THE ROCKWOOL FOUNDATION
Research

WORKER HETEROGENEITY AND LARGE FIRMS

DAVID HÉMOUS **MORTEN OLSEN**

STUDY PAPER 174 MAY 2022

Worker Heterogeneity and Large Firms

Study Paper No. 174

Published by:

Address:
The ROCKWOOL Foundation Research Unit
Ny Kongensgade 6
1472 Copenhagen, Denmark

Telephone +45 33 34 48 00
E-mail: kontakt@rff.dk
https://www.rockwoolfonden.dk/en

May 2022

Worker Heterogeneity and Large Firms

David Hémous Morten Olsen *

February 2022

Abstract

Over the past 20 years there has been a substantial shift in the micro structure of the Danish economy: i) low labor share firms account for a substantially higher share of value added and ii) large firms are relatively larger. Though low labor share firms continue to employ skilled workers almost in proportion to their share of economic activity, their employment of less skilled workers has not increased proportionately. In this paper, we focus on wages paid by large and low labor share firms. We show that there is a substantial wage premium for both low labor share firms and large firms and that the wage premium for large firms has increased substantially over the period, almost equally across skill-type. We conclude that although some segments of the labor market has been decoupled from the growth of profitable large firms, the workers that remain do benefit substantially from the growth of their employers.

*David Hémous, University of Zurich and CEPR, david.Hémous@econ.uzh.ch, Morten Olsen, University of Copenhagen, mgo@econ.ku.dk. This project has been generously funded by The Rockwool Foundation under the project title "Globalization, New Technologies and the Labor Market". David Hémous thanks the ERC starting grant *Automation*. We thank Marcus Pill Pedersen and Emilie Vestergaard for exceptional research assistance. We thank a number of people

1 Introduction

A number of recent studies have documented a decline of the aggregate labor share, the share of total GDP that is paid out to labor. This trend is present in a number of different countries (Karabarbounis and Neiman, 2014). Recent works has demonstrated the important role of micro-data: the decline is largely driven not by a decline in the median labor share of firms, but a substantial decline for largest firms (Kehrig Vincent, 2021; Autor, Dorn, Katz, Patterson, and Van Reenen, 2021). In an accompanying paper we show that such trends are similar in Denmark (Hémous and Olsen, 2022). However, these papers study the aggregate labor share and leave untouched the question of how these changes affect different groups of workers. In this paper we take advantage of detailed Danish data linking workers and firms and specifically address this question.

In Hémous and Olsen (2022) we showed a dominant role of large firms. The share of total value added accounted for by the top 1 per cent of firms (measured by value added) rose from 25 to 50 per cent for the manufacturing sector from 1995 to 2017 and from 22 to 38 in the private sector as a whole (from 1999 to 2017). In the following we therefore focus on the wage characteristics of workers in low labor share firms and in large firms. This is particularly relevant given our conclusion in past work, that rising markups are an important driver of large firms' declining labor share. Is any of the rise in markups shared with workers? We focus on the manufacturing firms, split workers into manual workers, knowledge/management workers and service workers, and answer the question in the affirmative.

We demonstrate two facts: First, low labor share firms pay on average a $10-30\%$ per cent wage premium depending on controls. This premium has declined somewhat from 1999 to 2017. Large firms paid a slight wage premium of $1-2\%$ in 1999 conditioning on worker observables but this premium has increased by to almost 10% in 2017. Interestingly, this rise only strengthens when we include firm fixed effect. That is, a given firm increases its wage premium when it becomes large. We address the question of whether these firms pay a premium because they hire more productive workers even conditioning on observables. We do so by controlling for unobservable worker characteristics using the Abowd, Kramarz and Margolis (1999) framework. This hardly affects the premia, suggesting that large and low labor share firms do indeed pay a premium for some quality workers. This is consistent with theories of rent-sharing such as Dickens and Katz (1987) or Krueger and Summers (1989). We show that the rise in the wage premium paid by large firms, though higher for high-skill workers has been rising almost equally

across skill-types throughout the period.

Our paper is related to a blossoming literature on the heterogeneity underlying the declining aggregate labor share (Kehrig and Vincent, 2021; Autor et. al. 2021 De Loecker, Eeckhout and Gabrial, 2020). These firms demonstrate the rising importance of low labor share firms and tie these changes into rising markups and market power. Where we depart from their analyses is in the use of data on individual workers. We instead demonstrate that although large firms scale up production without corresponding rises in employment they do pay higher wages.

