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Buying Out the Means of Production: Wages, Employment and Productivity in Labor-Managed Firms

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Buying Out the Means of Production:

Wages, Employment and Productivity in Labor-Managed Firms

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Buying Out the Means of Production: Wages, Employment and Productivity in Labor-Managed Firms*

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September 22, 2025

[Link to the most recent version]

Abstract

This paper studies the effect of labor management - the majority ownership of a firm by its employees - on firm-level outcomes using administrative matched employer-employee data from Italy. My approach addresses issues of endogeneity by focusing on worker buyouts (WBOs, for short) - transitions from conventional ownership to labor management. I compare WBO firms to firms that are similar in observable characteristics and also undergo a restructuring, but remain conventionally owned. Labor management causes weekly wages to decrease by 9.3%, but total compensation remains unchanged once potential dividends are taken into account. Within-firm inequality decreases because wage cuts are larger at the top of the within-firm distribution: the P90/P50 ratio decreases by 8.1%. WBO firms are also less hierarchical, with a 33.8% higher likelihood of not having any managers at all. Moreover, I show that in the short-run there is a large and negative effect on employment, which however dissipates 3 years after the transition. There is no evidence that labor-managed firms are less productive or invest less than conventional firms.

Keywords: worker cooperatives, worker representation, wages, inequality, productivity, management.
JEL Classification: G34, J31, J54, M54, P13

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Sintesi del Lavoro

Questo articolo studia l'effetto della cooperazione di produzione e lavoro – la proprietà e il controllo maggioritari di un'impresa da parte dei suoi dipendenti – sugli esiti a livello di impresa, utilizzando dati amministrativi di su lavoratori e imprese. Il mio approccio affronta i problemi di endogeneità concentrandosi sui worker buyouts (WBO) – transizioni da impresa convenzionale convenzionale alla cooperativa di produzione e lavoro. Confronto le imprese WBO con imprese simili per caratteristiche osservabili e che attraversano anch'esse una ristrutturazione, ma rimangono a proprietà convenzionale. La gestione del lavoro causa una riduzione del 9,3% dei salari settimanali, ma la retribuzione complessiva dei lavoratori rimane invariata una volta tenuti in conto i potenziali dividendi. La disuguaglianza salariale all'interno dell'impresa diminuisce perché i tagli salariali sono più forti nella parte alta della distribuzione: il rapporto P90/P50 si riduce dell'8,1%. Le imprese WBO risultano inoltre meno gerarchiche, con una probabilità più alta del 33,8% di non avere alcun dirigente o quadro. Inoltre, mostro che nel breve periodo vi è un effetto negativo sull'occupazione, che però si dissipa entro tre anni dalla transizione. Non vi è evidenza che le imprese gestite dai lavoratori siano meno produttive o investano meno rispetto alle imprese convenzionali.

Parole chiave: cooperative di produzione e lavoro, rappresentazione dei lavoratori, salari, disuguaglianza, produttività, gestione d'impresa

1 Introduction

How does the distribution of control and property rights in a firm affect its wage distribution and overall performance? In conventional firms (CFs), control and ownership are concentrated in the hands of investors or entrepreneurs. In contrast, labor-managed firms (LMFs) are owned by employees, who elect directors based on the "one head, one vote" principle. Labor-managed firms have coexisted along conventional firms for nearly two centuries and are found in virtually every economy. Currently, about 10% of the global workforce is employed in some type of cooperative [CICOPA, 2017].[1] Understanding the implications of labor management can provide insights into weaker forms of worker representation, like unions, co-determination and employee ownership, which are common all over the world [Farber et al., 2021; Jäger et al., 2021]. Some theoretical papers have argued that LMFs should pay higher wages and be more productive than conventional firms because worker ownership improves motivation and co-monitoring [Kandel and Lazear, 1992]. Others have argued the opposite, saying that common ownership could lead to free-riding [Alchian and Demsetz, 1972; Holmstrom, 1982]. Also, it is unclear whether labor management decreases *overall* wage inequality by redistributing wages from high- to low-wage workers, or only *within-firm* by inducing exit of high-earners [Abramitzky, 2008]. Given rising wage inequality [Song et al., 2019] and decreasing worker bargaining power [Stansbury and Summers, 2020], one key question is whether increasing worker representation in firms implies a tradeoff between equality and efficiency.

Providing causal estimates of labor management is challenging because a firm's legal form is chosen by its owners. A comparison of existing LMFs and conventional firms is unlikely to provide credible causal estimates. To address this issue, I study worker buy-outs (WBOs) in Italy. WBOs occur when employees of a conventional firm acquire its assets, transforming it into a worker cooperative.[2] Typically, the predecessor firm to a WBO is a firm in distress. Using detailed matched employer-employee data from Italian social security, I compare WBO firms to a matched sample of conventional firms that also undergo a restructuring but remain conventionally owned. Identification rests on parallel trends assumptions. To support the validity of my approach, I show that trends for the outcomes of interest are parallel in the pre-treatment period. Additionally, I discuss the main sources of selection into a WBO: the level of financial distress, worker homogeneity and social capital, political connections of the firm and the specificity of human capital. I show that characteristics are balanced across the two groups of firms.

