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Wage Inequality's Decreasing Effect on Enterprise Operating Revenues

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Abstract: This study assesses whether wage inequality affects enterprises' operating revenues and whether operating revenues reversely affect wage inequality. To study our research questions, we analyze panel data from Norway and find that wage inequality decreases operating revenues. I.e., increasing high earners' wages relative to those earning low ones—or decreasing low earners' wages relative to those earning high ones—decreases operating revenues. It implies that wage inequality is detrimental to enterprise performance. Reversely, decreasing operating revenues increases wage inequality. I.e., low earners' wages are reduced relatively more than those earning high ones when enterprise revenues decrease. Increasing operating revenues, on the other hand, does not decrease wage inequality.

Keywords: dynamic unconditional quasi-maximum likelihood panel regression; dynamic GMM panel regression; instrumental variables

1. Introduction

This study aims to assess whether wage inequality affects enterprises' operating revenues and whether operating revenues reversely affect wage inequality. To study our research questions, we analyze a panel of more than 5000 Norwegian enterprises between 2008 and 2014. Largely we will argue in the following paragraphs that wage inequality is likely to decrease operating revenues, and reversely, we will argue that operating revenues are likely to increase wage inequality.

Wage inequality implies that a few employees earn relatively high wages compared to many others earning relatively low ones. Aarstad and Kvitastein (2021a) have summarized extensive literature examining wage inequality and shown that it is more prevalent in large rather than small industries in the number of enterprises (Aarstad and Kvitastein 2021b). In line with this research, other studies have found that profitability in the national economy, internal labor markets, and international trade affect wage inequality (Elgin et al. 2020; Nogueira and Afonso 2019; Pedace 2010).

An argument for wage inequality at an enterprise level is that high-earners, e.g., managers, align their interests with the owners (Beatty and Zajac 1994). This alignment of interests, in turn, induces the managers to increase enterprise revenues. High wages may moreover attract competent managers and other employees in key positions. Research has nonetheless indicated weak or absent performance effects from offering high wages to a small group of employees (Jensen and Murphy 1990; Kerr and Bettis 1987). Moreover, national-level research has even shown negative effects of economic inequality on growth and development (Berg et al. 2018; Voitchovsky 2005).

In this study, we similarly argue that wage inequality may have a negative effect on value creation. Taking an enterprise-level of analysis, we particularly suggest that wage inequality will decrease operating revenues. The reason for our assumption is that wage inequality implies that employees in lower ranks earn less than otherwise. Consequently,

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wage inequality may induce a sense of unfairness among most employees earning relatively low salaries and hamper motivation. Taken together, we argue that wage inequality likely induces a lower production of goods and services, or lower quality of goods and services produced, which hampers operating revenues.

A parallel way to craft the argument is to assume an enterprise's wage budget as a fixed unit. I.e., an enterprise can decide to distribute the wage budget relatively evenly among the employees, which induces low wage inequality, or unevenly, which induces high wage inequality. In the latter case, a large share of the employees will earn less than in the former, which may hamper motivation. Consistent with our argument above, this issue precludes value creation and depresses operating revenues.

Having argued that wage inequality will likely negatively affect operating revenues, we do not rule out an opposite positive outcome. An argument for this is that wage inequality reflects key personnel, e.g., the management group and other critical employees, being particularly stimulated to increase their achievements on behalf of the enterprise, which in turn will increase operating revenues. Voitchovsky (2005) found that economic inequality among high-earners increases national growth and development, giving weight to this reasoning. Shortly, we test the two opposing arguments empirically.

Reversely, we study if operating revenues affect wage inequality. Operating revenues likely affect wages, but it is unclear how they affect their distribution. Yet having said that, Elgin et al. (2020) found that national profitability increased wage inequality, and Aarstad and Kvitastein (2021a) showed that industry-level operating profits increased wage inequality. In line with these studies, we assume that operating revenues will not only increase average wages but also increase wage inequality. I.e., those earning most at the outset will receive the largest relative wage premium when enterprise monetary resources abound.

2. Methodology

As noted, we study a panel of Norwegian enterprises between 2008 and 2014, and it is modeled by merging person-level data with enterprise-level data. Employees at year t were identified as those working full-time in the same enterprise at year t and t_{-1}. We included enterprises with at least 20 employees in the first year registered in the data. In the following years, we included observations of those same enterprises if they had at least ten employees. Enterprises with operations at more than one plant were excluded to avoid noise in the data concerning mergers, acquisitions, and demergers.

Our variables of primary interest are operating revenues and wage inequality at an enterprise level. In addition, we include average wages and enterprise size in full-time employees as control variables. The continuous variables were log-transformed, and Table 1 reports how they were measured.

Table 1. Variables.

