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Discussion Paper in Economics No 15-14

December 2015

ISSN 0143-4543

Are individual characteristics all that matter in earnings determination: evidence from the US and Germany

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December 17, 2015

Abstract

Industry wage differentials may result either from the structure of the industry (demand type) or human capital (supply type) characteristics of the employed labour force. This study uses two major data sets from Germany and the US that allow the investigation of the effects of these demand and supply type factors on average earnings across industries. The main contribution of the paper shows that aggregate demand relevant to the particular industry has a strong positive effect on the industry's average earnings in addition to the previously established results regarding the significance of the effects of worker and firm characteristics. Consequently, labour market policies, which address solely the characteristics of the workforce and their human capital without due consideration of the macroeconomic environment and the structure of the industry, should be expected to produce the disappointing results of an increasing share of low pay employment in the wage distribution.

Keywords: macroeconomic demand, industrial earnings, vacancies

JEL: J31, J63, E24

Acknowledgements: Placeholder for later acknowledgements here

1 Introduction

Classical and neo-classical labour market theory assumes that pay is largely determined by how productive the individual worker is and how effective market incentives are in mobilising his or her productive effort. Thus, the inference would be that earnings differences mainly reflect individuals' relative worth and hence low earnings are symptomatic of low levels of ability and skill. Consequently, the only important determinant of an individual's position on the earnings ladder would be the human capital he or she brings to the labour market and his or her inherent productivity. Mincer (1974) argued that "*the model of worker self-investment as the basic determinant of earnings might be criticised as giving undue weight to the supply of human capital while ignoring the demand side of the market. Certainly demand conditions in general, and employer investments in human capital of workers in particular, affect wage rates and time spent in employment, and thereby affect earnings. The present approach is initial and simple and greater methodological sophistication is clearly desirable*" (page 137). Yet, the theoretical and empirical investigations of the classical tradition have largely ignored the effects of demand factors on the determination of earnings that would need to be taken into account in assessing the policy repercussions of the human capital model.

In contrast to the human capital model predictions of the labour market, the job competition model (Thurow, 1957) is based on the proposition that there is a queue of workers competing for jobs, with those at the head of the queue being hired first. Education determines the likelihood of getting a job, but only a particular level of education required for that job is directly rewarded in terms of pay. A more encompassing framework is captured by the assignment model (Tinbergen, 1956; Sattinger, 1993) which incorporates both supply and demand features of the labour market, by suggesting there is an allocation problem of assigning workers with various attributes to a range of jobs with differing levels of complexity. Precisely where workers are located will determine the pay that they are likely to receive.

Furthermore, alternative approaches to labour market analysis suggest that relationships in the labour market are determined by industry structures, inequalities in bargaining power and deficient labour demand, and this can lead to the systematic underpayment of certain labour groups. The basic proposition is that the individual's position on the earnings ladder derives from the characteristics of the employing establishment rather than the worker. This approach focuses on the structure of the labour market and their impact on capabilities and return to human capital of individuals

(Bluestone, 1970; Wachtel and Betsey, 1972; Ryan, 1990).

Evidence suggests that low paid workers are not spread evenly throughout all industries, even if they operate in similar product markets. They are usually concentrated in industries that have failed, for some reason or other, to provide a level of wage to their employees comparable to similar workers employed in similar industries. Isolating these reasons can provide some insight into the underlying mechanisms responsible for generating the increased incidence of low paid employment in some industries.

Thus, the focus of this study is the average earner in an industry and the forces affecting his or her earnings. It attempts to evaluate the effect of the industry's characteristics on the average pay and, then, to evaluate the relative importance of those characteristics on the variation of industry average earnings versus the average human capital characteristics and the level of macroeconomic demand relevant to the particular industry.

In view of the above, this paper examines the average earnings across industries in two advanced industrialised countries for which suitable data is available. Thus, for the US 16 industries and 51 states, and for Germany 63 industries and sixteen Bundesland regions, are investigated, over the period 1990-2013. The variable to be explained is always the average level of industry earnings by year and region or state. The explanatory variables include the average mix of human capital characteristics of employees in the industry, the structural characteristics of the industry namely (average firm size, level of unionisation) and the level of macroeconomic demand relevant to the particular industry.

The remainder of the paper henceforth is set out as follows. In the next section an overview of the pertinent literature on the industrial wage structure is presented. Section 3 describes the data in the study, while section 4 discusses the methodologies employed. The results are discussed in section 5 and conclusions and policy implications are offered in section 6.

2 Overview of the literature

Human capital theory suggests that an individual's human capital endowment is the sole mechanism for someone getting and maintaining a well-paid job. Early work by Becker (1962, 1964); Mincer (1974); Ben-Porath (1967) describes the contributions of experience and education to the earnings potential of individuals. A large literature estimating wage

equations evaluates this theory (Heckman et al., 2003). Although no-one could deny that skill supply via education, work experience and other human capital investments affects where workers fall in the earnings distribution, this study focuses on the contribution of industry characteristics and structural demand factors on the determination of earnings levels.

Competitive conditions in the labour market should ensure that labour is paid a wage which reflects its net productivity, where this has been adjusted for differences in working conditions. Earlier studies reveal that industry-specific variables play no part in competitive explanations of earnings differences (Pugel, 1980). However, later studies revealed that industry effects account for between 7 to 30 per cent of the variation of non-union wage rates and 10 to 29 per cent of the variation of union wage rates in 1983 (Dickens and Katz, 1987). There are several reasons offered in the literature as an explanation for some industries to pay more than others. Amiti and Davis (2012) show that a fall in output tariffs lowers wages in import-competing firms but increases the wages paid by exporting firms using Indonesian data. Tariffs have also been shown to cause wage premiums in certain industries in Columbia by creating rents (Goldberg and Pavcnik, 2005b). Other industries may be characterised by employment contracts designed to circumvent regulation on pay and benefits. Brown and Sessions (2003) show that, in the UK, the increased use of fixed term contracts tends to reduce wages, and that this cannot be attributed to those on fixed term contracts having lower levels of education.

Krueger and Summers (1988) point to firm characteristics as an important source of wage differences across industries. Hence, average firm characteristics should be expected to affect industry average pay. The above authors' conclusions are based on their findings that differences in earnings differentials persist, conditional on worker fixed-effects, and within occupations. Using matched employer-employee data, Abowd et al. (2012) confirm[1] that high paying employers may exist if a desire for equity, within firms with many high-skill jobs, drives up the wages of other workers (Thaler, 1989). Furthermore, in the UK, Metcalf (1999) points out that "the incidence of low pay is far higher among workers in the private than the public sector, among those in workplaces with no union recognition and in smaller rather than larger workplaces." It appears that eight sectors (largely services) account for the bulk of the low paid workforce and no less than two-fifths of them are located in retailing and hospitality alone.

[1]Abowd et al. (2012) also find that specific human capital, which is not always captured with observable characteristics, has a strong effect on pay, especially in the US.

Other factors may be important in explaining why certain industries pay more. For example, the selection into jobs by workers facing wage discrimination may contribute to low pay. Using Canadian data, Baker and Fortin (2001) conclude that women are not low paid when they work in "female jobs". The gender pay gap narrowed through the 1990s as women enter traditionally male occupations (Blau and Kahn, 2000). However, recent studies suggest that non-cognitive skill differences may explain why a gap persists today (Grove et al., 2011). Other studies suggest that workers with higher infra-marginal tolerance for undesirable conditions are able to select into higher paying jobs (Gibbons and Katz, 1992).

