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Working Paper No. 99

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Samuel Muehlemann, Paul Ryan and
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Monopsony power, pay structure and training

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Abstract

Although interest in monopsonistic influences on labour market outcomes has revived in recent years, only a few empirical studies provide direct evidence on it. This paper analyses empirically the effect of monopsony power on pay structure, using a direct measure of labour market 'thinness'. We find that having fewer competitors for skilled labour is associated at the level of the establishment with lower pay for both skilled labour and trainees, but not for unskilled labour. These findings have potentially important implications for the economic theory of training, as most recent models assume that skilled pay is set monopolistically but both unskilled and trainee pay are determined competitively. Our results support those assumptions for skilled pay and unskilled pay, but not for trainee pay.

JEL-Codes: J24, J31, J42

Keywords: Monopsony, wage differentials, firm-sponsored training.

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1. Introduction

The recent renewal of interest in monopsony power in the labour market is indicated by the various articles introduced by Ashenfelter, Farber and Ransom (2010).

Monopsony power is present when the firm faces an upward-sloping labour supply curve, which gives it the power to set the wage, in contrast to its impotence if faced by the perfectly elastic supply curve of perfect competition. Monopsony was initially thought of in literal terms, as a single buyer in an isolated labour market, and judged correspondingly rare in practice. However, an individual firm can still face an upward-sloping supply curve even when other firms in the labour market compete with it for labour, whether because of fewness of competitors (oligopsony), a dispersion of both jobs and workers in terms of location and non-wage attributes (classic differentiation), or the costs of either geographical mobility or search-related information (Boal and Ransom 1997).

Indeed, while the classic source of monopsony power – few competing firms and/or collusion by employers – might not at first sight seem especially relevant to modern labour markets, recent theories of monopsony power essentially involve the same assumption. Even when many employers are present in a labour market, the other factors may mean that individual workers face ‘few employment opportunities’, because of the costs of locating vacancies or travelling to distant locations, which means that labour markets are effectively ‘thin’ (Manning, 2003a: 106-108).

Much of the evidence of monopsony power has been indirect, involving aspects of wage dispersion, the finance of work-based training, pay differences by race and sex, and the effects of changes in statutory minimum wages (Bhaskar, Manning and To 2002). Recent research has focused on more direct evidence, in terms of the elasticity of labour supply to individual firms (e.g., Ransom and Sims 2010; Staiger, Spetz and Phibbs 2010).

A second, longer-standing potential source of direct evidence is the association between pay and buyer concentration across local labour markets: does the presence of fewer employers mean lower pay? Boal and Ransom (1997) noted the absence of empirical consensus on the issue, even in markets for skilled labour that might be expected to be monopsonistic, notably school-teachers and hospital nurses. Some older studies, including Bunting (1962) and Hirsch

and Schumacher (1995), found little or no evidence that wages are lower in markets with fewer employers; others, including Link and Landon (1976), evidence that they are. Boal and Ransom (1997) attributed the weak pattern of results to the availability of only variable and partial controls for heterogeneity across localities in other potential determinants of pay, notably in workers' living costs and in the attributes of employers. In particular, they pointed to the tendency for pay to be inversely associated with fewness of employers in unskilled occupations as well. As such markets might be expected to behave competitively, the same association suggests that the apparent effect of fewness of employers is actually caused by the difficulty of delineating local labour markets empirically and controlling statistically for their attributes. However, as that inference is itself not well established empirically, the issue should remain open.

This paper adopts the latter approach, analysing the effects of fewness of firms across local labour markets. We analyse the association between pay and fewness of employers across local labour markets in a wide range of occupations, unskilled and skilled. We first establish evidence of a fewness effect on pay in skilled labour markets but not in unskilled ones. Then we analyse the association between fewness and the pay differentials between skilled employees, unskilled employees, and trainees within an establishment. This specification potentially controls for heterogeneity of firms and local living costs. We find that skill differentials are higher in local labour markets with fewer employers, and, given that uncontrolled differences in living costs and employer attributes are unlikely to matter as much for intra-firm pay differentials as for absolute pay levels, we interpret that association as evidence of monopsony power. Furthermore, we find that monopsony power is associated more with the number of local competitors in the same sector rather than the number in all sectors, which suggests that our results are not due to the overall level of economic activity in the locality.

An analysis of monopsony in relation to skill differentials in pay is economically interesting in its own right as well. Contemporary models of the finance of work-based training interpret evidence that employers share the cost of general training, which they could not do under perfect competition, in terms of an assumption that firms have monopsony power over skilled labour, but not over unskilled labour. The result is 'wage compression' between skilled and unskilled labour, i.e., a smaller growth in pay than in marginal product as an employee's skill

is increased by training. Wage compression in turn provides the incentive to and opportunity for firms to bear the costs of training (Stevens 1994; Acemoglu and Pischke 1999a).

This central assumption has lacked direct evidence, and relied instead on indirect evidence such as the distribution of training costs, and the relationships between pay, post-training separations and recruitment in markets for skilled labour (Acemoglu and Pischke 1998). The validity of that assumption may however be limited, particularly when unskilled employees and trainees are distinguished, and the possibility of monopsony power over trainees is allowed (Wolter and Ryan 2010).

Our evidence concerns Switzerland, a country whose training system closely resembles the German one, from which influential conclusions have been drawn about monopsony power, pay structure, and training volume (Acemoglu and Pischke 1998; Dustmann and Schönberg 2009). We analyse a representative data set for 3,500 establishments in Switzerland in 2004, into which have been merged the attributes of the local labour markets in which those establishments are located. We consider pay within the largest category of skilled employment, at detailed occupation level, at the establishment, relative both to trainees in the same occupation and to unskilled employees. The results represent a wide range of occupations, not just the particular ones (e.g., nurses) or the broad ones (e.g., white collar workers) that dominate the literature. We find evidence of significant monopsonistic influence on the pay of both skilled workers and trainees, but not on that of unskilled workers.

The next section discusses analytically issues concerning monopsony power in labour markets. Section 3 outlines the sources of our data. In section 4 we outline our estimation strategy. Section 5 presents the results for the effects of monopsony on, first, the firm's pay level and pay structure in general, and, second, on training-related pay structure in firms that provide formal training. The conclusions come in section 6.

2. Economics of monopsony

What generates buyer power in the labour market, and what are its effects on pay, employment and training?

2.1 Pay setting and employment

The idea of monopsony may best be illustrated by the question asked in Manning (2003b : 3): “What happens if an employer cuts the wage it pays its workers by one cent?”. Assuming perfect competition, all workers immediately leave the firm, as implied by the law of one wage. However, if not all would leave, the firm can create a rent by lowering wages below the competitive level. The literal case of monopsony is a single buyer in a particular labour market (Robinson 1933). The stereotypical example is a small coal mining town with no employers beside the mining firm, which gives the latter wage-setting power similar to the price-setting power a monopolist enjoys in a product market.

However, instances of literal monopsony are rare or non-existent. More plausibly, only a few employers may compete for a particular type of labour in a locality, in which case each oligopsonist enjoys monopsony power without being a strict monopsonist. Although outcomes under oligopsony are a priori indeterminate, in the sense of being sensitive to assumptions about behaviour in the face of strategic interdependence, in some models, notably Cournot competition, an equilibrium exists in which the presence of fewer employers is associated with lower pay. Similarly, even if collusion is more important in practice than economists have tended to believe, the scope for its success, i.e., attaining the low wage of literal monopsony, increases as the number of oligopsonists declines, thereby reducing the benefit to the firm of breaking rank and increasing the visibility to other firms of its having done so (Boal and Ransom 1997; Manning 2010).

