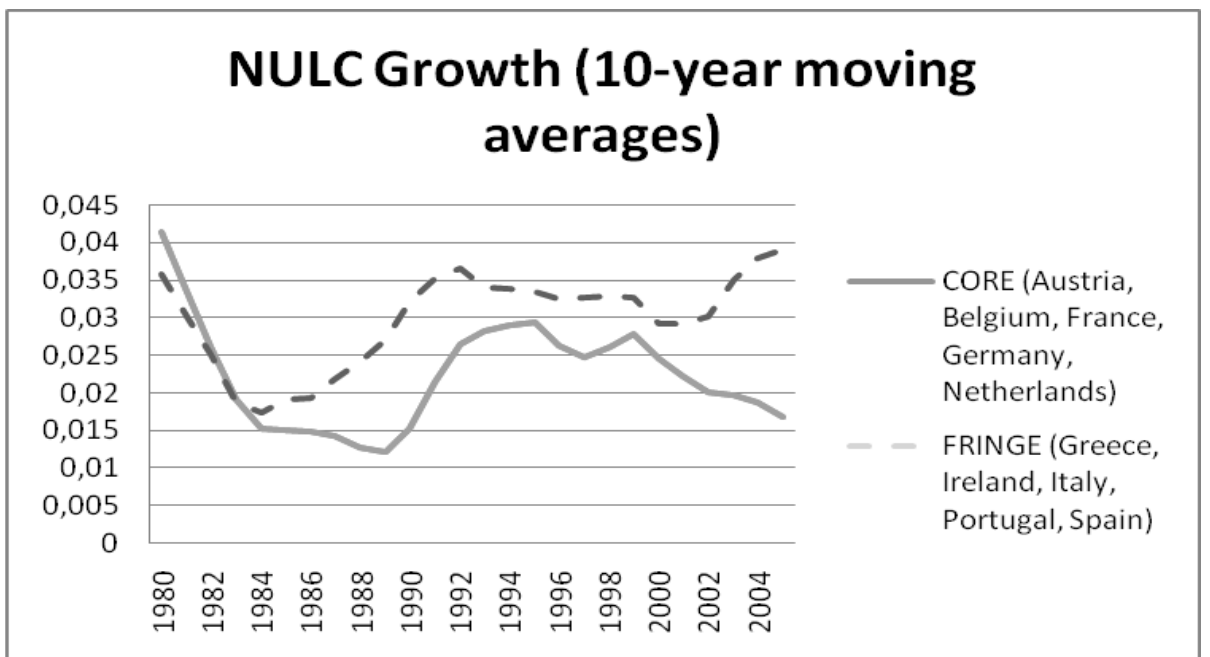</table>

Table 1

Graph 1

Wage Growth (10-year Moving Averages)

Graph 2

NULC Growth (10-year moving averages)