Variable	Description
Operating revenues	Measured in 2014 prices by using Statistics Norway's consumer price index inflator.
Wage inequality	Gini index of full-time employees' wages.
Average wages	Based on full-time employees and measured in 2014 prices using Statistics Norway's wage index inflator.
Full-time employees	Counted straightforwardly.

3. Results

Table 2 reports dynamic unconditional quasi-maximum likelihood fixed-effects panel regressions with robust standard errors (Kripfganz 2016) and models independent and control variables at t and t_{-1}. Also, it includes unreported year dummies as controls (which is also the case in later tables).

Table 2. Dynamic unconditional quasi-maximum likelihood fixed-effects panels with robust standard errors.

	Model 1	**Model 2**	**Model 3**	**Model 4**
Dependent variable at t	Operating revenues		Wage inequality	
Dependent variable at t_{-1}	0.392 ***	0.392 ***	0.437 ***	0.436 ***
	(0.073)	(0.073)	(0.021)	(0.021)
Wage inequality at t	−0.066 **	−0.063 **		
	(0.022)	(0.021)		
Wage inequality at t_{-1}	0.027			
	(0.021)			
Operating revenues at t			−0.024 **	−0.022 **
			(0.009)	(0.008)
Operating revenues at t_{-1}			0.015 †	
			(0.008)	
Average wages at t	0.659 ***	0.661 ***	0.257 ***	0.261 ***
	(0.070)	(0.070)	(0.050)	(0.050)
Average wages at t_{-1}	−0.175 *	−0.171 †	0.012	0.020
	(0.087)	(0.088)	(0.047)	(0.046)
Full−time employees at t	0.451 ***	0.450 ***	0.097 ***	0.101 ***
	(0.047)	(0.047)	(0.015)	(0.015)
Full−time employees at t_{-1}	−0.104 ***	−0.102 ***	−0.047 ***	−0.041 ***
	(0.029)	(0.028)	(0.011)	(0.011)
Year dummies included	Yes	Yes	Yes	Yes
N enterprise−year obs./enterprises	20,082/5149	20,082/5149	20,082/5149	20,082/5149
Min./avg./max. obs. per enterprise	2/3.90/5	2/3.90/5	2/3.90/5	2/3.90/5

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Two-tailed tests for regressors and robust standard errors in parentheses.

Model 1 shows that a one percent increase in wage inequality at t significantly decreases operating revenues by 0.066 percent, but the effect at t_{-1} is non-significant. Omitting wage inequality at t_{-1} in Model 2 does not alter any statistical conclusion. Models 3 and 4 show that operating revenues at t have a significant negative effect on wage inequality, but the effect is not as marked as in the two previous models. Also, the coefficient is borderline significant positive at t_{-1} (Model 3), which indicates a weak "bounce back" effect.

Concerning the control variables, average wages seem to increase operating revenues, albeit leveling off somewhat the following year (Models 1 and 2). The probable reason for the increase is that wages stimulate the production of goods and services, but wages can also be a proxy for highly motivated and productive employees (theoretically, we cannot rule out reverse causality, but Table 3, using instrumental variables, concludes similarly). Unsurprisingly, increasing employment increases operating revenues, but the effect abates somewhat the following year (Models 1 and 2). Increasing average wages increases wage inequality (Models 3 and 4), which implies that those earning most at the outset take out a premium when overall wages increase. Finally, increasing employment increases wage inequality, albeit leveling off the following year (Models 3 and 4). The increase is probably because many newly recruited employees have relatively low experience and hence earn relatively low wages.

Table 3. Dynamic two-step Arellano-Bover/Blundell-Bond GMM panels with instrumental variables and robust standard errors.