Even interpreted in terms of oligopsony, the importance of monopsony power might be doubted given the large numbers of employers that function in many modern labour markets. Recent work emphasises however the potential relevance of monopsony power even in such contexts (Manning 2003b; Ashenfelter et al. 2010). Inelasticity in the supply of labour to the firm may be expected to result from frictions in the labour market – notably from the costs to workers of information about job vacancies and the costs of geographical mobility, and also from dispersion in job attributes and worker preferences concerning travel costs and other non-wage amenities (type of work, social ties, etc.; Boal and Ransom 1997). For example, workers who face substantial travel-to-work costs refuse a more distant job when the wage gain from changing jobs is less than increased cost of getting to and from work (Bhaskar and To 1999; Manning 2003a). Alternatively, if job search is taken to be costly, not least because

vacancies are scarce, workers may not be aware of alternative job opportunities in the first place. Under such conditions, the labour market remains ‘thin’ from the worker’s perspective, and the firm faces a rising supply price of labour, even when many employers formally compete in the same labour market (Manning 2010).

Examined in more detail, the first class of models involves ‘classic differentiation’: i.e., the dispersion of job attributes and worker preferences in general, and those concerning geographical location in particular. As a result of fixed costs of market entry, firms do not exist at all places in geographical space and jobs are therefore differentiated in the eyes of workers by their distance from the worker’s home – a form of product differentiation analysed by Salop (1979). Assuming non-trivial travel-to-work costs, the geographical heterogeneity of jobs and workers then gives the firm market power over workers who live nearby (Bhaskar and To, 1999; Hamilton, Thisse and Zenou 2000; Brueckner, Thisse and Zenou 2002).¹

The second class of model involves the economics of job search (Burdett and Mortenson 1998). In these models, jobs are assumed to be identical, and workers will now leave their employers for another job if the wage exceeds their current wage. The problem is the difficulty of finding such an employer, given the cost of job search. Monopsony power is high when the arrival rate of job offers is low – as it is when search costs are high. The supply of labour to the firm increases with its wage, in that firms that pay higher wages lose fewer employees to their competitors. In equilibrium, where employment is constant, the flow of new hires is equal to the flow of workers leaving the firm. The number of quits that a firm avoids by offering higher pay is equal to the number of recruits it attracts. The firm’s elasticity of labour supply can be estimated from the association between its wage and its separation and recruitment rates, with a potentially important difference between the short run and the long run (Manning 2003b, Manning 2006). The low elasticities reported in recent research² require search costs so high as to suggest not that any higher wage job can be

¹ Thus Staiger, Spetz and Phibbs (2010) find that deregulation-generated wage increases at particular hospitals affected pay at other hospitals in the same locality, but had little effect on their employment, which suggests considerable monopsony power in local labour markets for nurses.

² A number of recent studies have adopted this very approach to obtain empirical estimates of the labour supply elasticity. Ransom and Sims (2010) estimate the labour supply elasticity for school teachers in Missouri of 3.7, which implies that school districts possess significant monopsony power. Hirsch, Schank and Schnabel (2010) report elasticities ranging from 1.9 to 3.7 in the German labour market, with women’s elasticity being always lower compared to men’s. Ransom and Oaxaca (2010) find an elasticity ranging from 2.4–3 for male and 1.5–2.5 for female workers in a regional grocery retailer located in the United States.

obtained by any job searcher, but rather that vacancies themselves are scarce (Manning 2010).

2.2 Monopsony power and training

Monopsony power holds centre stage in the economics of work-based training. Mainstream models³ address what had previously been seen as an anomaly in human capital theory (Becker 1964): employers' investments in 'general' skills (Dionisius et al. 2009), which could not happen in perfect competition. The anomaly can be explained by assuming imperfect competition, in the shape of monopsony power for employers over skilled labour, and, in particular, of greater monopsony power over skilled than unskilled labour. That paired assumption generates wage compression, defined as a growth with the amount of training received in marginal product that exceeds that in pay. Given wage compression, employers maximise profits by reducing unskilled employment in favour of skilled employment; training provides the link between the two adjustments (Stevens 1994, 2001; Acemoglu and Pischke 1998, 1999a, 1999b; Dustmann and Schönberg 2009).⁴

The assumption that monopsony power applies to skilled workers is typically justified in terms of an underlying heterogeneity of employers. Stevens (1994) assumes that the content of skill requirements in any given occupation differs across employers, and that the value to other employers of a firm's skilled workers is therefore less than their value to the firm itself, which has trained them for its own requirements exactly.

By contrast, the typical assumption about pay setting for unskilled workers and trainees, whether implicit or explicit, is perfect competition, which equalises marginal products and pay across employers. 'Free entry at the start of period 1 makes that w_1 [trainee pay] is set such as to drive expected profits to zero' (Leuven 2005: 97).⁵ The assumption corresponds to

³ For a recent survey article see Leuven (2005).

⁴ Acemoglu and Pischke (1999a) note that even if the monopsony-based rate of exploitation (ratio of marginal product to the wage) is the same for trainees as for skilled workers, the firm's absolute surplus is greater for the skilled worker, which creates some incentive to provide training.

⁵ See also Winkelmann (1996), Chang and Wang (1996) and Stevens (1999: 21). Acemoglu and Pischke (1999b) also analyse a 'fully competitive' regime, in which the firm pays trainees only what is necessary to obtain their services, while competition for trainees denies the firm any super-normal profits. They do however also analyse two alternatives, a 'constrained' and a 'cooperative' regime, in which trainees cannot or will not accept the competitive level of pay, though the source and feasibility of such non-competitive behaviour is not stated.

an expectation that unskilled workers are equally valuable to employers across the entire range of sectors and job tasks.

This pair of contrasting assumptions – monopsony for skilled labour, perfect competition for unskilled labour and trainees – has become the norm in the training literature. That status may be attributable partly to those models' central prediction, viz. that employers rationally incur costs for 'general' training, and partly to the analytical simplification that the assumptions permit. In any case, the paired assumptions are widely viewed as having general applicability (Manning 2003b: 304).

That view may however be unwarranted. Some evidence suggests monopsony in markets for trainee labour. The surpluses earned during training by some German and many Swiss employers suggest less than perfectly competitive markets for trainee labour (Dionisius et al. 2009). Similarly, the effectiveness of the episodic episodes of industrial action conducted by apprentices in British metalworking industry in the last century is inconsistent with the assumption of perfect competition for trainee labour, but consistent with monopsony (Ryan 2010).

Manning (2003b: 302-5) observes that monopsony power may not only be present over unskilled workers and trainees, it may even be stronger than over skilled workers. He sees a potential cause in a higher rate of recent labour market entry among young trainees, resulting in lower wage elasticities of separations and accessions than among adults.

Greater monopsony power over trainee labour than over skilled labour may be expected from other attributes of the two groups too. When trainees are young (teenagers or young adults) and living with and subsidised by their parents, the costs of geographical mobility tend to be proportionately higher for them than for adult employees, which increases their dependence on local employers, and which, if local employers are few, generates greater monopsony power. Secondly, although younger workers have the incentive (because of a longer expected working life) to invest more in labour market search, matching and mobility than do older ones, their inexperience may still mean a smaller stock of accumulated information, and with it more dependence on their current employer.

Conversely, other factors may make monopsony power weaker over trainees than over other workers. As trainees are typically young, they may have more alternatives to wage-earning – including full-time education and family-financed leisure – than do skilled workers. They may also have lower requirements for labour income, given fewer family responsibilities, which may reduce their dependence on, not only on the labour market in general, but also any particular employer. We therefore treat it as an empirical issue, whether trainee pay is affected by monopsony power, and, if it is, whether it is more affected than is skilled pay.