A substantial literature has used micro data to demonstrate that some firms pay wage premia for equally skilled workers (Abowd et al., 1999; Goux and Maurin, 1999; Abowd, Creecy, and Kramarz, 2002; Gruetter and Lalive, 2009; Holzer et al.,2011). Card, Heining and Kline (2013) use West German micro data and show that a substantial part of the rising wage income inequality from 1985 to 2019 can be explained by positive assortative matching between high-skilled workers and high-wage firms. We do not find corresponding rises in wage income inequality in manufacturing in Denmark. We instead focus on the role played by large and low labor share firms.

The paper is structured as follow. In Section 2 we outline the data. In Section 3 we highlight the central elements of Hémous and Olsen (2022) related to this paper. In Section 4, we present the main body of our analysis. Section 5 concludes.

2 Data

We rely on the matched firm and person data collected by Statistics Denmark. These cover the universe of people as well as firms in Denmark and matched employee-employer links. Each person might have several firm links any given year. We consider the one with the highest annual pay and consider only full-time employment. We focus on hourly pay (including pension and other contributions). Table 1 gives summary statistics for hourly wages for the manufacturing sector, deflated by the consumer price index. We have 263 thousand observations in 1999 falling to 147 thousand in 2017. Average log of real wages rose by .1 and the standard deviation was largely constant at around 0.36. In the following we will focus on two occupation groups, both based on ISCO88 occupation classifications. *Manual* is defined as "craft and related trades workers", "plant operators and assemblers", and "Elementary Occupations". *Knowledge and Management* workers as "Managers" and "Professionals" and "Technicians and associate professionals". We

Table 1: Summary Statistics - log of real hourly wage

	All Workers			Share of workers		
Year	Count (thousand)	Mean log(wage)	std. dev.	Knowl./man.	Services	Manual
1999	263	5.37	0.37	21%	8%	66%
2005	230	5.44	0.35	25%	10%	57%
2010	156	5.51	0.36	35%	7%	51%
2017	147	5.46	0.36	39%	7%	48%

Note: All full-time employees in Manufacturing

also show service occupations.[1] The share of manual workers has declined from 66% to 48% with a corresponding increase for knowledge and management workers. The share of services has remained relatively constant at just below 10 per cent throughout the period. Unlike in other economies (Card et al., 2013) income inequality has not risen substantially in the Danish manufacturing sector during the period considered.

In the following we highlight the main changes for firm data. We then take these trends as a starting point for our analysis using person data.

3 Changes in Firm Heterogeneity

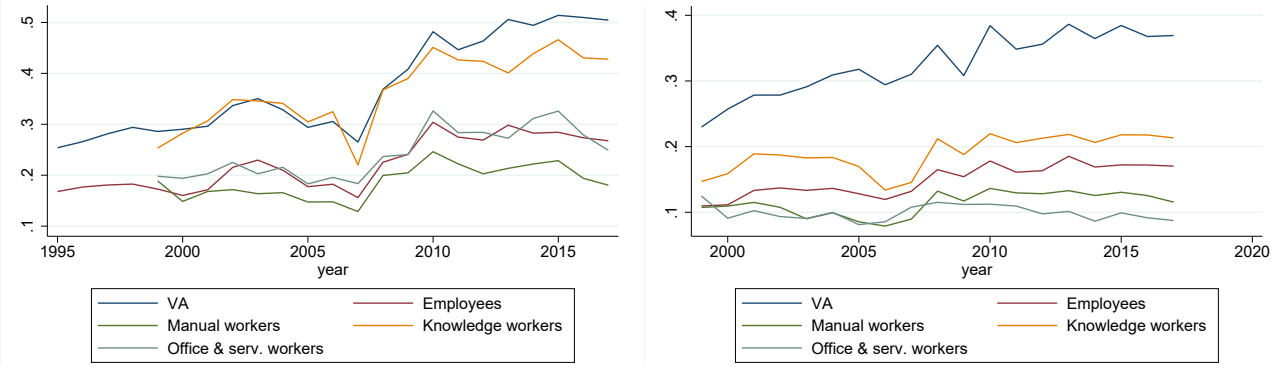
3.1 Aggregate trends for firms

We highlight to distinct features of the aggregate economy from our analysis in Hémous and Olsen (2022). First, Figure 1 considers firms in the lowest quintile of the labor share distribution, LL firms, and assign value added and various sub components of employment to these firms.