This paper offers an additional explanation, which has received little attention in the literature. The analysis is motivated in part by the findings of Du Caju et al. (2010) that employer, employee, and job characteristics together explain at most 40% of wage premium across industries. The possibility that an excess (or shortage) in the demand for labour could lead to higher (or lower) wages, conditional on worker and firm characteristics, is considered in this paper. Existing evidence on this topic is limited. As demand fell during health care restructuring in the US during the 1990s, Schumacher (2001) found that the fall in both the absolute and relative wages of nurses was unrelated to their personal characteristics. In their examination of the effects of structural change within the US steel industry in the 1980s, Beeson et al. (2001) found that the decline in employment was accompanied by a fall in mean wages and a rise in the variance of wages, particularly for those on low wages and with poor education. The rise in wage inequality was particularly evident for young males, and also spilled over to firms in the supply chain.

The positive wage-effects of an increase in demand for labour documented in this study are related to studies which show that positive wage-effects follow increases in demand for college educated labour (Katz and Murphy, 1992). Murphy and Welch (1993) and Juhn et al. (1993) link the increase in wages from 1940-1990 to increases in the demand for skilled (highly educated) workers. More recent changes in the wage structure are also linked to the demand for specific skill. Autor et al. (2003, 2008) find that the polarisation of the US wage structure can be linked to a decrease in demand for middle-skill jobs which are increasingly off-shored. In Germany, Dustmann et al. (2009) find evidence of polarisation which can be linked to change in the type of skill in demand by employers (Spitz−Oener, 2006). Similar findings exist for the UK (Goos and Manning, 2007), and other European Countries (Goos et al., 2009). Whereas these studies document nuanced changes in wage structure stemming from the demand for

specific types of skill, this paper documents changes stemming from the macroeconomic demand relevant to the particular industry.

3 Data

This paper uses data from two of the largest western economies: the Annual Social and Economic Supplement (ASEC), widely known as the "March CPS" of the US Current Population Survey (CPS), and the GSOEP (German Socio-Economic Panel). Since labour markets differ substantially between Europe and North America, this approach demonstrates the robustness of the results to particular institutional arrangements and policies.

The US data is drawn from a monthly US household survey conducted jointly by the US Census Bureau and the Bureau of Labour Statistics, comprising basic labour force and demographic questions on income, employment, poverty, health insurance and taxation (King et al., 2010). The data spans sixteen years (t) from 1997-2013 sixteen 1990 industry codes (i) and 51 US states (l). Personal characteristics used in the analysis include age, educational attainment, full-time/part-time employment status and gender. Characteristics of the firms employing respondents are also used. These characteristics include firm size and whether or not workers are unionised. To retain some homogeneity in the sample self-employed workers and respondents younger than 15 are excluded.

Analysis is undertaken at the industry- region- level. Data for each variable are averaged within each unique cell of industry, US State and year (ilt) to obtain the appropriate level of aggregation in the data. This collapse of the data has the advantage of removing individual heterogeneity by averaging within each i, l, t cell. Continuous variables such as age or years of education are first grouped into discrete categories that are more informative when collapsed. Education is represented by the share of employees holding the a university degree or higher for each industry-region-year group, firm size is captured by the shares of firms which have less than 10, 10-99 and more than 100 employees, and age is captured by groupings that represent the shares of workers less than age 25, age 25-45 and aged above 45. Summary statistics are presented in Table 1, panel A.

Data on job vacancy rates obtained from the Job Openings and Labour Turnover Survey (JOLTS) are also used in the analysis. These data are available in monthly

series at the national level for 16 industry codes for the years 2001-2013. Agriculture is excluded. This paper uses the March vacancy rates, which correspond to the month during which the ASEC survey is conducted.

Data from Germany come from the German Socioeconomic Panel (GSOEP) which is a longitudinal survey covering sixteen Bundeslands, or federal regions, (l). The data spans twenty-three years (t) since unification, from 1990-2012, and includes 63 industries (i) encoded by NACE (Statistical Classification of Economic Activities in the European Union)[2]. The GSOEP has maintained a high response rate throughout this period and is considered to be a remarkably stable panel. Variables are constructed to mirror the analysis for the US and the data is collapsed to a similar level across the 63 industries and 16 Bundeslands (federal regions). University education is defined as corresponding to third-level education in the GSOEP dataset. Two firm size ratio dummy variables differ slightly from the US data, representing firms with less than 20 employees, 20-199 employees, and the omitted category firms with 200 or more employees.

The job vacancy rate by industry for Germany is obtained from the publicly available Eurostat Tables. This paper uses the annual vacancy rate from 2000-2012 for all sectors including agriculture. The level of aggregation of industries is higher than that available in the GSOEP data itself providing information on 13 industrial groupings over the period[3]. Summary statistics are presented in Table 1, panel B.

4 Estimation Methodology

The objective of the paper is to investigate the determinants of the position of the earnings of workers in particular regional industries within the earnings distribution. Thus, the basic hypothesis to be tested views the average wage in the industry as a function of both average personal characteristics of the employees in the industry (loosely supply-

[2]The data for new hires and terminations is only available for 1991-2012 (waves 8 through 29 in GSOEP), since new hires are defined as individuals who are in employment in year t who were not in employment in year $t-1$ in the specific industry; conversely terminations are defined as individuals who are not in employment in year t who were in employment in year $t-1$ in that industry. Hence, data is not used from 1990 (wave 7) except for its use in respect of calculating new hires and terminations.

[3]Vacancy data for Germany from 2000-2003 is marked as "preliminary" by Eurostat. Vacancy data for the years 2000-2008 is available according to NACE v1.1 categories and for the years 2010-2012 according to the NACE v2 categories. Several industry groups in v2 are collapsed to merge with the earlier coding structure by manually calculating the vacancy rate from job opening and vacancy counts also provided by Eurostat. Data for 2009 are only available in a quarterly series so the average vacancy rate across the four quarters is used. Not all industry groups report vacancy statistics in all years.

type variables) and the average establishment variables and other industry determined variables (demand-type variables). The important innovation of the paper is that in addition to assessing the effects of the employees' average human capital and the effects of the structure of the industry on the position in the industry's average earnings, it also aims to assess the effects of the macroeconomic demand relevant to the industry on the industry average pay.

In general, the literature has abstracted from investigating the effects of the macroeconomic demand relevant to the industry on the industry average pay. This reflects both the difficulty of empirically approximating the level of demand relevant to the industry and the lack of relevant information in the large scale surveys which are normally designed to capture only human capital variables. This paper adopts a methodology that provides the theoretical underpinnings for the level of macroeconomic demand relevant to the industry.