The results are potentially important, as the predictions of economic models of training may be sensitive to assumptions about pay-setting. In particular, the phenomenon of production-oriented training, in which firms provide training more in order to reduce short-term production costs than to increase future skill supply, lies outside the explanatory scope of mainstream models of training, but it is potentially explicable in terms of what might be termed wage decompression, based on greater monopsony power over trainee than over skilled labour (Wolter and Ryan 2010).⁶

A further potential difficulty in mainstream models of training, implicit in the above discussion, is the assumption that trainees and unskilled workers can be treated as a single category, in terms of pay-setting. The assumption is consistent with the fact that any firm can in principle make its unskilled employees into trainees and thus convert them into skilled workers. Informal on-the-job training given to existing adult employees at the workplace can plausibly be described in such terms. In particular, such training typically involves no reduction in pay for trainees during training (Ryan 1984; Barron, Berger and Black 1999).

The same may not however be the case for formalised long-term training for intermediate skills – a category that includes, in both Europe and North America, apprenticeship programmes, a type of training on which much of the evidence of employers' investment in general skills is based. In such programmes, trainees typically differ from unskilled employees, in terms of educational attainment, age, experience, seniority and pay in particular. Their lower pay is no surprise, as training costs are high and skills are certified and therefore presumptively general. But it may also be affected by differences in average age

⁶ Manning (loc. cit.) predicts from the assumption of greater monopsony power over trainees than over skilled labour that firms will be unwilling to offer training, forcing workers to sponsor their own training apart from employment ('education'). An alternative possibility may however be production-oriented training, and the exploitation of trainees as production labour.

and length of service (lower) and educational attainments (higher), and also by the extent to which training contracts are institutionally distinct from regular employment contracts (Marsden and Ryan 1991; Ryan et al. 2010). For these reasons, pay setting for trainees may differ from that for unskilled workers, and with it the extent of monopsony power.

3. Data

Our data come from a recent (2004) administrative survey of the costs of apprenticeship training to Swiss employers.⁷ The establishments involved are a random sample taken from the Establishment Register, operated by the Swiss Federal Statistical Office, which contains all non-agricultural establishments in the country. After classifying establishments as to whether they provide apprenticeship training or not and sampling randomly within each category, our data comprise 2,413 training establishments, with a total of 13,454 apprentices, and (with a lower sampling frequency) 1,863 non-training firms.⁸

Our evidence for trainees concerns work-based training for skilled occupations in Switzerland. The training is organised as apprenticeship, combining training and work experience at workplaces with part-time vocational education at public colleges. It resembles closely its German counterpart, a centre of interest in recent economic analyses of training, not least in its clear distinction between the status of trainee and employee. Formally recognised apprenticeship training programmes, lasting between two and four years, operate in some 250 occupations, distributed across all sectors of the economy. More than three fifths of young people enter this type of training, typically after completion of lower secondary schooling (Hoeckel et al. 2009: 13; OPET 2009). The advantage of evidence for Switzerland lies in the availability of data for both particular employers' training programmes and the local labour markets in which they operate.

The survey collected information on the pay of skilled and unskilled employees, trainees, and on such attributes of the establishment as its size, geographical location, sector and the

⁷ The series of surveys of the cost to employers of apprenticeship training in Germany in recent decades, which began with the Edding Commission (1974), is reviewed in Dionisius et al. (2009). The Swiss survey used broadly the same methodology as its German counterparts.

⁸ Most establishments do not provide training: in 2005 only 17.8 per cent of all establishments provided apprenticeship in any occupation (FSO 2005), though the share rises to around one-third if one-person businesses are excluded (Muehleemann et al. 2007: p. 144). The Swiss Federal Statistical Office used a sampling rate of 1.0 per cent for non-training establishments and 3.4 per cent for those that train. The data represent the entire national training system, excluding only a handful of agricultural apprentices.

occupations for which it trains. ‘Skilled’ and ‘unskilled’ employees are distinguished according to whether they have completed an apprenticeship in the occupation in which they are currently employed. The ‘unskilled’ category therefore includes workers without any post-compulsory education.⁹

Pay is measured as the annual pre-tax basic pay of full-time employees and trainees, averaged across all individuals (apprentices or employees) in the occupation in the establishment. Calculated from its monthly counterpart, it includes employee social security contributions, but excludes 13th and 14th month additional payments and any other non-regular payments, including performance bonuses.¹⁰

Summary statistics for pay and establishment attributes are reported in Table 1, for all firms and for training firms only; full definitions of the variables are given in the Appendix (Table A1). Skilled workers’ pay exceeds unskilled pay by around 30 per cent on average. Unskilled pay is 4.5 times as high as trainees’ pay, and skilled pay 6.5 times higher. The pay of skilled employees is 5.2 per cent higher in non-training than in training establishments. As unskilled pay differs little between the two categories, wage compression is greater in establishments with training than in those without it.

The data also include establishment size, the amount of workplace-based training provided per trainee, and qualitative information on the profitability of and the technology used by the establishment.

⁹ Unskilled workers may however have some continuing or informal training but not enough for their skills to be certified, even though Switzerland has a system for certifying informally acquired skills. The unskilled category therefore comprises all workers whose skill levels are below those of certified skilled workers.

¹⁰ An alternative, wider definition of pay, including additional payments and employers’ social security contributions and therefore close to total labour cost, was also considered. Base pay amounts on average to 81.3 per cent of this measure of total labour cost (for skilled and unskilled employees combined). When pay is defined instead as total labour cost, the results of the regressions in section 6 change only slightly, and the index of monopsony power (number of firms per hectare) remains highly significant.

Table 1: Descriptive statistics

Variable	Mean	Std.dev.	Min	Max
<i>All firms (N=3592):</i>				
Annual pay of skilled worker ('000 CHF)	65.579	9.716	36.000	120.00
Annual pay of unskilled worker in firm ('000 CHF)	47.475	5.100	24.000	80.640
Skilled worker / unskilled worker pay ratio	1.378	0.177	1.000	1.750
Number of firms in area per hectare (sector)	0.035	0.038	0.001	0.145
Number of firms in area per hectare (all sectors)	0.256	0.158	0.010	0.562
Number of farms per hectare	0.023	0.008	0.002	0.043
Firm size 1-9 employees	0.706	-	0	1
Firm size 10-49 employees	0.234	-	0	1
Firm size 50-99 employees	0.032	-	0	1
Firm size 100+ employees	0.028	-	0	1
Profitability (<i>1=very good /rather good, 0=medium/ rather poor /very poor</i>)	0.361	-	0	1
Technical status of equipment (<i>1=very good /rather good, 0=medium/ rather poor /very poor</i>)	0.533	-	0	1
<i>Training firms (N=2243)</i>				
Annual pay of skilled worker ('000 CHF)	63.352	10.834	36.000	120.000
Annual pay of unskilled worker in firm ('000 CHF)	47.796	54.518	24.000	80.640
Annual average apprentice pay ('000 CHF)	10.313	24.402	3.647	24.675
Skilled worker / unskilled worker pay ratio	1.322	0.188	1.000	1.750
Apprentice / unskilled worker pay ratio	0.218	0.056	0.092	0.513
Skilled worker / apprentice pay ratio	6.422	1.654	2.301	15.668
Number of firms in area per hectare (own sector)	0.031	0.034	0.001	0.145
Number of firms in area per hectare (other sectors)	0.213	0.135	0.001	0.562
Number of firms in area per hectare (all sectors)	0.244	0.153	0.010	0.562
Number of farms per hectare	0.023	0.008	0.002	0.043
Firm size 1-9 employees	0.557	-	0	1
Firm size 10-49 employees	0.321	-	0	1
Firm size 50-99 employees	0.053	-	0	1
Firm size 100+ employees	0.068	-	0	1
Hours of formal training per apprentice/week	6.022	3.337	0.500	20.000
Profitability (<i>1=very good /rather good, 0=medium/ rather poor /very poor</i>)	0.382	0.486	0	1
Technical status of equipment (<i>1=very good /rather good, 0=medium/ rather poor /very poor</i>)	0.549	0.498	0	1

Source: 2004 Survey.