Panel A shows that the share of value added going to LL firms rose from around 25 to 50 per cent and with it the share of knowledge workers/management to from 25 to 42 per cent from 1999 to 2017. This trend is not visible for manual workers out of which around 20 per cent are employed in LL firms throughout.

Second, there has been a growing role of very large firms in the top 1 per cent of the size distribution. Figure 2 demonstrates that the share of value added going to the largest firms has increased both in the manufacturing and for the economy as a whole.

[1] The occupations don't fully add up to 100% due to a few unclassified occupations and a few classified as being in "agriculture, forestry and fishery".



(a) Manufacturing Firms **(b)** Private Sector

Figure 1: The share of total factors going to the bottom 20 per cent of the labor share distribution

This has happened while the labor share of individual firms in this group has declined substantially.[2]

In the following we supplement this analysis by considering the income of workers with a particular focus on the very large firms and those with low labor share. We also pay specific attention to workers in the two categories *manual* and *knowledge and management*.

4 Changes to the Wage Structure

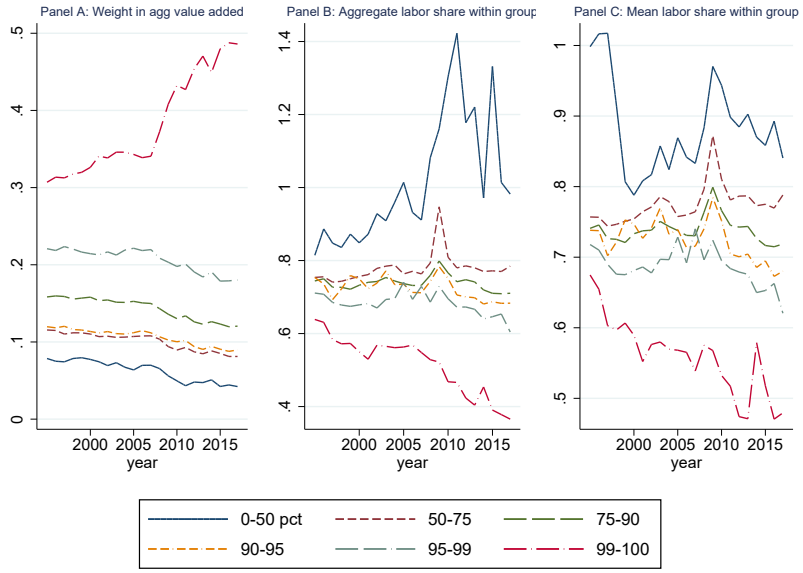
4.1 Aggregate labor income inequality

In the following we turn from the employment trends of Figure 1 and consider the labor income of workers. Throughout we consider the sample of workers in Table 1 (though a few observations are dropped when the full set of covariates are not available). First we plot 4 measures of income inequality: the standard deviation of wage income, the 80/50 gap of log wages, the 80/20 gap and the 50/20 gap. Consistent with the findings of table 1 there is little trend in overall income inequality in manufacturing during this period. Income inequality has in fact fallen among Manual workers.[3]

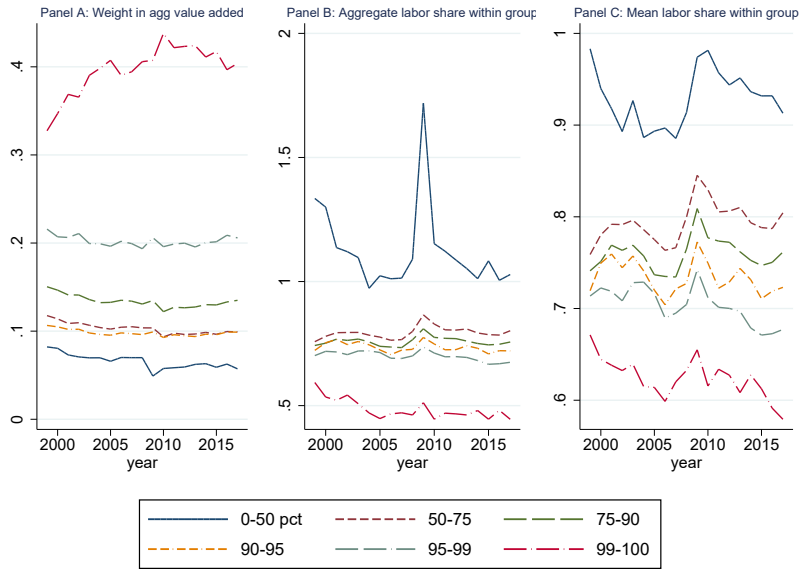
With this in mind we now turn to the main body of the analysis. The role of large