This paper uses two proxies capturing the industry demand for labour in the tradition of the search theory (Holt, 1969; Modigliani and Tarantelli, 1973; Holt, 1970; Fazzari et al., 1998). The first proxy is the net flow of workers into jobs within a particular state and industry. Because there is considerable detail in the industry measure (26 different 2-digit industry codes are available), this measure provides a substantial amount of cross-sectional variation. Respondents in the ASEC data are linked year-to-year so that new-hires and recent involuntary separations (redundancies) are observed. Because of a change in the unique identifier in 2005, it is not possible to identify past labour market status for this particular year. To analyse the net flow, the 2005 value for the number of redundancies is imputed with linear interpolation. The second proxy is the job opening rate, or job vacancy rate, obtained from JOLTS data. One potential advantage of this measure is that, instead of varying across industries and states, this measure varies only across industries. This may be favourable for capturing more precisely the aggregate demand pertaining to particular industries.

Overall, the literature suggests that there should be expected to be a connection between the industry wage level and the level of macroeconomic demand relevant to the specific industry. A useful starting point in this regard is the wage curve (Blanchflower and Oswald, 1995). The wage curve suggests a negative relationship between levels of unemployment and wages rates, when these variables are expressed in regional terms. Blanchflower and Oswald (1995) argue that the wage curve reflects the observation that a worker who is employed in a region of high unemployment earns less than an identical

individual who works in a region with low unemployment. Blanchflower and Oswald (1995) show that there is a stable relationship linking regional unemployment and the level of pay which is a downward-sloping convex curve. The wage curve should be expected to also be relevant at the regional industry and occupation level. Thus, the wage curve for industry i in region l at time t can be represented by equation (1).

$$W_{ilt} = f_1(U_{ilt}) \tag{1}$$

The unemployment rate, U, in turn is determined by labour market flows, namely the number of hires, H, and redundancies (or fires), R, in relation to the total number of workers in the labour force, N, as indicated in equation (2), at the regional industry level, such that

$$U_{ilt} = f_2\left(\frac{(H_{ilt} - R_{ilt})}{N_{ilt}}\right) \tag{2}$$

Hence, taking together equations (1) and (2) yields equation (3)

$$W_{ilt} = f_3\left(\frac{(H_{ilt} - R_{ilt})}{N_{ilt}}\right) \tag{3}$$

This can then be used to provide an augmented form of the usual human capital earnings function where regional industry earnings differences at time t, W_{ilt}, are explained not only by human capital (person) characteristics, $\mathbf{P}_{ilt}$, and industry (or firm) characteristics, $\mathbf{F}_{ilt}$, but also, following equation (3), by demand effects, $\mathbf{D}_{ilt}$. In this earnings function, the variable to be explained is the average earnings in the industry i in region l at time t as a proportion of the industry average earnings at time t, as shown in equation (4). The explanatory variables include a number of human capital characteristics (age, gender, educational qualifications) defined as the average of the human capital characteristic in industry i in region l at time t as a proportion of the overall incidence of these human capital characteristics at time t, and demand type variables, namely "industry structure" variables (level of unionisation and firm size) and the level of macroeconomic demand relevant to the industry, similarly defined, as follows:

$$W_{ilt} = \alpha_1 + \mathbf{P'}_{ilt}\alpha_2 + \mathbf{F'}_{ilt}\alpha_3 + \alpha_4 D_{ilt} + \epsilon_{ilt} \tag{4}$$

The identification strategy in this paper removes the individual heterogeneity among workers and firms by averaging the data over region, time and two-digit industry, in line with Abowd et al. (2012). This allows the identification of changes in average wages of workers in industry groups with data that is cleansed of the differences in human capital within regional industry groups. Cleansing the data in this way should mitigate the complicating factors including self-selection into industries based on some unobserved characteristics, such as individual "ability". Because firm characteristics are also absorbed into the regional industry averages, firm-specific factors such as efficiency wage setting (Borjas and Ramey, 2000; Du Caju et al., 2010) have limited effects. Finally, the inclusion of industry fixed effects may capture some additional sources of wage variation at the industry level. These sources might include whether on not minimum wages are a binding constraint in some industries compared to others, whether certain industries have a higher share of occupations which pay more, industry-specific market power (Abowd et al., 2012), and the exposure of certain industries to trade openness (Goldberg and Pavcnik, 2005a; Amiti and Davis, 2012)[4].

The equation to be estimated is shown in equation (5). Separate estimations are performed for the US and Germany. The regressions are weighted with the employment counts in each regional industry cell so that the results are representative of the employment distribution in the micro data. However, because the data are collapsed to the regional industry level, the error structure accounts for arbitrary correlation within industry and region.[5] All independent variables in the regression model, except for the industry employment share, are expressed in terms of the difference between the industry-region level and the annual average across all industry-regions. This accounts for any potential time trends or changes in survey methodology. For a given characteristic share at the regional-industry level x, the regression covariate is given by $(x_{ilt} - \bar{x}_t)$.

$$\begin{aligned} \bar{w}_{ilt}/\bar{w}_t = \beta_0 &+ \beta_1(\bar{d}_{ilt} - \bar{d}_t) \\ &+ \beta_2(\bar{m}_{ilt} - \bar{m}_t) + \beta_3(\bar{e}_{ilt} - \bar{e}_t) + (\bar{\mathbf{a}}_{ilt} - \bar{\mathbf{a}}_t)'\beta_4 \\ &+ \beta_5(\bar{p}_{ilt} - \bar{p}_t) + \beta_6(\bar{u}_{ilt} - \bar{u}_t) + \beta_7(\bar{c}_{ilt} - \bar{c}_t) + (\bar{\mathbf{s}}_{ilt} - \bar{\mathbf{s}}_t)'\beta_8 \\ &+ \beta_9(n_{ilt}/\bar{n}_t) + \epsilon_{ilt} \end{aligned} \tag{5}$$

[4](Kambourov and Manovskii, 2009) found that human capital is specific to the occupation rather than the industry.

[5]Some heteroskedasticity may be introduced in this procedure. This issue is considered of secondary importance to the benefits of accounting for any potential group structure in the residuals within industry and region (Angrist and Pischke, 2009).

The dependent variable is the average earnings in industry i in region l ($\bar{w}_{ilt}$) expressed as a proportion of overall average earnings ($\bar{w}_t$). The measure of average earnings used is based on "total wage income" of employees in USD for the US and the "gross labour income" of employees in Euros for Germany. If the ratio $\bar{w}_{ilt}/\bar{w}_t$ exceeds one, then this denotes region-industries with greater than average earnings in year t. It is important to notice in the above variable specification that since in the numerator the current value is subtracted from the average value over the period for every point in time, this specification is a specification similar but not identical to the fixed effect specification of Mundlak (1978).

The first independent variable of interest captures macroeconomic demand in an industry relative to the average across all industries. One element is macroeconomic demand, following equation (3). This is shown in the first line of equation (5). This flow measure is approximated within each industry-region, ilt, as the excess of the new employment hires ratio, h, over the employment termination ratio, r. The new employment hires ratio, h, is defined as new hires recorded with job tenure of less than one year, as a proportion of the total number of employees. The employment termination ratio, r, is approximated as job terminations due to company closure, dismissal, mutual agreement, or end of contract, as a proportion of the total number of employees. Equation 6 provides further detail for the construction of the macroeconomic demand variable, which relies on the further difference of hires and redundancies:

$$(d_{ilt} - \bar{d}_t) = \frac{h_{ilt} - r_{ilt}}{n_{ilt}} - \frac{\bar{h}_t - \bar{r}_t}{\bar{n}_t} \tag{6}$$

Variables capturing human capital characteristics and the supply of labour are included in the econometric model. These are shown in the second line of equation (5). These include the ratio of male to female employees, m, the ratio of university to non-university educated employees, e, and the age ratios for three age bands; below 25 years of age, 25 to 45 and 46 and above, $\mathbf{a}$. Two age ratio dummy variables are included capturing ages 15-24 and 25-44 respectively (i.e. the omitted category is workers aged 45 or over).