We enlarge the survey data with locational information, concerning the commune (i.e., municipality, local authority) in which the establishment is situated, taken from the Swiss Federal Statistical Office. The key variable is the number of (non-agricultural) establishments within the establishment's local labour market, differentiated by two-digit sectors, taken from the Swiss establishment register, which is administered by the Swiss Federal Statistical Office. We take from the census of establishments in agriculture the number of farms in the locality, as a measure of the degree of rurality of the local labour market.

We take local labour markets to be based on particular towns, and include all establishments that can be reached from the town centre within 30 minutes by car under normal traffic conditions.¹¹ This criterion is preferable to the two alternative criteria that dominate the empirical literature on monopsony: the administrative district (e.g., town and city boundaries) and travel distance (e.g., a 30 kilometre radius from the town centre).¹² We define the 67 largest Swiss towns and cities as each constituting the centre of a local labour market, and classify all establishments as belonging to one, and only one, of those markets.¹³ If the establishment is situated in a town that is not large enough to be treated as the centre of a labour market, it is classified as belonging to the closest one.

Taking monopsony power as arising from buyer concentration in the labour market, we measure it as the number of establishments in an establishment's local labour market divided by the area covered by the market: i.e., number of establishments per hectare.¹⁴ Other scholars have used a two-dimensional conception of monopsony power in local labour

¹¹ In our data, travel time to particular establishments was measured with the software *Microsoft Autoroute 2005*. The 30 minute criterion is chosen in the light of actual travel to work times: in 2000, 84 per cent of Swiss employees spent no more than 30 minutes travelling to and from work (one way trip; FSO 2000). Duranton and Overman (2005) find for the UK that the localization of employment takes place mostly within 50km, which broadly corresponds to a travel time of 30 minutes. Similarly, Manning (2003a) reports for Britain that more than 80 per cent of travel-to-work times last no more than 30 minutes.

¹² Commuting cost is in principle a function of both time (foregone earnings or leisure) and distance (fares, gasoline, etc.), with a positive correlation between time and distance. The correlation is however limited and in some cases (e.g. when both home and job are located beside a freeway or railway line) a long distance does not necessarily imply long time of travel. We implicitly treat the costs of time as more important than the costs of distance in cases of divergence.

¹³ In densely populated areas, such as the region around Zurich, travel-to-work districts overlap, in the sense that an establishment located at or near the intersection between two districts can potentially recruit workers from either district.

¹⁴ An alternative to the number of employers is total employment in the local market. Neither measure is ideal, and in the case of literal monopsony (a 'company town'), total employment would be distinctly inferior to number of employers as a measure. Data for the ideal measure (number of vacancies) are not available, however, and in any case the two measures are highly correlated and generate broadly similar statistical results, but with slightly weaker associations when total employment is used.

markets: the size of the market and the (absolute) number of employers (in the same occupation and sector; Hirsch and Schumacher 1995). Our use of travel-to-work areas rather than local government administrative ones allows us to compress these two dimensions into one by standardising the number of employers for the geographical size of the market.

We allow for potential sector-specificity in competition for labour by distinguishing between establishments in the same (two-digit) sector and those in other sectors. To the extent that skilled occupations are sector-specific, competition for skilled labour is expected to count only within the sector of the establishment in question. Thus, in Silicon Valley, competition may be expected to be fierce for IT hardware engineers, but not for pipeline welders, and this favours the use of the in-sector rather than the all-sector measure of fewness of firms. By contrast, for accountants, an occupation present in all sectors, the all-sector measure is expected to be superior. As systematic data on the sector-specificity of skills across occupations are not available, we measure buyer concentration on both the in-sector and the all-sector bases and compare the results attained on each basis.¹⁵

Table A2 in the Appendix provides summary statistics for the number of establishments within individual local labour markets by two-digit sector. For example (first row), the number of establishments within mining and quarrying averages nearly 20 across the 63 local labour markets, and ranges from a minimum of zero to a maximum of 50. Across all sectors (penultimate row), the average is 416 establishments within the individual sector and local labour market; the minimum number averages ten, the maximum number 1685. These data suggest that competition for labour – that is, setting aside labour market frictions – is potentially substantial overall, and highly variable across localities, both within particular sectors and across sectors as a whole.

Finally, we need to control statistically for other local attributes that not only potentially influence pay but also do so in association with fewness of employers. The notable factor is rurality: living costs, and with them pay, are expected to be lower in the countryside and in country towns than in large towns and cities. We therefore include a measure of the importance of farming in the local labour market, in terms of the number of farms per hectare.

¹⁵ A two-way classification of employment by occupation and sector would be required to judge the extent of sector specificity in skills, but no such data are available for Switzerland.

4. Estimation and results

This section discusses the issues that arise in estimating monopsony effects on pay from cross-sectional data on establishments and local labour markets. It then presents the estimates, distinguishing between results for all establishments and for those that offer training.

4.1 Empirical strategy

Our empirical approach contains two components: first, an analysis of standardised absolute levels of pay within particular occupations; second, an analysis of occupational differentials in pay between skilled employees, unskilled employees, and trainees. The latter results are of particular interest for two reasons: first, they implicitly control for the various firm-specific and location-specific factors that have been seen as distorting those previous studies of monopsony power that exploit variation across local labour markets; second, they bear directly on the economics of training, as noted in section 2 above.

In more detail, our first dependent variable is average pay in occupation k in establishment i , relative to mean for pay in that occupation in the country as a whole:

$$\frac{w_{ki}}{\bar{w}_k} = \alpha M_{ki} + \beta X_i + \epsilon_{ki} \quad (1)$$

where w_{ki} is average pay in occupational group k (skilled, unskilled¹⁶, trainee) in establishment i , and \bar{w}_k is average worker pay across establishments in the same occupational group (at national level); M_{ki} is our indicator of monopsony power (number of establishments per hectare in the same local labour market as establishment i , distinguishing between establishments in the same sector and in other sectors)¹⁷; X_i , a vector of establishment attributes (size, technical status and profitability). Controls for occupation and sector are

¹⁶ We standardise unskilled pay as the ratio of unskilled pay observed in establishment i employing skilled workers in occupational group k , divided by average pay of unskilled workers in all establishments in the whole country employing skilled workers in occupational group k . (When we standardise instead by unskilled pay in the whole country, our empirical results with respect to monopsony power remained qualitatively unaffected.)

¹⁷ Swiss Census data do not permit us to identify (as an establishment's local competitors) only other establishments that have employees in the skilled occupation by which the establishment in question is represented in the survey. We therefore take its competitors to be all local establishments that operate in the same sector (product market). The closer the fit between principal occupation and sector across establishments, the less is this discrepancy. Some occupations are highly sector-specific, such as retailing salesperson (to retailing); others less so, such as administrator (*Kaufmann/frau*) to banking.

included. The occupational categories (k) for the skilled worker and trainee groups comprise the 23 most important occupations in Switzerland, which accounted for roughly 70 per cent of all apprenticeship contracts in 2004 (and thus cover the largest categories of skilled occupations by employment, see Potterat 2006).¹⁸

Thus, the advantage of our empirical approach is that we analyse average pay in a single occupational category in an establishment, rather than the average pay of skilled workers in all occupations in that establishment, in order to reduce any uncontrolled occupation-specific effects on pay.