[2]Appendix 6 demonstrates that the separation rate for workers has declined slightly over the time period considered and is slightly lower for large firms.

[3]For confidentiality reason, percentiles are calculated as the average across a whole percentile, i.e. $80th$ percentile is the average across those weakly above 80 and strictly below 81.



(a) Manufacturing



(b) Private Economy

Figure 2: The aggregate and mean labor share within groups by size

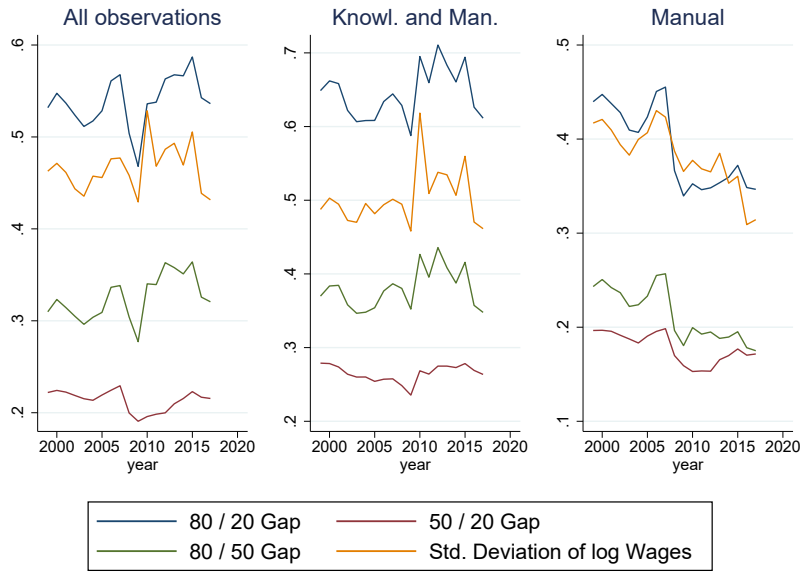


Figure 3: Log Wage Inequality trends for full time workers in manufacturing

and low labor share firms in wage determination.

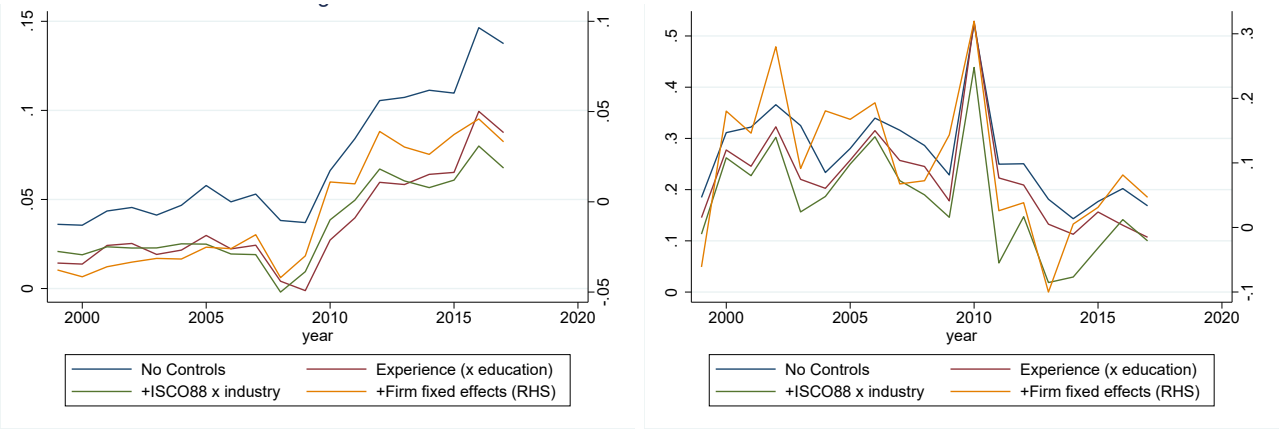
4.2 The role of large firms and those with low labor share