A number of variables are also entered in the regression that capture a number of structural characteristics of the industry. These are shown in the third line of equation (5). These characteristics may also reflect the level of macroeconomic demand faced by an industry. The share of full-time *permanent* workers is captured by the variable

p. The specification also controls for union coverage rates of the workers within an industry[6]. Unfortunately this variable, u is only available in the GSOEP for selected years 1990, 1993, 1998, 2001, 2003, 2007 and 2011[7]. The variable c, available only in the GSOEP, captures the share of workers on temporary contracts or permanent contracts but working irregularly (for example seasonal work). Firm sizes within the industry are captured with the vector $\mathbf{s}$, which varies slightly according to the data available. For the GSOEP, this vector includes the share of firms with <20 employees and the share with $20-199$ employees. For the ASEC, it includes the share of firms with <10 employees and the share with $10-100$ employees. As long as there is a positive amount of unemployment in the economy, the number of workers, n, may also be considered a demand-side characteristic representing the employment share of a given regional industry. Throughout, the employee shares sum to one: $\sum n_{ilt}/\bar{n}_t = 1$.

5 The determination of industry earnings: OLS estimates

5.1 Estimates for the US

The regression results based on equation (5) are shown in Table 2 for the US. Results are shown with different combinations of regional dummy variables and one-digit industry dummy variables that capture fundamental differences across sectors of the economy. The discussion that follows focuses on the most conservative specification (4). Year-specific effects, including labour market policy changes, are accounted for in this specification because both the dependent and independent variables are expressed as quantities relative to the annual average. Appendix Table 8 demonstrates the robustness of the results to the exclusion of 2005, the year for which the redundancies measure is interpolated.

Human capital factors are shown to affect industrial average wages. The coefficient for the male-female ratio is positive and significant. A 1% increase in the proportion of male workers in an industry relative to the national average would lead to an increase in the ratio of industry to average earnings by 0.17. The traditional reasons explaining the gender wage gap range from differences in human capital, occupational sorting and

[6]In the GSOEP survey individuals were asked whether they were trade union members, whereas in the ASEC they are asked if they are members or otherwise covered by a union agreement.

[7]An appendix shows the results for both the US and Germany without the union coverage variable, and for Germany with union coverage using imputed (linearly interpolated) values for the missing years.

discrimination (see Gannon et al. (2005) for Europe and Blau and Kahn (2006) for the US). Unsurprisingly, the higher the proportion of university educated workers in a particular industry, the higher are the average earnings in that industry. A 1% increase in the proportion of university-educated workers in a regional industry relative to the national average would lead to an increase in the ratio of regional industry to average earnings by 0.57. These results are consistent with a substantial and robust return to human capital investment for US workers. Card (1999) surveys this literature and suggests that causal estimates may be close to 10% per year of education. Industries dominated by younger workers have significantly lower average earnings in comparison to those with higher shares of workers aged forty-five or above. For example, an increase in the proportion of workers under 25 in a regional industry and the national average proportion by 1% would lead to a decrease in the ratio of industry to average earnings by 0.6. This estimate is consistent with the larger body of literature stemming from Mincer (1974) demonstrating the importance of controlling for experience in the estimation of earnings.

The characteristics of regional industries are also found to be related to earnings. Regional industries with a higher share of full time workers pay on average higher earnings. The coefficient can be interpreted as follows: A 1% increase in share of full-time workers in a regional industry relative to the national average, would increase the ratio of industry to average earnings by 0.83. These results are consistent with the theoretical literature suggesting that part-time or temporary employees might receive less training than their full-time counterparts or may choose to invest less in their own human capital (Becker, 1962; Mincer, 1974). Similar results have been found in past studies summarised by Hirsch (2005). Industries with a high concentration of small and medium sized firms also tend to have lower than average earnings compared to those characterised by larger firms. For example, a 1% increase in the proportion of firms in a regional industry that employs less than 10 workers, relative to the national average, would lead to a decrease in the ratio of industry to average earnings by 0.29. This result is in line with the established literature that larger firms pay higher wages, a literature which may be traced back to Moore (1911) and has been frequently reconfirmed in numerous studies in many different countries since. Indeed, in a recent survey by Oi and Idson (1999), the firm size effect is found to be at least as important as the gender wage gap.

Macroeconomic demand is shown to have a strong positive effect on the average wages of regional industries. Conditional on worker and firm characteristics, a 1% increase in the net flow into employment in a given regional industry and the national average flow

increases the ratio of regional industry to national average wages by 0.72. It should be noted that this effect, which stems from labour flows, is in addition to the premium paid to larger industries captured by β_8. The size of the industry, as measured by the share of the national labour force it employs, has significant effects on industry average earnings. This reflects the baseline effect of the level of demand for labour facing the industry over the long term. Regional industries characterised by high demand may attempt to attract labour from across the industrial distribution by offering higher wages. For example, a large manufacturing employer in one state that secures a contract which significantly increases production may wish to provide incentives to labour to relocate from neighbouring states. They may also attract workers employed in different fields of work, in which case a wage premium may be necessary to compensate a worker that leaves a job where they currently enjoy a return to their specific human capital.

The importance of macroeconomic demand is highlighted also by using the national level industry-specific job vacancy rate as a proxy for aggregate demand. Table 3 presents results from the US. An increase in the vacancy rate above the national average of 1 percentage point leads to an increase in the wage ratio of 0.68. Standard errors are clustered at the industry level because this is the source of variation for the vacancy rate. The estimate is statistically significant at the 1% level.[8] This measure provides convincing evidence that aggregate demand factors across industries have significant and important effects on relative wages.

5.2 Estimates for Germany

It is salutary that the main findings regarding the US hold for Europe's largest economy as well. Table 4 presents results for Germany corresponding to results for the US in Table 2. The sign and significance of these results match those for the US entirely, with the exception of the employment share, which is negative in the specifications with Bundesland dummy variables.

[8]Because cluster-robust standard errors may not satisfy the asymptotic assumptions when the number of clusters is small, a cluster-robust wild boostrap procedure is used to prove p-values that satisfy these assumptions (Cameron et al., 2008). This procedure validates the initial results. P-values are presented at the bottom of Table 3.

5.3 Notable differences of the results between the US and Germany

The return to education appears to be higher for the US relative to Germany for some specifications. However the coefficients are almost identical in the most stringent specification (4). A 1% rise in the proportion of university-educated workers in a regional industry compared to the national average is associated with a 0.57 increase in the ratio of regional industry to average earnings in both countries. Specifications without region dummy variables are consistent with cross-country comparisons in the literature (Trostel et al., 2002) which indicate that an additional year of schooling has on average twice the effect on industry earnings in the US as it does in Germany. Similarly, the industry earning premium for a full-time job is much higher in the US than Germany. This is consistent with greater overall wage inequality in the US relative to Germany (Acemoglu, 2003). This difference in industry earnings may also be affected by working hours, which are typically higher in the US than Germany (Nickell, 1997)[9]. One covariate not available in the US data is the share of temporary workers. This is found to decrease average wages in Germany.