Table 1

The effects of Peer-Wages on National Wages

	AUSTRIA	BELGIUM	FINLAND	FRANCE	GERMANY	GREECE	IRELAND	ITALY	NETHERLANDS	PORTUGAL	SPAIN
Periods	10	14	14	14	14	14	14	14	14	13	13
Sections	13	13	13	13	13	13	13	10	13	13	13
Observations	130	170	182	182	182	182	182	140	182	157	169
C	0.211*** (4.286)	0.374*** (5.187)	0.129** (1.988)	0034 (0.665)	0.031 (0.794)	0.921*** (9.530)	0.312*** (4.172)	0.176** (2.223)	0.195*** (3.611)	0.362*** (3.240)	0.346*** (5.341)
D(CPI)	-0.024*** (-8.631)	-0.014** (-2.514)	0.002 (1.236)	0.006 (1.153)	0.003 (0.626)	0.008 (1.095)	0.011*** (2.839)	0.004 (1.351)	0.006*** (2.895)	0.014*** (3.763)	-0.008** (-2.432)
UD	-0.002** (-2.138)	-0.001 (-0.794)	-0.001 (-0.935)	0.012*** (3.638)	0.005*** (7.237)	-0.017*** (-6.183)	-0.002*** (-2.977)	-0.001 (-0.397)	-0.003** (-2.131)	-0.007** (-2.002)	-0.009*** (-3.226)
D(UR)	-0.019*** (-5.617)	0.008*** (2.768)	-0.008*** (-4.759)	-0.002 (-0.560)	-0.003 (-0.646)	-0.002133 (-0.244)	-0.009** (-2.593)	-0.011** (-2.464)	0.007*** (3.012)	-0.027*** (-6.091)	0.005*** (3.063)
DLOG(PROD)	1.996*** (6.856)	0.189 (1.192)	0.536*** (4.816)	0.302* (1.888)	0.079 (0.342)	0.718*** (3.807)	-0.078 (-0.654)	0.681*** (4.775)	-0.033 (-0.273)	0.483** (2.471)	0.517*** (4.368)
WPH(T-1)/WPH^{Peer}(T-1)	-0.100*** (-2.808)	-0.231*** (-6.764)	-0.061** (-2.060)	-0.109*** (-2.631)	-0.117*** (-3.928)	-1.308*** (-9.707)	-0.322*** (-4.010)	-0.190*** (-2.796)	-0.102*** (-3.121)	-0.596*** (-4.354)	-0.201*** (-3.355)
Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.593	0.413	0.242	0.184	0.544	0.580	0.263	0.523	0.271	0.515	0.441
Adjusted R-squared	0.531	0.347	0.163	0.100	0.497	0.536	0.187	0.470	0.195	0.456	0.378
F-statistic	9.598***	6.285***	3.078***	2.180***	11.531***	13.306***	3.444***	9.797***	3.583***	8.684***	7.001***
Prob(F-statistic)	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Durbin-Watson stat	1.947	2.079	2.560	1.986	2.074	2.046	2.603	2.456	1.934	2.257	2.033

The dependent variable is the lagged percentage change of national wages per hour (ΔWPH). C is the intercept, Δ(CPI) the change of the CPI, UD is union density. D(UR) is the change of the unemployment rate. Δ WPH(T-1)/WPH^{Peer}(T-1) is the lagged ratio of national over Peer-Wages. T-values are in parentheses. *,** and *** denote significance at the 10%, the 5% and the 1% level.

Table 2

The size of the spill-overs of a 1% reduction in national wage growth on other countries

		Effected Country										
		Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain
Effecting Country	Austria		-0.232%	-0.065%	-0.517%	-4.502%	-0.039%	-0.067%	-0.921%	-0.325%	-0.055%	-0.222%
	Belgium	-0.319%		-0.201%	-5.778%	-7.067%	-0.140%	-0.590%	-1.774%	-4.864%	-0.257%	-0.946%
	Finland											
	France	-0.240%	-1.908%	-0.112%		-4.136%	-0.120%	-0.274%	-2.256%	-1.057%	-0.303%	-1.757%
	Germany	-1.263%	-1.535%	-0.277%	-2.852%		-0.158%	-0.294%	-1.973%	-1.788%	-0.266%	-0.909%
	Greece	-3.009%	-9.068%	-0.410%	-19.531%	-46.116%		-2.022%	-40.014%	-14.789%	-1.079%	-9.032%
	Ireland	-0.462%	-5.194%	-0.584%	-6.796%	-10.655%	-0.315%		-3.367%	-5.218%	-0.395%	-2.022%
	Italy	-0.924%	-1.530%	-0.198%	-4.933%	-7.087%	-0.503%	-0.318%		-1.647%	-0.368%	-1.958%
	Nether-lands	-0.156%	-1.677%	-0.136%	-1.210%	-3.261%	-0.078%	-0.170%	-0.656%		-0.100%	-0.359%
	Portugal	-1.156%	-5.760%	-0.726%	-16.851%	-23.376%	-0.357%	-0.807%	-9.128%	-6.789%		-28.467%
	Spain	-0.489%	-1.672%	-0.142%	-9.086%	-7.605%	-0.288%	-0.458%	-4.912%	-1.795%	-2.772%	
	Average Effect on Other EMU-Members	-0.891%	-3.543%	-0.310%	-8.380%	-13.663%	-0.245%	-0.617%	-8.010%	-4.743%	-0.693%	-5.681%

Percentages imply that during the observed period a X% of a 1% reduction in wage growth are passed on to other countries on average. The calculation is based the recalculation of the key independent variables using average weighting factors and coefficients.