We run a Mincer style regression of the type

$$logw_{i,t} = \beta_1 x_{\boldsymbol{J}(i,t),t} + X'_{i,t}\beta + \epsilon_{i,t}, \tag{1}$$

where $logw_{i,t}$ are the hourly wage of worker i at time t, $\boldsymbol{J}(i,t)$ is an indicator which assigns worker i to a firm at time t. Hence, $x_{\boldsymbol{J}(i,t),t}$ is characteristics of the employer of individual i (notably, an indicator for a large firm or an LL firm) and $X_{i,t}$ contains various controls such as education, experience, industry and occupation.

We specifically focus on large firms (top 1 per cent by value added) and low labor share (those in bottom quintile). That is, we run regressions based on equation (1) and include dummies for either being large or having low labor share. We allow the coefficient to vary by year (additional information on the regression follows from Table 2 below). Figure 4.A considers four versions of equation (1) and plots the coefficient of associated with being a large firm for each (With a substantial number of observations the confidence intervals are generally very small – substantially less than 0.01 – and are omitted for clarity). The first contains only year dummies. It shows a wage premium of



(a) Coefficient on dummy for large firm (top 1 per cent)

(b) Coefficient on dummy for low labor share firm (bottom 20 per cent)

Figure 4: The coefficient on large / low labor share firms from equation (1) - manufacturing

large firms that rose by 10 points from around 4 per cent to 14 per cent. The next line includes individual controls, specifically a cubic control in experience fully interacted with three levels of education (low, middle and high). This reduces coefficient but the increase over the period considered is still 7 points. Several studies (Bernard and Jensen, 1995; Autor, Katz and Kearney, 2008) show that part of the rise in US income inequality can be explained by wages across industries. We add a full set of interactions of occupation and industry dummies though it does not much alter the coefficient on large firms (there are 35 industry codes in manufacturing and 730 occupation categories for a total of 25,550 fixed effects).

Finally, we include firm fixed effects. That is, we identify the effect of large firms as a within firm effect as they move in and out of this category. Two things appear: First, the estimated effect is negative in the early parts of the period (this line is to be read on the RHS). Second the growth continues to be almost 10 per cent over the sample. Consequently, there has been a substantial shift in the wage premium for large firm. In 2017, a given firm that grows to be among the top 1 per cent increases pay, even conditional on observables.

This is distinct from the role of LL firms where there is, if anything, a reduction in the coefficient on low labor share firms from 20 to 30 per cent in the beginning of the time period to $10-15\%$ towards the end of the time period. When controlling for firm fixed effect the same downward trend appears.

We conclude this section by including both of the terms in a regression. The results

Table 2: Wage regressed on size of firm and LL status

	(1) log(wage)	(2) log(wage)	(3) log(wage)	(4) log(wage)	(5) log(wage)	(6) log(wage)	(7) log(wage)
Large	0.0632***		0.0701***	0.0381***	0.00150	-0.0416***	-0.0565***
	(0.00102)		(0.00103)	(0.000961)	(0.00147)	(0.00195)	(0.00205)
Low Labor share		0.276***	0.327***	0.217***	0.109***	0.117***	0.124***
		(0.00501)	(0.00505)	(0.00460)	(0.00464)	(0.00464)	(0.00466)
Large x (year-1999)						0.00519***	0.00405***
						(0.000147)	(0.000149)
Large x (year-1999)xKnl							0.00136***
							(0.000166)
Large x Knl							0.0701***
							(0.00276)
Constant	5.305***	5.348***	5.298***	5.035***	5.069***	5.071***	5.069***
	(0.000870)	(0.000534)	(0.000873)	(0.00179)	(0.00194)	(0.00194)	(0.00194)
Edu x experience				X	X	X	X
Occ x industry				X	X	X	X
Firm FE					X	X	X
Obs	3590905	3590905	3590905	3588299	3586956	3586956	3586956
R^2	0.0651	0.0636	0.0679	0.308	0.353	0.354	0.354