The effect of macroeconomic demand relevant to the industry is also significantly higher in the US. This may reflect the differential importance of supply and demand factors across countries. One explanation for this difference is that lower firing costs and less centralised bargaining in the US allow for a greater degree of response by employers to macroeconomic demand. Nevertheless, in both countries there remains a strong and significant effect from the demand side variable in the labour market. This in itself is an important result because it demonstrates that the importance of the macroeconomic demand for labour in terms of earnings is not the result of any particular institutional settings in Germany or the US.

Because union membership information is not available for several years in the GSOEP, it is imputed in the main results for the missing years 1991-92, 1994-97, 1999-2000, 2002, 2004-06, 2008-10 and 2012. Appendix, Table 9 presents results Germany without the union imputation. As can be seen, the estimates are consistent with the results reported above, indicating robustness with respect to this procedure.

The alternative proxy for demand, the industry-level job vacancy rate, is not found to have a significant impact in Germany. Results using the limited vacancy rate data for

[9]This effect may be exacerbated by the frequency of industry earnings reported. The data report each respondent's total pre-tax wage and salary income for the previous calendar year in the US, while for Germany they report gross labour income in the current month.

Germany from 2000-2012 are presented in Table 5. It is likely that both the sparse data and the lesser effect of demand on wages in Germany contribute to the insignificance of this measure.

5.4 The importance of demand

This section compares several specifications which might be used to explain wage differentials across industries in order to establish the relative importance of worker characteristics, firm characteristics, and demand factors. Table 4 compares nine specifications using the US data. By comparing specification (1) to specifications (2) and (3), for example, it is evident that both demand proxies improve the fit of the regression. The most informative exercise is a comparison of the last three columns. Relative to specification (7), without any demand proxy, specification (8) shows that the vacancy rate explains an additional 4% of the variation in wages across regional industries. This is a significant component of the wage in light of the richness of this specification. The net flow proxy is also able to explain an additional 1.5% of the variation in wages, conditional on worker and firm characteristics.

5.5 The determination of industry earnings: fixed-effects estimates

In this section a more rigid econometric methodology is undertaken that provides evidence on the impact within regional industries. There is some scope for individuals to select into particular industries or regions according to unobserved ability and according to the wages they pay. A worker with skills that are transferrable across industries might be expected to pursue work in an industry where average wages are higher. If there is a systematic mechanism behind this selection, then the average wages of industry-regions may be endogenous. Consider, for example, the possibility that higher ability secretaries select into the education relative to those who select into the manufacturing sector observing the favourable working conditions and relative pay of jobs in educational institutions. Differences in the relative sizes of these industries across regions might affect selection decisions in ways that are not accounted for by separate intercepts industry or state.

A fixed-effects model, shown in equation (7), is estimated to account for industry-region specific unobserved factors. This model shuts down all time-fixed variation across states and regions with industry-region specific intercepts, μ.

$$\bar{w}_{ilt} = \bar{\mathbf{P}}'_{ilt}\delta_1 + \bar{\mathbf{F}}'_{ilt}\delta_2 + \delta_3 D_{it} + \mu_{il} + \tau_t + \epsilon_{ilt} \tag{7}$$

Time dummies, τ, are also included to account for time trends at the aggregate level. This specification identifies the effect of demand on average wages using only the within-industry-region changes in labour demand over time. The benefit of this procedure is that it may be more likely to identify δ_3. Standard errors are clustered at the JOLTS industry level and the estimation is weighted using the employment counts prior to collapse for the year 2000. However, it is important to note that the above fixed-effects estimation and the above clustering on industry level naturally purges a significant part of the variation in levels of demand relevant to the industry that is persistent across regions and states. This should be expected to significantly weaken any effects of this demand on the industry wage.

The specification is also simplified to ease the interpretation of the estimated model parameters. Earnings, w, are measured annually in thousands of US dollars and other variables in the vectors $\mathbf{P}$ and $\mathbf{F}$ are simply the employment shares of each characteristic in the industry-region cell.

Increased demand within a regional industry increases the average income of workers in that industry. Estimates of equation 7 are presented in Table (7). In column (1), it is shown that an increase of 1% in the national-level industry-specific vacancy rate leads to an increase in average wages of \$735 US per year. This estimate is economically significant. At an average annual salary of \$31,000, a \$735 increase represents an increase in income of about 2%. The estimate varies slightly in specifications (3) and (4) according to the controls for person and firm covariates, but remains fairly stable and statistically significant at the 5% level with standard errors clustered at the industry-level.

Coefficients on the other variables are also as expected in terms of size and sign. An increase in the share of university educated workers by 1% increases average wages by about \$287. A single percentage point increase in the share of male workers is associated with average wages that are about \$135 higher per year. This is approximately the same effect that is expected from a 1% increase in the share of full time workers.

Estimates using the alternative proxy, the net flow of workers, are also computed for both the US and Germany. These results are statistically insignificant although they have the expected signs. This, combined with the greater predictive power of the vacancy proxy in Table (6), suggest that aggregate level vacancy rates by industry may

be a more powerful representation of the aggregate demand facing a particular industry in the case of the US.

Table 1: Variable description and summary statistics for cell-level data

Panel A: US Current Population Survey (CPS), 1997-2013

Variable	Description	Mean	SD	N
Income (w)	Wage income (1000s $US per year)	33.243	17.718	14183
Vacancy Rate	Industry-level job vacancy rate	2.507	1.006	10447
Net Flow	Net flow(hires-fires)/employed	0.973	0.105	13238
New Hires	Number of new hires	32.733	47.852	14309
Redundancies	Number of fires/redundancies	1.886	7.123	14309
Male	Share of workers that are male	0.540	0.248	14204
Education	Share of workers with at least a Bachelor's degree	0.250	0.211	14203
Age <25	Share of workers age <25	0.241	0.196	14200
Age 25-45	Share of workers age 25-45	0.489	0.200	14204
Full Time	Share of workers with full-time permanent contracts	0.812	0.187	14091
Unionised	Share of workers covered by a union	0.126	0.229	11479
Firm Size <10	Share of workers in firms with <10 employees	0.152	0.160	14183
Firm Size 10-99	Share of workers in firms with 10-99 employees	0.238	0.178	14183
Employment	Number of employed persons (thousands)	27.847	15.336	14309