Our second dependent variable is relative pay, i.e., the ratio of mean pay in one occupational group (skilled, unskilled, trainee) relative to that in another group:

$$\frac{w_{ki}}{w_{ji}} = \gamma M_{ki} + \delta X_i + \epsilon_{ki} \quad (2)$$

where w_{ki} is average pay in occupation group k , and w_{ji} in occupation group j , in establishment i . When the two groups are skilled employees and unskilled employees, this formulation tests for wage compression associated with monopsony power ($\gamma < 0$).

We control for different establishment characteristics, represented by the vector X_i . Pay may be expected to vary with such employer characteristics as establishment size, technology, and profitability. To some extent this is predicated on monopsony power: in particular, given an upward sloping supply curve, larger establishments have to offer higher pay to maintain their higher level of employment. But even in the absence of monopsony power, companies that are more technologically advanced, productive and profitable are expected to pay more, as part of widespread rent-sharing in labour markets (Manning 2010). We therefore include both establishment size and a combined indicator of the technological sophistication and profitability of the establishment.¹⁹ Finally, from the human capital standpoint, firms that

¹⁸ The remaining occupational categories are grouped by the length of the training required to obtain the professional qualification (two, three and four years).

¹⁹ The survey provides only qualitative, self-assessment measures of technological level and profitability, summarised in Table 1 above. Owing to a high (positive) correlation between the two measures, we combine them into a single indicator that takes on the value 1 if either the technological level or profitability have a reported value of “very good” or “rather good”, and the value 0 otherwise.

provide more training are expected to offer lower pay to trainees. We therefore control at establishment level for the amount of training provided per trainee.

Weakness or absence of controls for other pay-relevant attributes of localities have impaired much of the empirical literature on monopsony power in local markets (Boal and Ransom 1997). The major prospective concern is living costs: the prices of housing, food, fuel, etc. vary considerably across localities, and are expected to cause pay to vary too. As it is normal for local labour markets in rural areas to have both few employers and low living costs, controls for living costs are necessary to avoid biased estimates of monopsony effects. Lacking measures of living costs by locality, we address the problem in three ways. First, we control statistically for rurality by including number of farms (per hectare) in the regressions.²⁰ Second, we use within-establishment pay differentials to control for locality effects. If differences in living costs across districts are assumed to have the same proportionate effect on the pay of skilled workers, unskilled workers, and trainees alike, any association between relative pay and fewness of firms can be interpreted as evidence of monopsony power. Third, while we analyse the effect on pay of the total number of establishments within a local labour market, we also analyse the effect of the number of establishments within the establishment's own sector. Thus, our empirical measure allows monopsony power to exist in any local labour market, not just in localities with low levels of economic activity.

Lacking employer-employee matched data, we cannot control directly for differences between establishments and localities in employee attributes, notably schooling and ability. Insofar as those attributes are associated with fewness of employers, our estimates of monopsony effects on pay become biased. Although number of employers and labour quality may not be associated across establishments within a sector, low pay may reflect low labour quality rather than monopsony power, and rural labour markets may have both fewer employers and lower labour quality.

Some reassurance is provided by two considerations. First, to the extent that establishments with higher pay employ proportionally higher labour quality in all occupations, our results for relative pay are unaffected by the lack of explicit controls for labour quality. Second, a

²⁰ We also used in the regressions alternative measures of rurality: number of cows per hectare or farmland per hectare. The three variables are highly inter-correlated and the results are not sensitive to which is chosen as control variable.

minimum educational attainment is present: first, all skilled employees possess a federal apprenticeship certificate in upper secondary education²¹; second, trainees are required by law to have obtained a certificate in lower secondary education before entering training.

Finally, as in all cross-sectional analysis, concerns arise about endogeneity. Can differences in pay across establishments be taken as exogenous, or may they be jointly determined with employment? A possible source of endogeneity might be the locational decisions of employers and workers: to the extent that firms move to low wage labour markets and workers to high wage ones, pay and employment are jointly determined. In particular, local labour markets with low pay can attract in-migration by employers, reducing the monopsony power of the existing employers. Such tendencies are however expected to be weak, given that firms typically face mobility costs too, based e.g., on: distance from customers; transportation costs; taxes; and loss of local externalities (LaFountain 2005, Devereux et al. 2007).²²

4.2. Results

We first test for monopsony power in the pay of skilled and unskilled employees in the sample of all establishments. The second step is to test for it for trainees as well, which means restricting the sample to establishments that provide apprenticeship training. We present results for both absolute pay and relative pay; in all equations are estimated by ordinary least squares, using cluster-robust standard errors.

All establishments

Starting with the full sample, we test for monopsony power in absolute pay using equation (1) above. The standardised absolute pay of skilled workers proves positively and significantly associated, as predicted, with the number of employers in the local labour market. The coefficient of 0.114 in column 1 of Table 2 means that a one standard-deviation increase in

²¹ The *Eidgenössisches Fähigkeitszeugnis (EFZ)* is a certified federal professional qualification at upper secondary education level (OPET 2009).

²² Instrumental variables regression would in principle address directly the issue of endogeneity. To be valid, an instrument would have to be associated with the number of competitors in the locality without itself having any direct impact on pay levels or differentials. Our data do not however contain such a variable.

the number of establishments in the local labour market is associated with an estimated increase in the pay of skilled workers in the establishment of 1.8 per cent. The same does not however apply to unskilled employees: changes in the number of local establishments are not significantly associated with their pay (column 3).

When the number of local establishments is divided into those in the same sector and those in other sectors, skilled pay proves positively associated with both (column 2). A one standard-deviation increase in the number of establishments in the same sector is associated with an increase in relative pay of 1.1 per cent; in other sectors, by the same amount. Neither variable is significant for unskilled employees (column 4).

These results align with the standard assumption of many economic analyses, that pay is set by monopsony power for skilled workers and by perfect competition for unskilled ones. They are however potentially impaired by the difficulty of controlling for fixed effects by establishment and locality. The difficulty is in principle removed when pay is analysed in relative terms – i.e., using differences in skilled and unskilled pay within an establishment to account for unobserved heterogeneity in the establishment and the locality..

The pay of an establishment's skilled employees remains positively associated with the number of local establishments when expressed in relative terms, using unskilled pay as the base. A one standard-deviation increase in the number of firms is associated with an increase in the skilled-unskilled pay differential of 1.6 per cent (column 5). When the sectoral affiliation of establishments is considered, a one standard-deviation increase in the number of establishments is associated with increases of 1.0 and 0.6 per cent in the relative pay of skilled employees, for 'same sector' and 'other sector' variants, respectively (column 6). This pattern suggests that competition for skilled labour has a somewhat stronger effect on relative pay when it occurs within a sector than across sectors, but that – consistent with cross-sectoral employment in some skilled occupations – competition across sectors is also influential.

Concerning other influences on pay, we find the standard positive relationship between establishment size and pay that is the predicted consequence of rising supply price, presumptively caused by monopsony power. The relative pay of skilled workers in establishments with 100 or more employees is eight per cent higher than that in those with

less than ten employees. The size effect on pay is also significantly positive for unskilled workers, but somewhat weaker than for skilled ones.