Standard errors in parentheses

Standard errors clustered at person-level in parentheses. Year fixed effects in all regressions. Large are firms in top 1 per cent by value added, Knl refers to occupations in knowledge and management (see text for details)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

are given in Table 2. Columns (1)-(3) produce results only including year fixed effects. We recover that large firms pay higher wages on average and that LL firms do so as well. Column (4) include interaction of education and experience as well as industry x occupation fixed effect. This reduces the effect from both LL and large status by about 50 per cent. On average large firms pays 6.3 per cent higher wages and low labor share firms pay 30 per cent more. Column (5) includes firm fixed effect. The effect of being a large firm is almost negligible which reflects the finding in Figure 4.A above. Interacting with a linear effect in year recovers an increasing premium of being employed in a large firm – controlling for fixed effects — of .5 percentage points a year. The coefficient on low labor share firms remains positive, though now reduced to 12 points.

Column (7) demonstrates that this effect is stronger for workers in the knowledge and management group though not dramatically so. Knowledge workers do receive a premium for working in large firms compared with other workers of 7 percent. This effect has been growing by .541 (.4 + .14) points throughout the period slightly more than the 0.4 points for the rest of the workers

We conclude that controlling for observables, firms that grow or have a low labor

share do pay higher wages than corresponding firms.

4.3 Controlling for worker heterogeneity

Do large firms pay more because they hire more productive workers? Even controlling for occupation-specific dummies as in Table 2, there is a substantial rise in the wage premium for workers in large firms, but in principle this could be due to large firms hiring more productive workers within observable categories. In the following we address this by using the framework of Abowd, Kramarz and Margolis (1999). We run the following regression

$$logw_{i,t} = \alpha_i + \psi_{\boldsymbol{J}(i,t)} + \beta_1 x_{\boldsymbol{J}(i,t),t} + X'_{i,t}\beta + \epsilon_{i,t}, \tag{2}$$

where α_i is a person-specific effect $\psi_{\boldsymbol{J}(i,t)}$ is a firm fixed effect for the firm where individual i is employed at time t and the rest of the equation repeats the framework of above.[4] The results are given in table 3 for the manufacturing sector. Both columns contain person fixed effects and all the additional covariates of Figure 4. Column (1) precludes person fixed effect whereas column (2) includes them. Both the coefficients on low labor share firms and the trend in the coefficient for large firms decline only marginally. Consequently, the results are consistent with these firms paying a wage premium even conditioning on worker characteristics.

5 Conclusion

We focus on the wages paid by large firms and firms with low labor share. We demonstrate that firms with low labor share generally pay higher wages even conditioning on worker quality. We further find that as large firms develop a larger role in economic activity, the wage premium that they pay rises, even conditioning on their labor share. This is so across occupations.

This suggests that whereas highly profitable firms with low labor share scale up production without proportionately scaling up employment of, in particular manual workers, the ones they retain do enjoy a wage premium.

[4]Naturally, identification requires shifts of employees between firms. There is sufficient turnover in Danish firms for identification for almost all observations to be used (the number of observations decline from 3.6 million to 3.45). We implement the estimation using the reghdfe algorithm of Correia (2015). The main regression here only includes workers employed in manufacturing and consequently ignore identification for these workers' employment spells in non-manufacturing. An alternative specification would include all workers, but allow for different coefficients for manufacturing.

Table 3: Wage regressed on size of firm and LL status including person fixed effects (manufacturing sector)

	(1) log(wage)	(2) log(wage)
Low Labor share	0.117***	0.0983***
	(0.00464)	(0.00460)
Large	-0.0416***	-0.0382***
	(0.00195)	(0.00190)
Large x (year-1999)	0.00519***	0.00462***
	(0.000147)	(0.000151)
Constant	5.071***	5.294***
	(0.00194)	(0.00854)
Firm FE		
Person FE		X
Obs	3586956	3452008
R^2	0.354	0.624

Standard errors in parentheses

Standard errors clustered at person-level in parentheses. Year fixed effects, education x (cubic experience), occ x industry fixed effects in all regressions. Large are firms in top 1 per cent by value added, Knl refers to occupations in knowledge and management (see text for details)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

References

Abowd, J., Creecy, Robert, and Kramarz, F. (2002). Computing person and firm effects using linked longitudinal employer-employee data. *Working Paper*.

Abowd, J., Kramarz, F., and Margolis, D. (1999). High wage workers and high wage firms. *Econometrica*, 67(2).