Panel B: German Socioeconomic Panel (GSOEP) 1990-2012

Variable	Description	Mean	SD	N
Income (w)	Gross labour income (1000s Euro per month)	2.194	1.342	15874
Vacancy Rate	Industry-level job vacancy rate	3.526	2.909	5313
Net Flow	(hires-fires)/employed	0.883	0.192	15883
New Hires	Number of new hires	14.401	25.517	15883
Redundancies	Number of fires/redundancies	1.544	3.101	15883
Education	Share of workers with "Higher Education" (ISECD 1997 codes)	0.203	0.262	15840
Age <25	Share of workers age <25	0.116	0.188	15883
Age 25-45	Share of workers age 25-45	0.512	0.299	15883
Male	Share of workers that are male	0.606	0.322	15883
Full Time	Share of workers with full-time permanent contracts	0.649	0.315	14628
Unionised	Share of workers covered by a union	0.308	0.367	4200
Firm Size <20	Share of workers in firms with <20 employees	0.167	0.263	15701
Firm Size 20-199	Share of workers in firms with 20-199 employees	0.292	0.284	15701
Temp workers	Share of workers in temporary or irregular contracts	0.192	0.258	14707
Employment	Number of employed persons (thousands)	10.657	2.140	15883

All variables measured at the cell-level where cells are the unique combination of industry and region. CPS has 16 industries and 51 states. GSOEP has 63 industries and 16 Bundesland regions. Union coverage in GSOEP is only available in 1990/3/8, 2001/3/7/11. German vacancy rates from Eurostat 2000-2012, US vacancy rates from JOLTS 2001-2013. Net flow not available in 2005 CPS as some workers not linkable in the IPUMS sample. Hires also include some obvious job switchers (past occupation or industry changes along with firm size). Redundancies include only involuntary job leavers. Income is not rescaled to match since earnings ratios are used in the analysis.

Table 2: Industry Wage Differentials in the US 1997-2013

	(1) w_{ilt}/w_t	(2) w_{ilt}/w_t	(3) w_{ilt}/w_t	(4) w_{ilt}/w_t
Demand (**D**)				
Net Flow	0.669***	0.393***	1.016***	0.716***
	(0.030)	(0.029)	(0.035)	(0.034)
Person ($\bar{\mathbf{P}}$)				
Share Male	0.319***	0.226***	0.212***	0.170***
	(0.013)	(0.013)	(0.020)	(0.019)
Share University Ed.	0.735***	0.559***	0.779***	0.556***
	(0.016)	(0.016)	(0.020)	(0.020)
Share Age < 25	-0.611***	-0.495***	-0.746***	-0.602***
	(0.031)	(0.029)	(0.030)	(0.029)
Share Age 25-45	-0.033	0.006	-0.064**	-0.034
	(0.029)	(0.028)	(0.028)	(0.027)
Firm ($\bar{\mathbf{F}}$)				
Share Full-time	0.879***	0.950***	0.721***	0.828***
	(0.026)	(0.025)	(0.026)	(0.025)
Union Share	-0.052***	-0.143***	0.008	-0.086***
	(0.012)	(0.012)	(0.012)	(0.012)
Firm Size <9	-0.243***	-0.338***	-0.219***	-0.294***
	(0.025)	(0.024)	(0.029)	(0.028)
Firm Size 10-99	-0.174***	-0.235***	-0.021	-0.134***
	(0.024)	(0.023)	(0.025)	(0.024)
Employment Share	4.530***	-8.567***	5.998***	-7.160***
	(0.742)	(1.063)	(0.730)	(1.107)
Constant	0.988***	0.888***	1.359***	1.256***
	(0.003)	(0.021)	(0.032)	(0.036)
State Dummies	NO	YES	NO	YES
Industry Dummies (9)	NO	NO	YES	YES
N	10,984	10,984	10,984	10,984
R^2	0.598	0.657	0.640	0.689

Source: March CPS. Standard errors in parentheses. Number of fires per state-industry imputed in 2005 with linear interpolation since data linkage issues prevent consistent observation of lagged labor market status in this year. Net flow is the number of hires - fires observed in the linked longitudinal sample.

Table 3: Industry Wage Differentials in the US 2001-2013

	(1) w_{ilt}/w_t	(2) w_{ilt}/w_t	(3) w_{ilt}/w_t	(4) w_{ilt}/w_t
Demand (**D**)				
Vacancy Rate	0.081**	0.056**	0.104***	0.068***
	(0.033)	(0.022)	(0.026)	(0.016)
Person ($\bar{\mathbf{P}}$)				
Share Male	0.535***	0.347***	0.069	0.076
	(0.096)	(0.106)	(0.133)	(0.135)
Share University Ed.	0.816***	0.599***	1.028***	0.605***
	(0.208)	(0.188)	(0.207)	(0.197)
Share Age < 25	-0.515**	-0.436*	-0.928***	-0.705***
	(0.240)	(0.224)	(0.122)	(0.094)
Share Age 25-45	0.042	0.057	-0.009	0.007
	(0.145)	(0.136)	(0.073)	(0.066)
Firm ($\bar{\mathbf{F}}$)				
Share Full-time	0.895***	1.087***	0.679***	0.937***
	(0.185)	(0.155)	(0.088)	(0.107)
Union Share	-0.193*	-0.339***	-0.044	-0.225**
	(0.103)	(0.107)	(0.088)	(0.081)
Firm Size <9	-0.340***	-0.368***	-0.345***	-0.421***
	(0.093)	(0.124)	(0.111)	(0.128)
Firm Size 10-99	-0.135	-0.238	0.039	-0.180
	(0.151)	(0.159)	(0.113)	(0.111)
Employment Share	8.349	-3.537	10.291*	-4.290
	(4.949)	(6.322)	(5.840)	(4.842)
Constant	0.963***	0.875***	0.874***	0.757***
	(0.030)	(0.038)	(0.075)	(0.071)
State Dummies	NO	YES	NO	YES
Industry Dummies (9)	NO	NO	YES	YES
Wild Boot p-value	0.028	0.062	0.000	0.000
N	10,186	10,186	10,186	10,186
R^2	0.683	0.765	0.724	0.789

Source: March CPS and March JOLTS. Standard errors in parentheses clustered on 16 industries. Wild Boot are cluster-robust wild bootstrap p-values using 1000 repetitions.

Table 4: Industry Wage Differentials in Germany 1990-2012

	(1) w_{ilt}/w_t	(2) w_{ilt}/w_t	(3) w_{ilt}/w_t	(4) w_{ilt}/w_t
Demand ($\mathbf{D}$)				
Net Flow	0.436***	0.196***	0.321***	0.135***
	(0.029)	(0.025)	(0.031)	(0.027)
Person ($\bar{\mathbf{P}}$)				
Share Male	0.528***	0.396***	0.652***	0.517***
	(0.013)	(0.011)	(0.018)	(0.016)
Share University Ed.	0.506***	0.664***	0.409***	0.571***
	(0.013)	(0.012)	(0.017)	(0.015)
Share Age <25	-0.480***	-0.315***	-0.440***	-0.312***
	(0.032)	(0.028)	(0.036)	(0.031)
Share Age 25-45	-0.039**	-0.032*	-0.085***	-0.081***
	(0.019)	(0.016)	(0.020)	(0.017)
Firm ($\bar{\mathbf{F}}$)				
Share Full-time	0.103***	0.264***	0.055**	0.273***
	(0.021)	(0.019)	(0.024)	(0.021)
Union Share	-0.253***	-0.185***	-0.330***	-0.214***
	(0.020)	(0.018)	(0.022)	(0.019)
Firm Size < 20	-0.367***	-0.242***	-0.114***	-0.092***
	(0.018)	(0.016)	(0.021)	(0.018)
Firm Size 20-199	-0.477***	-0.305***	-0.361***	-0.218***
	(0.016)	(0.014)	(0.019)	(0.016)
Share Temp	-0.166***	-0.143***	-0.196***	-0.083***
	(0.027)	(0.023)	(0.029)	(0.025)
Employment Share	5.065***	-3.014***	7.047***	-6.311***
	(0.469)	(0.494)	(0.610)	(0.723)
Constant	0.953***	1.189***	0.697**	0.894***
	(0.004)	(0.028)	(0.296)	(0.257)
Bundesland Dummies	NO	YES	NO	YES
Industry Dummies (13)	NO	NO	YES	YES
N	11,899	11,899	9,916	9,916
R^2	0.392	0.552	0.391	0.549

Source: GSOEP. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Net flow is the number of hires − number of fires observed in the linked longitudinal sample. Union share imputed with linear interpolation for missing years.