The possibility that competition for labour has different effects on pay according to the size of establishment – e.g., affecting pay less strongly in large than in small plants – is examined by interacting establishment size and number of establishments.²³ No significant interactions emerge.

Rurality, a proxy for local attributes potentially related to living costs, also matters: the number of farms in the local labour market – interpreted as an inverse proxy for living costs – is negatively and significantly associated with pay in all equations. A one standard-deviation increase in the number of farms is associated with a reduction of 1.2 per cent in skilled pay, one of 0.5 per cent in unskilled pay, and one of between 0.6 and 0.8 per cent in the skilled-unskilled pay differential, depending on whether the sectoral affiliation of local establishments is distinguished or not.

Our measure of the condition of the establishment, based on managers' reports of equipment quality and profitability, is positively associated with pay for skilled employees, but not for unskilled ones. Firms that use more modern technology or are more profitable have around two per cent higher pay for skilled workers but no pay premium for unskilled ones. All regressions involve controls for unobserved fixed effects by sector.

Training establishments

We noted in section 2 above that pay setting for trainees may differ from that for skilled and unskilled workers, and that employers may possess market power over trainees, particularly apprentices, even when they do not over unskilled workers.

We therefore widen the scope to include pay determination for trainees, which means restricting the sample to establishments that offer apprenticeship training. We first re-estimate the absolute pay and the relative pay equations (1 and 2, above, respectively) for training firms only, using the equivalent equations for trainees. We also control for the amount of training provided by including a measure of average training time provided per trainee, as

²³ Large establishments might enjoy more monopsony power than small ones, for a give number of competitors – so that, where one very large plant competes with many very small ones, number of establishments might not capture well the monopsony power of the large establishment.

measured by the weekly hours that skilled workers are removed from productive work on average in order to provide training.

The results show that the number of local establishments is associated with the absolute level of pay across training establishments, as for all establishments. A one standard-deviation increase in the number of local establishments is associated with an increase of 1.5 per cent in skilled pay among training firms, as compared to 1.8 per cent in the full sample (Table 3, col. 1).²⁴ When local competitors for labour are distinguished according to ‘own sector’ or ‘other sector’ status, the coefficients on both variables are correctly signed, but neither is statistically significant ($p=.05$; loc cit., column 2).²⁵ Nor does any significant effect emerge for the number of establishments, however the variable is defined, in the case of unskilled pay. The results for the control variables, notably the degree of rurality, are similar to those for the ‘all establishments’ sample, except that the technology-profitability index is now insignificant.

Including trainees, as distinct from unskilled employees, we find monopsony effects on absolute pay. A one standard-deviation increase in the number of local establishments is associated with an increase of trainee pay of 1.9 per cent (loc. cit., col. 5). When the sectoral affiliation of establishments is brought in, the effect is found to involve the ‘same sector’ measure, a one standard-deviation increase in which is associated with an increase in trainee pay of 3.3 per cent. The number of establishments in other sectors, by contrast, has no significant association with trainee pay.

²⁴ As economic theories of training predict that training firms have more monopsony power than non-training ones, the difference between the coefficients might be viewed as anomalous. Our result – quite apart from its small size, statistically speaking – bears however on a different issue: whether an increase in monopsony power has more effect on pay among training firms than among other ones.

²⁵ The coefficient on the ‘other sectors’ variable is significant at $p=.10$. Statistical insignificance in the training establishments sub-sample, in contrast to the results for all establishments, is associated with higher standard errors.

Table 2: Regression results: skilled pay, unskilled pay and pay differentials

	Skilled pay		Less skilled pay		Skilled/unskilled pay	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of establishments in locality per hectare (all sectors)	0.114 (0.023)		0.015 (0.015)		0.104 (0.019)	
Number of establishments in locality per hectare (own sector)		0.302 (0.153)		-0.014 (0.060)		0.368 (0.134)
Number of establishments in locality per hectare (other sectors)		0.082 (0.038)		0.021 (0.022)		0.062 (0.028)
Number of farms per hectare	-1.337 (0.414)	-1.311 (0.423)	-0.580 (0.292)	-0.584 (0.292)	-0.812 (0.350)	-0.775 (0.353)
Establishment size 10-49 employees	0.066 (0.010)	0.066 (0.010)	0.053 (0.003)	0.053 (0.003)	0.017 (0.009)	0.018 (0.009)
Establishment size 50-99 employees	0.086 (0.016)	0.084 (0.016)	0.036 (0.006)	0.037 (0.006)	0.060 (0.019)	0.059 (0.019)
Establishment size 100+ employees	0.084 (0.016)	0.085 (0.016)	0.033 (0.010)	0.035 (0.010)	0.084 (0.012)	0.085 (0.012)
Technical status of equipment / profitability	0.020 (0.005)	0.020 (0.005)	0.001 (0.003)	0.001 (0.003)	0.019 (0.007)	0.019 (0.007)
Sector controls	Yes	Yes	Yes	Yes	Yes	Yes
Occupation controls	No	No	No	No	Yes	Yes
Constant	0.991 (0.015)	0.993 (0.015)	1.035 (0.009)	1.035 (0.009)	1.294 (0.015)	1.294 (0.015)
R ²	0.105	0.105	0.449	0.449	0.342	0.343

Notes: Cluster-robust standard errors in parentheses; n = 3562

This evidence of monopsony power in apprentice pay setting is inconsistent with the assumptions of contemporary models of training, which for the most part treat trainees and ‘unskilled’ workers as identical and assume competitive pay setting for both. Also striking is the evidence that non-competitive effects on trainee pay involve the number of establishments in the same sector (i.e., ex post, the sector in which training is occurring), not the number in other sectors: trainees might be expected to lack sector affiliation before they start training. If so, competition should therefore be measured, and matter statistically, on an ‘all sector’ basis rather than an ‘own sector’ one. The result may be interpreted as evidence that potential trainees develop affiliations (preferences), by sector and implicitly by occupation (e.g. hairdressing), before they start training, combined with a high success rate for would-be trainees in terms of finding a training place in their preferred sector and occupation.²⁶ Our result suggests that offers of training by employers in sectors other than the desired one are not valued highly, even when well paid.

We now analyse pay differentials between the three occupational categories (skilled, unskilled, and trainees), as representing the specification for which uncontrolled establishment and locality effects may be expected to be weak. We consider first the pay differential between skilled and unskilled workers. The number of establishments in the local labour market again proves positively and significantly associated with pay structure. A one-standard deviation increase in the number of establishments (all sectors) is associated with an increase in the skilled-unskilled pay differential of 1.6 per cent (Table 4, col. 1) – a finding that similar to that for all firms (Table 2, col. 5).

Separation of number of establishments according to ‘own’ and ‘other’ status produces, as for absolute skilled pay, positive coefficients, but no significant association with either variable (Table 4, col. 2).²⁷

²⁶ There is empirical evidence in favour of this hypothesis, as 70 per cent of Swiss apprentices report that they get their first choice of training occupation (SKBF, 2010).

²⁷ The number of firms becomes insignificant when the sample is restricted to training firms partly because of the increase in standard errors, which may in turn reflect a reduction in identifying variation caused by non-randomness in the selection of firms according to training status: training firms are expected to have more monopsony power on average.