Autor, D., Dorn, D., Katz, L., Patterson, C., and Van Reenen, J. (2020). The fall of the labor share and the rise of superstar firms. *The Quarterly Journal of Economics*, 135(2):645–709.

Card, D., Heining, J., and Kline, P. (2013). Workplace heterogeneity and the rise of west german wage inequality. *Quarterly Journal of Economics*, 128(3).

Correia, S. (2015). Rehdfe: Stata module for linear and instrumentantal-variable/gmm regresssion absorbing multiple levels of fixed effects.

De Loecker, J., Eeckhout, J., and Unger, G. (2020). The rise of market power and the macroeconomic implications. *Quarterly Journal of Economics*, 135(2).

Dickens, W. and Katz, L. (1987). Interindustry wage differences and industry characteristics. *Unemployment and the Structure of Labor Markets*.

Goux, D. and Maurin, E. (1999). Persistence of interindustry wage differentials a reexamination using matched worker-firm panel data. *Journal of Laobr Econonomics*, 17(3).

Gruetter, M. and Lalive, R. (2009). The importance of firms in wage determination. *Labour Economics*, 16(2).

Hemous, D. and Olsen, M. (2022). The firms behind the labor share evidence from danish micro data. *Working Paper*.

Holzer, H., Lane, J., Rosenblum, D., and Andersson, F. (2011). Where are all the good jobs going what national and local job quality and dynamics mean for u.s. workers. *Russen Sage Foundation Press*.

Karabarbounis, L. and Neiman, B. (2014). The Global Decline of the Labor Share. *Quarterly Journal of Economics*, 129(1):61–103.

Kehrig, M. and Vincent, N. (2021). The micro-level anatomy of the labor share decline. *The quarterly journal of economics*, 136(2):1031–1087.

Kruger, A. and Summers, L. (1988). Efficiency wages and the inter-industry wage structure. *Econometrica*.

Appendix

6 Separation Rates

We calculate the probability of separation across firm deciles for selected years. Figure 5 shows the result. The separation rate is slightly lower for the largest firms. It has slightly declined

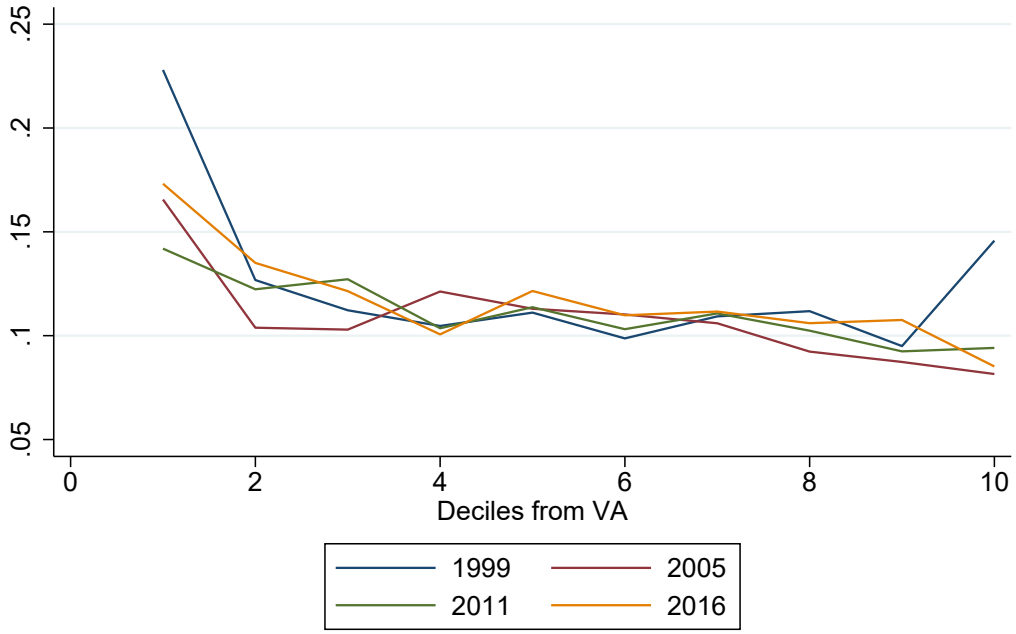


Figure 5: Share of workers that leave firm within next year by size deciles