	Model 1	**Model 2**	**Model 3**	**Model 4**
Dependent variable at t	Operating revenues		Wage inequality	
Dependent variable at t_{-1}	0.195	0.185	0.506 ***	0.498 ***
	(0.184)	(0.171)	(0.133)	(0.130)
Dependent variable at t_{-2}	0.126 *	0.130 *	0.047	0.051
	(0.056)	(0.051)	(0.060)	(0.059)
Wage inequality at t	−0.099 **	−0.103 **		
	(0.037)	(0.034)		
Wage inequality at t_{-1}	0.005			
	(0.022)			
Operating revenues at t			−0.045 ***	−0.045 ***
			(0.011)	(0.011)
Operating revenues at t_{-1}			0.004	
			(0.012)	
Average wages at t	1.13 ***	1.13 ***	0.286 ***	0.288 ***
	(0.179)	(0.174)	(0.059)	(0.059)
Average wages at t_{-1}	−0.117	−0.115	0.044	0.046
	(0.117)	(0.115)	(0.053)	(0.050)
Full−time employees at t	0.750 ***	0.753 ***	0.108 ***	0.111 ***
	(0.088)	(0.083)	(0.017)	(0.015)
Full−time employees at t_{-1}	−0.063	−0.061	−0.042 *	−0.040 *
	(0.048)	(0.045)	(0.017)	(0.015)
Year dummies included	Yes	Yes	Yes	Yes
Wald χ^2	2072.7 ***	2.79×10^6 ***	395.8 ***	391.9 ***
Second order z−value [a]/p−value	−1.36/0.173	−1.51/0.131	−0.13/0.896	−0.207/0.845
Hansen J test of over−id./p−value	5.44/0.908	4.59/0.970	10.9/0.456	11.2/0.515
Diff−in−Hansen (exl. group)/p−value	4.45/0.955	3.14/0.925	9.03/0.251	9.58/0.296
Diff−in−Hansen (difference)/p−value	3.03/0.882	1.45/0.836	1.82/0.768	1.58/0.812
Number of instruments	27	27	27	27
N enterprise−year obs./enterprises	21,017/6018	21,017/6018	21,017/6018	21,017/6018
Min./avg./max. obs. per enterprise	1/3.49/5	1/3.49/5	1/3.49/5	1/3.49/5

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Two-tailed tests for regressors and robust standard errors in parentheses. [a] Arellano–Bond test for zero autocorrelation in first-differenced errors.

Table 3 replicates the previous analyses using the dynamic two-step Arellano-Bover/Blundell-Bond GMM panel regression with instrumental variables. Our motive for this estimation technique is that we cannot rule out independent variables as being strictly exogenous, i.e., we cannot rule out that "they are correlated with ... possibly current realizations of the error [term]" (Roodman 2009, p. 86). In lay terms, it implies that we cannot rule out independent variables at year t being affected by the current values of the dependent variable (Li et al. 2021). Specifically concerning our study, we have argued that wage inequality affects operating revenues and that operating revenues reversely affect wage inequality, i.e., we have argued that the causality goes in both directions. We report heteroscedasticity bias-corrected (wc) robust standard errors (Arellano and Bover 1995; Blundell and Bond 1998; Windmeijer 2005). Also, we add the lagged dependent variable at t_{-2}. The statistical conclusions are largely unaltered, except that the independent variables at t show stronger effects and that the effect of operating revenues at t_{-1} on wage inequality is now non-significant.[1] The post-estimation autocorrelation tests and

the Hansen J overidentification tests are non-significant. Similarly, the post-estimation correlations between endogenous variables and unobserved fixed effects (two last tests) are non-significant, indicating valid instruments (for an explanation of these tests, please see, e.g., Li et al. 2021).

Model 1, Table 4, using fixed effects regressions with robust standard errors, replicates the second model in the two previous tables but omits the lagged dependent variable as it could otherwise have induced biased estimates (cf. Nickell 1981). Overall, the statistical conclusions are unaltered compared to the previous models. Model 2 (Model 3) only includes observations where wage inequality increases (decreases) from t to t_{-1}. Albeit Model 3 shows a borderline-significant effect, Models 2 and 3 indicate that increasing wage inequality decreases operating revenues while decreasing wage inequality increases them. Similar exercises in Models 4–6, switching the dependent and independent variable, show that increasing operating revenues do not decrease wage inequality (Model 5). Decreasing operating revenues, on the other hand, tend to increase it (Model 6).

Table 4. Dynamic Fixed-effects panels with robust standard errors.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Dependent variable at t	Operating revenues			Wage inequality		
Wage inequality at t	−0.054 * (0.021)	−0.075 * (0.035)	−0.052 † (0.027)			
Operating revenues at t				−0.019 * (0.007)	−0.003 (0.012)	−0.023 † (0.014)
Average wages at t	0.740 *** (0.090)	0.618 *** (0.166)	0.974 *** (0.092)	0.205 ** (0.071)	0.343 *** (0.055)	0.060 (0.126)
Average wages at t_{-1}	0.008 (0.059)	−0.061 (0.122)	−0.069 (0.076)	0.116 ** (0.034)	0.049 (0.038)	0.180 ** (0.052)
Full−time employees at t	0.567 *** (0.029)	0.609 *** (0.058)	0.547 *** (0.038)	0.089 *** (0.016)	0.081 *** (0.019)	0.095 *** (0.025)
Full−time employees at t_{-1}	0.059 ** (0.021)	0.009 (0.053)	0.084 ** (0.031)	−0.015 (0.010)	−0.030 * (0.013)	0.001 (0.016)
Year dummies included	Yes	Yes	Yes	Yes	Yes	Yes
N enterprise−year obs./enterprises	27,898/6751	14,047/6127	13,851/6075	27,898/6751	15,565/5996	12,333/5597
Min./avg./max. obs. per entreprise	1/4.1/6	1/2.3/6	1/2.3/6	1/4.1/6	1/2.6/6	1/2.2/6
F−value	151.6 ***	85.3 ***	69.2 ***	14.1 ***	8.22 ***	6.88 ***
R−sq. within/between	0.232/0.583	0.259/0.597	0.229/0.571	0.020/0.077	0.027/0.102	0.022/0.052
Wage inequality at $t > t_{-1}$		Yes				
Wage inequality at $t < t_{-1}$			Yes			
Operating revenues at $t > t_{-1}$					Yes	
Operating revenues at $t < t_{-1}$						Yes

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Two-tailed tests for regressors and robust standard errors in parentheses.