Table 3: Skilled, unskilled and trainee pay, training establishments only

	Skilled pay		Less skilled pay		Trainee pay	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of establishments in locality (all sectors)	0.098 (0.030)		0.022 (0.137)		0.127 (0.033)	
Number of establishments in locality (own sector)		0.200 (0.260)		0.016 (0.010)		0.959 (0.190)
Number of establishments in locality (other sectors)		0.083 (0.049)		0.023 (0.018)		0.008 (0.047)
Number of farms per hectare	-0.971 (0.512)	-0.961 (0.515)	-0.693 (0.276)	-0.692 (0.275)	-2.318 (0.584)	-2.217 (0.598)
Establishment size 10-49 employees	0.064 (0.012)	0.064 (0.012)	0.043 (0.007)	0.043 (0.007)	0.047 (0.013)	0.047 (0.013)
Establishment size 50-99 employees	0.079 (0.016)	0.079 (0.016)	0.023 (0.008)	0.023 (0.008)	0.041 (0.012)	0.039 (0.012)
Establishment size 100+ employees	0.089 (0.016)	0.089 (0.016)	0.024 (0.011)	0.024 (0.011)	0.084 (0.016)	0.084 (0.016)
Technical status of equipment / profitability	0.001 (0.007)	0.001 (0.007)	0.000 (0.007)	0.000 (0.007)	0.001 (0.009)	0.000 (0.009)
Hours of weekly training time x 10 ⁻¹					-0.026 (0.014)	-0.025 (0.014)
Sector controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.001 (0.018)	1.002 (0.018)	1.019 (0.011)	1.019 (0.011)	1.034 (0.027)	1.040 (0.027)
R ²	0.101	0.101	0.240	0.240	0.089	0.097

Notes: N= 2243; Cluster-robust standard errors in parentheses.

The number of farms, our measure of the rurality of localities, does not have a significant association with relative pay among training establishments – a result consistent with the similarity of its association with absolute pay in both employee categories (Table 3).

Similarly, the indicator used for technology and profitability is not significantly associated with relative pay.

By contrast, plant size is positively related to the skilled-unskilled wage differential, which is about 10 per cent higher in firms with 100 or more employees compared to firms with less than 10 employees. The significance of plant size is consistent with its greater importance for the absolute pay of skilled than for that of unskilled workers (Table 2, above).

Table 4: Within-establishment pay differentials in training firms

	Skilled / unskilled		Trainee / unskilled		Skilled / trainee	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of establishments in locality (all sectors)	0.100 (0.031)		0.020 (0.007)		-0.265 (0.233)	
Number of establishments in locality (own sector)		0.240 (0.241)		0.221 (0.045)		-5.706 (2.041)
Number of establishments in locality (other sectors)		0.080 (0.055)		-0.009 (0.011)		0.504 (0.365)
Number of farms per hectare	-0.381 (0.499)	-0.363 (0.507)	-0.354 (0.127)	-0.330 (0.129)	5.744 (3.575)	5.142 (3.731)
Establishment size 10-49 employees	0.034 (0.015)	0.034 (0.015)	0.002 (0.003)	0.002 (0.003)	0.105 (0.103)	0.105 (0.102)
Establishment size 50-99 employees	0.073 (0.022)	0.073 (0.022)	0.003 (0.004)	0.003 (0.004)	0.172 (0.123)	0.183 (0.121)
Establishment size 100+ employees	0.100 (0.018)	0.100 (0.018)	0.011 (0.003)	0.011 (0.003)	0.107 (0.114)	0.108 (0.114)
Technical status of equipment / profitability	0.005 (0.011)	0.005 (0.012)	0.002 (0.003)	0.001 (0.003)	0.027 (0.087)	0.019 (0.086)
Hours of weekly training time (x 10 ⁻¹)			-0.010 (0.003)	-0.010 (0.003)	0.174 (0.147)	0.167 (0.146)
Sector controls	Yes	Yes	Yes	Yes	Yes	Yes
Occupation controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.190 (0.047)	1.190 (0.047)	0.190 (0.012)	0.190 (0.012)	6.393 (0.311)	6.393 (0.313)
R ²	0.192	0.193	0.472	0.477	0.331	0.335
Observations	2243	2243	2243	2243	2243	2243

Notes: Cluster-robust standard errors in parentheses.

Turning to the pay differential between trainees and unskilled employees, we find a positive association with number of establishments (all sectors). A one standard-deviation increase in the number of establishments is associated with a 1.4 per cent increase in the relative pay of trainees (Table 4, col. 3). This suggests that reductions in competition in a locality depress trainee pay proportionately more strongly than they do skilled pay.

Breaking down competition by the two sector categories suggests – as for absolute trainee pay (Table 3) – that it is competition in the same sector, not other sectors, that matters. A one standard-deviation increase in the number of establishments in the same sectors is associated with an increase in trainees' relative pay of 4.4 per cent (Table 4, col. 4), whereas an increase

in the number in the same sector is not associated with any significant difference in relative pay.

Rurality, viz. the number of farms in the local labour market, has a significant association with trainees' relative pay: a one-standard deviation increase in the number of farms is associated with a decrease in relative pay of 1.4 per cent (*loc cit.*, cols 3, 4). This reflects the stronger negative association of absolute pay with rurality for trainees than for unskilled employees.²⁸ In addition, the relative pay of trainees and unskilled workers in establishments with more than 100 employees is about 6 per cent (or 0.12 percentage points) higher than in firms with less than 10 employees.

The number of weekly training hours provided by the employer has a significantly negative association with relative pay, consistent with the predictions of human capital theory, and reflecting lower absolute pay for trainees in establishments that provide more training. A one-standard deviation increase in weekly training hours decreases trainee relative pay by 1.6 per cent.

Finally, having tested for monopsony power over skilled employees and trainees, using unskilled employees as an implicit control group, the question arises: is monopsony power greater over skilled workers than over trainees? Influential models of training assume that this is the case, and that it generates 'wage compression'. The issue is however a priori ambiguous: some factors point to greater monopsony power for trainees than for skilled workers, others to less (section 2.2).

Our data exceptionally permit us to test for monopsony power in terms of the pay differential between skilled workers and trainees within occupations. The skilled-trainee pay differential is not associated with number of local establishments when the latter is measured on an 'all sector' basis, but it is when establishments in the same sector (only) are considered (Table 4, cols. 5, 6). A one-standard deviation increase in the number of establishments in the same sector is associated with a 3.4 per cent decrease in the pay of skilled workers relative to that of trainees (col. 6). As noted above, the pattern may be explicable in terms of cross-sector competition for skilled labour in particular occupations, combined with strong *ex ante*

²⁸ A result not shown in Table 4 is that the coefficient on number of establishment is affected only marginally by the removal of the rurality variable.

preferences for sectors and occupations among potential trainees. It suggests that monopsony power is associated with wage decompression, not wage compression, when trainees replace unskilled employees as the numeraire.

The extent of wage compression is however not significantly associated with any of the control variables – rurality, establishment size, technology/profitability, nor with training intensity – apart, that is, from fixed effects by sector and occupation.

In sum, the results suggest that monopsony power, at least in the spatial dimension that our data capture, is indeed associated with wage compression between skilled and unskilled employees, as is widely assumed in the economics of training. The evidence also suggests, by contrast, that monopsony power leads, under these circumstances at least, to wage decompression between skilled employees and trainees. This result, which does not align with the assumptions of standard economic models of training, points to the need, first, to distinguish between trainees and unskilled workers, and, second, to consider production-oriented motives in order to explain the supply of training by the employer (Wolter and Ryan 2010).

6. Conclusions

Using a direct measure of the ‘thinness’ of local labour markets, we test for the presence of monopsony power in markets for skilled labour, unskilled labour, and trainees in the contemporary Swiss labour market. We control for establishment-specific and locality-specific determinants of pay by focusing on pay differentials between skilled workers and unskilled employees, on the one side, and trainees in the same establishment, on the other.