Table 5: Industry Wage Differentials in Germany 2000-2012

	(1) w_{ilt}/w_t	(2) w_{ilt}/w_t	(3) w_{ilt}/w_t	(4) w_{ilt}/w_t
Demand ($\mathbf{D}$)				
Vacancy Rate	-0.010*	-0.009	0.002	0.001
	(0.005)	(0.005)	(0.002)	(0.002)
Person ($\bar{\mathbf{P}}$)				
Share Male	0.492***	0.355***	0.577***	0.491***
	(0.053)	(0.053)	(0.104)	(0.051)
Share University Ed.	0.685***	0.777***	0.616***	0.699***
	(0.043)	(0.064)	(0.065)	(0.108)
Share Age <25	-0.316**	-0.181	-0.326*	-0.204
	(0.142)	(0.112)	(0.160)	(0.129)
Share Age 25-45	0.056	0.014	0.015	-0.035
	(0.071)	(0.068)	(0.052)	(0.047)
Firm ($\bar{\mathbf{F}}$)				
Share Full-time	0.044	0.246***	-0.018	0.260***
	(0.053)	(0.046)	(0.070)	(0.059)
Union Share	-0.285	-0.308*	-0.276	-0.264*
	(0.188)	(0.168)	(0.163)	(0.142)
Firm Size <19	-0.358**	-0.247**	-0.174	-0.093
	(0.148)	(0.102)	(0.180)	(0.131)
Firm Size 20-199	-0.568***	-0.404***	-0.470***	-0.307***
	(0.084)	(0.064)	(0.121)	(0.079)
Share Temp	-0.487***	-0.472***	-0.500***	-0.389***
	(0.087)	(0.108)	(0.083)	(0.098)
Employment Share	6.116***	-0.882	6.500***	-6.474
	(1.161)	(3.106)	(1.423)	(3.671)
Constant	0.970***	1.063***	0.639***	0.742***
	(0.011)	(0.029)	(0.123)	(0.111)
Bundesland Dummies	NO	YES	NO	YES
Industry Dummies (13)	NO	NO	YES	YES
N	4,819	4,819	4,819	4,819
R^2	0.441	0.547	0.468	0.572

Source: GSOEP. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Vacancy rate from Eurostat vacancy statistics. Union share imputed for missing years.

Table 6: Comparing various specifications for wage differences in the US, 1997-2004, 2006-2013

	(1) w_{ilt}/w_t	(2) w_{ilt}/w_t	(3) w_{ilt}/w_t	(4) w_{ilt}/w_t	(5) w_{ilt}/w_t	(6) w_{ilt}/w_t	(7) w_{ilt}/w_t	(8) w_{ilt}/w_t	(9) w_{ilt}/w_t
Demand ($\mathbf{D}$)									
Vacancy Rate		0.099***			0.037***			0.089***	
		(0.004)			(0.004)			(0.004)	
Net Flow			0.848***			0.316***			0.797***
			(0.034)			(0.035)			(0.036)
Person ($\bar{\mathbf{P}}$)									
Share Male	0.237***	0.281***	0.311***				0.109***	0.158***	0.179***
	(0.019)	(0.021)	(0.018)				(0.020)	(0.022)	(0.020)
Share University Ed.	0.524***	0.759***	0.698***				0.450***	0.631***	0.588***
	(0.018)	(0.022)	(0.019)				(0.021)	(0.024)	(0.021)
Age <25	-0.924***	-0.953***	-1.062***				-0.476***	-0.475***	-0.607***
	(0.025)	(0.026)	(0.024)				(0.031)	(0.033)	(0.030)
Age 25-45	0.107***	0.054*	-0.069***				0.086***	0.059**	-0.064**
	(0.026)	(0.028)	(0.026)				(0.028)	(0.030)	(0.028)
Firm ($\bar{\mathbf{F}}$)									
Share Full-time				1.222***	1.220***	1.237***	0.825***	0.742***	0.800***
				(0.022)	(0.025)	(0.022)	(0.027)	(0.031)	(0.026)
Union Share				-0.039***	-0.023*	-0.003	-0.124***	-0.092***	-0.069***
				(0.012)	(0.013)	(0.013)	(0.012)	(0.013)	(0.012)
Firm Size 0-9				-0.485***	-0.577***	-0.535***	-0.268***	-0.368***	-0.315***
				(0.030)	(0.035)	(0.030)	(0.030)	(0.033)	(0.029)
Firm Size 10-99				-0.331***	-0.388***	-0.370***	-0.117***	-0.182***	-0.147***
				(0.025)	(0.029)	(0.026)	(0.025)	(0.028)	(0.025)
Employment Share				-16.671***	-17.955***	-15.522***	-11.448***	-12.449***	-7.861***
				(1.188)	(1.456)	(1.190)	(1.152)	(1.387)	(1.137)
Constant	1.351***	1.473***	1.346***	1.116***	1.087***	1.135***	1.275***	0.936***	1.263***
	(0.035)	(0.036)	(0.034)	(0.026)	(0.028)	(0.026)	(0.039)	(0.027)	(0.038)
N	12,457	9,504	12,457	10,235	8,124	10,235	10,234	8,124	10,234
R^2	0.608	0.661	0.629	0.634	0.668	0.637	0.670	0.711	0.685

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Fixed-effects estimates, US 2001-2013

	(1) Avg Wage Income	(2) Avg Wage Income	(3) Avg Wage Income	(4) Avg Wage Income	(5) Avg Wage Income	(6) Avg Wage Income
Demand (D)						
Vacancy Rate	0.735**		0.918***	0.604**		
	(0.295)		(0.260)	(0.255)		
Person ($\bar{P}$)						
Share Male	0.135***	0.135***	0.138***		0.140***	
	(0.017)	(0.017)	(0.025)		(0.025)	
Share University Ed.	0.287***	0.287***	0.284***		0.283***	
	(0.022)	(0.022)	(0.018)		(0.018)	
Share Age 24-45	0.121***	0.119***	0.141***		0.140***	
	(0.024)	(0.025)	(0.019)		(0.019)	
Share Age >45	0.161***	0.160***	0.191***		0.192***	
	(0.026)	(0.026)	(0.020)		(0.020)	
Firm ($\bar{F}$)						
Share Full-time	0.134***	0.134***		0.212***		0.219***
	(0.015)	(0.015)		(0.020)		(0.020)
Union Share	0.0004	0.001		0.001		0.001
	(0.008)	(0.008)		(0.007)		(0.007)
Firm Size 0-9	-0.075***	-0.074***		-0.099***		-0.099***
	(0.019)	(0.019)		(0.020)		(0.020)
Firm Size 10-99	-0.047**	-0.047**		-0.065***		-0.065***
	(0.017)	(0.017)		(0.017)		(0.017)
Constant	0.044	0.054**	0.109***	0.252***	0.043	0.259***
	(0.026)	(0.025)	(0.030)	(0.018)	(0.033)	(0.017)
Fixed-Effects (μ_{il})	YES	YES	YES	YES	YES	YES
Year Dummies(τ_t)	YES	YES	YES	YES	YES	YES
N_{ilt}	8,883	8,883	10,337	8,883	10,337	8,883
N_{il}	805	805	816	805	816	805
R^2	0.374	0.373	0.307	0.275	0.305	0.275