Table 2

The effects of peer unit labour costs on national unit labour costs

	AUSTRIA	BELGIUM	FINLAND	**FRANCE**	**GERMANY**	GREECE	IRELAND	ITALY	**NETHERLANDS**	PORTUGAL	SPAIN
Period	**10**	14	14	**14**	**14**	14	14	14	**14**	13	13
Cross-sections	**13**	13	13	**13**	**13**	13	13	10	**13**	13	13
Observations	**130**	170	182	**182**	**182**	182	182	140	**182**	157	169
C	**0.114*** (3.401)**	0.082 (1.076)	0.101 (1.189)	**-0.083** (-2.513)**	**-0.109*** (-6.662)**	0.084 (1.218)	0.119*** (2.611)	0.014 (0.320)	**-0.048 (-1.637)**	-0.105** (-3.047)	0.029 (0.644)
Δ(CPI)	**-0.013*** (-4.542)**	-0.018*** (-3.329)	0.004 (0.851)	**-0.007 (-1.448)**	**-0.004 (-1.332)**	0.004 (0.427)	-0.004 (-0.833)	0.001 (0.268)	**0.006** (2.474)**	-0.008** (-1.902)	-0.011*** (-3.682)
UDAUT	**-0.002** (-2.565)**	-0.001 (-0.506)	-0.001 (-0.966)	**0.013*** (3.424)**	**0.005*** (6.649)**	-0.004 (-1.022)	-0.002* (-1.836)	0.000 (-0.215)	**0.002* (1.960)**	0.008*** (4.296)	0.001 (0.424)
DLOG(EMP)	**0.601*** (8.687)**	0.729*** (7.436)	0.709*** (12.589)	**0.343*** (3.154)**	**0.688*** (10.572)**	0.693*** (5.993)	0.533*** (6.902)	0.652*** (7.564)	**0.719*** (17.277)**	0.433*** (3.521)	0.599*** (11.579)
ΔNULC^{Peer} (T-1)	**0.190*** (3.147)**	0.066 (0.580)	-0.220 (-1.326)	**0.190* (1.928)**	**0.183** (2.326)**	-0.339 (-1.163)	0.083 (0.481)	-0.067 (-0.654)	**0.156** (2.364)**	0.112 (0.725)	0.063 (0.648)
Fixed Effects	**YES**	YES	YES	**YES**	**YES**	YES	YES	YES	**YES**	YES	YES
R-squared	**0.763**	0.373	0.636	**0.458**	**0.640**	0.298	0.451	0.421	**0.718**	0.303	0.659
Adjusted R-squared	**0.730**	0.308	0.601	**0.405**	**0.606**	0.230	0.397	0.361	**0.691**	0.224	0.624
F-statistic	**22.745*****	5.691***	18.045***	**8.710*****	**18.367*****	4.374***	8.460***	7.044***	**26.247*****	3.812***	18.400***
Prob(F-statistic)	**0.000**	0.000	0.000	**0.000**	**0.000**	0.000	0.000	0.000	**0.000**	0.000	0.000
Durbin-Watson stat	**2.165**	2.079	2.440	**1.747**	**2.119**	1.181	2.159	2.518	**1.794**	2.225	2.180

The dependent variable is the lagged percentage change of national nominal unit labour costs (ΔNULC). C is the intercept, Δ(CPI) the change of the CPI, UD is union density. DLOG(EMP) is the percentage change of sectoral employment. ΔNULC^{Peer} (T-1) is the lagged value of peer unit labour costs. T-values are in parentheses. *,** and *** denote significance at the 10%, the 5% and the 1% level.

Appendix

ISIC Classification of Sectors

ISIC Rev. 3	Description
15-16	Food and Tobacco
17-19	Textiles, dressing apparel and Leather
20	Wood and Cork
21-22	Paper, Paper Products and Printing
23-25	Coke, Chemicals and Rubber
26	Non-Metallic Mineral Products
27-28	Metals and Fabricated Metal Products
29	Machinery and equipment n.e.c
30	Office machinery
31	Electrical Machinery n.e.c
32	Radio, TV and Communication equipment
33	Medical and Optical instruments
34-35	Motor vehicels and Transport Equipment
36-37	Recyling and Manufacturing n.e.c

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