The results suggest that firms possess market power over skilled workers, and that differences in that power are associated with differences in pay. The within-establishment pay differential between skilled and unskilled labour increases with the number of competitors in the local labour market. The finding contrasts to some earlier studies that found no effect for employer concentration on pay when controls are imposed for other locality-specific factors. A key difference from earlier studies is our definition of local labour markets, as dependent on travel-to-work time rather than political borders or travel distance, which provides us with

a superior measure of the commuting costs that underlie monopsony power, as captured here. Our evidence also covers a wider range of skilled occupations than in the previous literature, which focused primarily on single occupations, such as nurse or school-teacher.

The pay effects we estimate are moderately large. A two standard-deviation increase in both directions in the local number of establishments in the same two-digit sector, which embraces the vast majority of cases, is associated, in the results for all establishments, with an increase in the relative pay of skilled to unskilled labour of 4.0 per cent; the same increase in the number of establishments in other sectors, with an additional 2.4 per cent. These magnitudes are consistent with the view of monopsony power as ‘widespread but small on average’ (Boal and Ransom 1997: 110). At the same time, our evidence captures only differences across establishments and only one source of monopsony power. More comprehensive measures, were they available, could be expected to show bigger effects on pay.

Our finding of monopsony power for employers in the Swiss labour market opens new perspectives on the economics of work-based training. We conclude that more monopsony power is associated with lower absolute pay for skilled workers, but not for unskilled workers. These results not only align well with the assumptions of mainstream models of training, they provide unusually direct evidence in support thereof. In addition, however, we find that firms have significant monopsony power over trainees, and that the effect on pay is proportionately stronger for trainees than for skilled workers: a one standard-deviation increase in the number of local employers in the same sector reduces the ratio of skilled pay to trainee pay by 3.4 percent. Monopsony is associated with wage decompression, not compression, in this dimension of training-related pay structure.

The stronger effect of monopsony power on pay for trainees than for skilled workers indicates that the ‘action’ when it comes to its stimulative effect on training involves trainees as least as much as skilled workers. This suggests that economic models of training should be extended to allow for greater monopsony power over trainees than over skilled workers. The result may be an incentive to employers to supply higher levels of training than predicted by some models of training under wage compression. The anticipated results are both a firmer analytical basis for the economics of production-oriented training, and the prospect of an economic theory of training that has greater generality than those that currently dominate the literature.

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Table A1: Definitions of variables

Variable	Definition
Pay	Mean annual pre-tax base pay in CHF (of apprentices, averaged across all years of training, or unskilled ^a employees, or skilled ^b employees) in the occupation and establishment, calculated from its monthly counterpart, including employees' (and apprentices') social security contributions, but not including 13th and/or 14th monthly pay, other non-regular payments (performance bonuses, etc.) and employers' social security contributions
Relative pay	Ratio of mean pay in two of the three categories (apprentices, skilled employees and unskilled employees)
Establishment size	Number of employees (apprentices excluded)
Hours of formal training per trainee per week	Total hours per week that skilled workers cannot work productively because they are instructing apprentices
Number of establishments per hectare (own sector)	Number of establishments in local labour market in the same two-digit sector / Area of local labour market in hectares
Number of establishments per hectare (all sectors)	Total number of establishments in local labour market / Area of local labour market in hectares

Notes: a. Employees who have not completed any type of post-compulsory schooling.

b. Employees who have completed apprenticeship training (i.e., a vocational qualification at upper secondary level) for the occupation in which they are working.

Table A2: Number of establishments within local labour markets by two-digit sector

Sector	Mean	Median ^a	S.D.	Min	Max
Mining and quarrying	19.6	19	11.0	0	50
Manufacture of food products and beverages	140.7	120	95.7	3	376
Manufacture of tobacco products	0.6	0	1.3	0	6
Manufacture of textiles and textile products	40.9	28	38.4	0	178
Manufacture of apparel; dressing and dyeing of fur	57.5	41	55.2	0	246
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	14.4	15	9.0	0	34
Manufacture of wood, and wood and cork products, except furniture; manufacture of straw and plaiting materials	314.2	278	191.7	22	913
Manufacture of pulp, paper and paper products	15.0	10	14.1	0	52
Publishing, printing and reproduction of recorded media	295.4	195	301.8	1	1390
Manufacture of coke, refined petroleum products and nuclear fuel	0.6	0	1.0	0	5
Manufacture of chemicals and chemical products	55.6	42	49.9	0	231
Manufacture of rubber and plastic products	47.7	39	39.3	0	170
Manufacture of other non-metallic mineral products	84.9	70	59.8	3	277
Manufacture of basic metals	16.1	13	12.3	0	52
Manufacture of fabricated metal products, except machinery and equipment	431.1	369	321.8	3	1440
Manufacture of machinery and equipment n.e.c.	196.6	159	153.0	1	691
Manufacture of office machinery, data processing devices	8.2	7	7.8	0	32
Manufacture of electrical machinery and apparatus n.e.c.	63.9	50	59.7	0	287
Manufacture of radio, television and communication equipment and apparatus	39.7	30	38.0	0	205
Manufacture of medical, precision and optical instruments, watches and clocks	192.2	146	166.1	0	759
Manufacture of motor vehicles, trailers and semi-trailers	10.6	8	9.7	0	39
Manufacture of other transport equipment	22.5	21	17.3	0	75
Manufacture of furniture, jewelry, musical instruments, sports goods, games and toys and other goods	214.8	174	169.7	7	718
Recycling	21.3	17	15.9	0	67
Electricity, gas, steam and hot water supply	35.1	33	18.8	3	91
Collection, purification and distribution of water	13.7	12	10.3	0	55
Construction	1906.0	1662	1350.6	60	6660
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	830.6	695	614.5	15	3062

Wholesale trade and commission trade, except of motor vehicles and motorcycles	1193.6	898	1166.5	11	5906
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	2829.9	2057	2147.1	79	10205
Hotels and restaurants	1363.7	1172	836.5	102	4161
Land transport; transport via pipelines	445.7	353	353.2	14	1691
Water transport	5.1	3	8.2	0	39
Air transport	13.2	4	25.4	0	101
Supporting and auxiliary transport activities; travel agencies	239.5	163	239.5	6	1092
Post and telecommunications	274.5	233	180.8	20	828
Monetary intermediation	245.0	176	246.3	9	1115
Insurance (except compulsory social security)	165.8	128	119.1	6	554
Activities auxiliary to financial intermediation	214.9	137	252.0	3	1128
Real estate activities	262.8	173	263.6	4	1292
Rental of machinery and equipment without operators and of personal and household goods	56.7	44	51.4	0	237
Computing services and related activities	721.5	449	874.4	6	4310
Research and development	31.8	20	32.4	0	114
Other business activities	3533.1	2368	3767.8	47	18305
Public administration and defense; compulsory social security	498.4	421	331.0	24	1483
Education	865.4	686	679.2	26	3230
Health, veterinary and social work	1487.5	979	1274.7	15	5680
Sewage and refuse disposal, sanitation and similar activities	102.9	82	75.0	6	365
Activities of membership organizations n.e.c.	326.1	221	262.4	11	1087
Recreational, cultural and sporting activities	432.7	275	403.2	11	1844
Other service activities	804.5	592	652.7	13	3012
Mean across sectors (in-sector establishments only)	415.6	311.5	354.4	10.4	1685.1
Mean number of establishments (all sectors) per local labour market	22,175	17,196	17,845.7	1188	85,746

Notes: a. rounded up to the nearest integer where a tie occurs.