Source: IPUMS CPS Panel data for linkable respondents. Excluding self-employed and military workers. Data collapsed to means in cells across region (l) industry(i) and year(t). Wages in 1000s of $US annually. Vacancies are job opening rates for 16 industries from the JOLTS. Other variables are shares in percentages. SE in parentheses clustered JOLTS Industries. Omitted age group is 16-25. Omitted firm size category is > 100.

6 Discussion and conclusions

This paper examined the effects of human capital, industry structure and macroeconomic demand on industry earnings using two major data sets from the US and Germany. The paper also evaluates two different proxies for aggregate demand across industries. The first important result is that the level of aggregate demand in a regional industry relative to the average across all regions and industries has a strong positive effect on average earnings of that regional industry. The second key result is that the national-level vacancy rate by industry holds more predictive power relative to proxies based on the net flow of workers.

Interestingly this study finds that union membership appears to be more important to industry average earnings in the US relative to Germany. Employee and firm characteristics are also found to be important in ways similar to prior findings in the literature. The share of employees with university education and industries with larger shares of older and male workers also tend to have higher industry average earnings. Industries characterised by smaller and medium sized firms tend to have lower average earnings, as do those characterised larger proportions of part-time workers.

The results make a clear contribution to the literature, embracing and extending previous knowledge about the determinants of industry average earnings. The results also show that worker ability is not the whole story behind industry earnings differentials. Macroeconomic factors and institutional characteristics play important and significant role.

These results have clear policy impact. They reinforce the importance of education in public policy aimed at reducing low-paid employment, but also advocate the promotion of policies which provide incentives to firms to value workers with experience and, arguably, dissuade disproportionate use of inferior contracts in preference for those which are full-time. Importantly, the results also highlight the importance of demand-side policies. The macroeconomic environment is important in addressing problems of low pay. The results suggest that demand-reducing policies that typically characterise austerity packages will have adverse effects in terms of achieving a productive, high-wage economy.

7 Appendix

Table 8: Industry Wage Differentials in the US 1997-2004 and 2006-2013

	(1) w_{ilt}/w_t	(2) w_{ilt}/w_t	(3) w_{ilt}/w_t	(4) w_{ilt}/w_t
Demand (**D**)				
Net Flow	0.690***	0.415***	1.096***	0.797***
	(0.031)	(0.030)	(0.037)	(0.036)
Person ($\bar{\mathbf{P}}$)				
Share Male	0.322***	0.233***	0.221***	0.179***
	(0.014)	(0.013)	(0.021)	(0.020)
Share University Ed.	0.747***	0.572***	0.801***	0.588***
	(0.017)	(0.017)	(0.020)	(0.021)
Share Age < 25	-0.619***	-0.501***	-0.746***	-0.607***
	(0.032)	(0.031)	(0.031)	(0.030)
Share Age 25-45	-0.057*	-0.015	-0.094***	-0.064**
	(0.030)	(0.029)	(0.029)	(0.028)
Firm ($\bar{\mathbf{F}}$)				
Share Full-time	0.870***	0.932***	0.706***	0.800***
	(0.026)	(0.026)	(0.026)	(0.026)
Union Share	-0.039***	-0.126***	0.020*	-0.069***
	(0.012)	(0.012)	(0.012)	(0.012)
Firm Size <9	-0.266***	-0.359***	-0.241***	-0.315***
	(0.026)	(0.025)	(0.030)	(0.029)
Firm Size 10-99	-0.184***	-0.245***	-0.043*	-0.147***
	(0.025)	(0.024)	(0.026)	(0.025)
Employment Share	4.110***	-8.914***	5.234***	-7.858***
	(0.755)	(1.096)	(0.740)	(1.137)
Constant	0.993***	0.903***	1.045***	0.974***
	(0.003)	(0.023)	(0.013)	(0.025)
State Dummies	NO	YES	NO	YES
Industry Dummies (9)	NO	NO	YES	YES
N	10,234	10,234	10,234	10,234
R^2	0.596	0.651	0.640	0.685

Source: March CPS. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Net flow is the number of hires−number of fires observed in the linked longitudinal sample.

Table 9: Industry Wage Differentials in Germany 1990-2012

	(1) w_{ilt}/w_t	(2) w_{ilt}/w_t	(3) w_{ilt}/w_t	(4) w_{ilt}/w_t
Demand (**D**)				
Net Flow	0.573***	0.272***	0.418***	0.180***
	(0.047)	(0.040)	(0.049)	(0.041)
Person ($\bar{\mathbf{P}}$)				
Share Male	0.514***	0.378***	0.667***	0.503***
	(0.022)	(0.018)	(0.030)	(0.025)
Share University Ed.	0.457***	0.632***	0.336***	0.522***
	(0.024)	(0.020)	(0.029)	(0.025)
Share Age <25	-0.480***	-0.289***	-0.432***	-0.264***
	(0.055)	(0.046)	(0.059)	(0.049)
Share Age 25-45	-0.045	-0.031	-0.103***	-0.085***
	(0.033)	(0.027)	(0.034)	(0.028)
Firm ($\bar{\mathbf{F}}$)				
Share Full-time	0.140***	0.276***	0.113***	0.293***
	(0.036)	(0.030)	(0.038)	(0.032)
Union Share	-0.199***	-0.145***	-0.296***	-0.187***
	(0.033)	(0.028)	(0.034)	(0.029)
Firm Size < 20	-0.282***	-0.201***	-0.038	-0.080***
	(0.030)	(0.025)	(0.034)	(0.029)
Firm Size 20-199	-0.422***	-0.260***	-0.294***	-0.178***
	(0.028)	(0.024)	(0.031)	(0.026)
Share Temp	-0.051	-0.076**	-0.079*	-0.022
	(0.045)	(0.038)	(0.047)	(0.039)
Employment Share	5.728***	-4.018***	7.413***	-8.259***
	(0.840)	(0.849)	(1.061)	(1.188)
Constant	0.955***	1.131***	0.812***	0.936***
	(0.006)	(0.045)	(0.095)	(0.091)
Bundesland Dummies	NO	YES	NO	YES
Industry Dummies (13)	NO	NO	YES	YES
N	4,000	4,000	3,337	3,337
R^2	0.362	0.565	0.398	0.594

Source: GSOEP. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Net flow is the number of hires − number of fires observed in the linked longitudinal sample.

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