4. Discussion

This study shows that wage inequality decreases enterprises' operating revenues. I.e., increasing high earners' wages relative to those earning low ones—or decreasing low earners' wages relative to those earning high ones—decreases operating revenues. The finding implies that wage inequality is detrimental to enterprise performance, and an explanation may be that decreasing low earners' wages may induce a sense of unfairness, hampering motivation among the majority earning low salaries. In turn, these issues affect the production of goods or services or decrease the quality of goods and services produced, reducing operating revenues.

Our findings align with studies showing economic inequality's negative effects on growth and development (Berg et al. 2018; Voitchovsky 2005). Also, they align with other research which indicates weak or absent performance effects from top management compensation (Jensen and Murphy 1990; Kerr and Bettis 1987). It implies that motivating numerous employees in relatively low positions with relatively high wages is more important for generating operating revenues than offering high wages and compensations to a relatively small group of employees in key positions. In other words, our findings counter the argument that increasing high earners' wages increase performance by attracting highly competent key personnel and aligning the interests of those in key positions with the owners' interests (cf. Beatty and Zajac 1994).

Reversely, our study shows that decreasing operating revenues increase wage inequality, i.e., low earners' wages are reduced relatively more than those earning high ones when operating revenues decrease. Conversely, increasing operating revenues does not decrease wage inequality, i.e., increasing operating revenues does not increase low earners' wages relative to those earning high ones.

A limitation of the study is that it only investigates a single national context. The results may deviate elsewhere in different cultures, which future research should investigate. A further limitation is that the study did not investigate which factors may genuinely explain the associations between wage inequality and operating revenues that we discovered, and this is also another topic for future research to delve into. A final limitation is that the study only investigated the changes in operating revenues as a relatively crude performance measure, and we, therefore, encourage future research to consider other output indicators. Moreover, finding that decreasing operating revenues increase wage inequality counters our argument and previous research, i.e., while industry- and national-level research shows that wage inequality increases when monetary resources abound (Aarstad and Kvitastein 2021a; Elgin et al. 2020), our enterprise-level study shows that wage inequality increases when operating revenues decrease. Level issues, measurement issues, or the use of control variables may explain the discrepancy, which we encourage future research to investigate.

5. Conclusions and Policy Implications

This study assessed whether wage inequality affects enterprises' operating revenues and whether operating revenues reversely affect wage inequality. To study our research questions, we analyzed a panel of more than 5000 Norwegian enterprises between 2008 and 2014.

The data showed that wage inequality decreases enterprises' operating revenues. I.e., increasing high earners' wages relative to those earning low ones—or decreasing low earners' wages relative to those earning high ones—decreases operating revenues. Reversely, the data showed that decreasing operating revenues increases wage inequality. I.e., low earners' wages are reduced relatively more than those earning high ones when operating revenues decrease. Conversely, increasing operating revenues does not decrease wage inequality, i.e., increasing operating revenues does not increase low earners' wages relative to those earning high ones.

A policy implication concerning the decreasing effect of wage inequality on operating revenues is that stockholders should reconsider managers' and other high-earning employees' compensation compared to those earning less. Our finding indicates that a

relatively equal wage distribution benefits enterprises' operating revenues and hence aligns with the stockholders' interests. A policy implication concerning the increasing effect of decreasing operating revenues on wage inequality is that those earning low wages at the outset should be aware of the issue, paying close attention to how they are compensated in the unfortunate event of an enterprise downscaling its operations.

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Note

[1] The Model 1 (Table 3) Stata code is xtabond2 l(0/2)y l(0/1)(x1 x2 x3) i.year, gmm(l2.y x1 x2 x3, lag(1 .) collapse) two robust where y is the dependent variable, x1 wage inequality, x2 average wages, x3 full time employees, and i.year year dummies (see Roodman 2009). Thus, independent variables are treated as endogenous at t and predetermined at t_{-1}. The Model 2 code is xtabond 2 l(0/2)y x1 l(0/1)(x2 x3) i.year, gmm(l2.y x1 x2 x3, lag(1 .) collapse) two robust. Models 3 and 4 use similar codes.

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