This paper has five main results. First, labor management reduces weekly wages by 9.3% and this effect is persistent over the 5 years after the transition. However, weekly wages may not fully capture worker-partners' compensation, since they are also entitled to a share of profits. Indeed,

[1] Of these, about 90% are self-employed members of producer cooperatives and 10% are employees of cooperatives or worker-members of worker cooperatives. The International Cooperative Alliance was founded in 1895. It has members from 105 countries and represents 3 million cooperative firms (not all of them worker cooperatives).

[2] Worker cooperatives are the most common real-world example of a labor-managed firm. From now on, I will use the two terms interchangeably.

when accounting for dividends, the effect on average compensation is not distinguishable from zero (-5.3%, standard error 3.7%).

Second, within-firm inequality decreases because high earners experience relatively larger wage reductions. After accounting for dividends, the 90th percentile of within-firm compensation decreases by 10.7% (15.9% unadjusted), while the median decreases by 2.2% (7.4% unadjusted). Importantly, I show that changes in wage policies play an important role. Effects are virtually identical when estimated only on stayers, defined as workers employed in the firm both before and after the transition. Also, LMFs are less hierarchical. They are 22.4 percentage points (33.8%) more likely to have no managers at all and consequently have .225 fewer layers on average.[3]

Third, employment drops by about 35% after the transition, but the effect is a precisely estimated zero after two years. The short-run decline in employment is driven by voluntary quits. Workers may be reluctant to join a WBO because of financial risks, including the requirement to contribute their unemployment benefits, and additional uncertainty surrounding a relatively uncommon practice such as labor management. These separations are unlikely to be layoffs because WBOs are designed to protect jobs, and worker-members may face pressures from policy-makers to retain previous employees.[4] Given the high turnover, I also study worker sorting out of and into labor-managed firms. I find that leavers are more positively selected (had higher wages pre-transition) in WBO firms compared to leavers in counterfactual firms. Hence, the results on wages are also partly due to changes in workforce composition. New hires are similar in the two types of firms.

Fourth, conditional on participating in the WBO, employment probability improves: workers employed in WBO firms after the transition are 5.7 percentage points (6.8%) more likely (though not statistically significant) to have a job in the following year, and 12.8 percentage points (18%) more likely to be employed within two years, compared to workers in control firms. This includes jobs at any employer, not only their current one.

Fifth, labor management does not impact labor productivity, measured as value added per worker. The estimated effect is negative but not significant. However, revenues per workers are negatively affected: the estimated effect is -28.4%. Therefore, labor-managed firms produce and sell less, but not less efficiently. This is because they have lower costs of external goods and services. Consistent with the result on employment, the effect on total revenues is negative and significant in the short run, but zero in the long run. Profitability and investment are also not affected significantly.

I rationalize my findings through a model of conventional firms and labor-managed firms. I expand on the work by Kremer [1997] and Montero [2022] by allowing for worker exit from LMFs. In the model, wages in LMFs depend in part on workers' individual productivity and in part on the firm's average output. This induces an inefficiency on the choice of effort. In the conventional

[3] Here, I define a firm to have one layer if it only employs blue-collar workers, two layers if it employs blue- and white-collar workers, 3 layers if it employs blue-collar, white-collar and managerial workers.

[4] According to representatives of one large cooperative association in Italy, layoffs of pre-WBO employees are extremely rare.

sector, the level of effort is also inefficient because employers have market power and wages are a fraction of workers' individual productivity. What type of firm is more efficient is determined by the relationship between the markdown and the optimal level of redistribution. I assume that the level of redistribution is chosen by the median worker to maximize her utility, taking into account a) the optimal effort choice by other workers and b) their participation constraint, which is determined by their wage in the conventional sector. If the median worker earns less than the average, she will choose to redistribute a positive fraction of firm surplus. Hence, within-firm inequality will be lower.

Depending on the parameters, either type of firm can be more productive. I calibrate the model using parameters from the data and the literature, finding that the two types of firms have very similar productivities, but that LMFs have a more egalitarian wage distribution. I also perform comparative statics and show that the relative productivity of low- vs. high-wage workers is a key parameter determining what type of firm is relatively more productive. If high-wage workers are much more productive than low-wage workers, the optimal level of redistribution chosen by the median worker will be high (provided that she is a low wage worker). Since redistribution induces an inefficient choice of effort, this will make LMFs relatively less productive than conventional firms.

This paper contributes to four strands of literature. First, it directly contributes to the empirical literature on labor-managed firms, worker cooperatives [Craig and Pencavel, 1992; Pencavel et al., 2006; Burdín and Dean, 2009; Fakhfakh et al., 2012; Burdín, 2016] and other institutions with cooperative property rights like kibbutzim [Abramitzky, 2008] and agricultural cooperatives [Montero, 2022]. I make three contributions to this literature. First, I have an original identification strategy that allows me to provide new causal evidence. Second, thanks to the richness of the data, I am able to precisely study the efficiency-equality tradeoff by looking at both the wage distribution and firm balance sheets. Third, although a clearly relevant setting, the manufacturing and services sector of a developed economy have not been studied in recent papers on labor-management.

Second, this paper contributes to the literature on industrial relations, which has mainly focused on unions [Freeman and Medoff, 1984; Card et al., 2014; Farber et al., 2021; Frandsen, 2021]. As in the literature on unions, I find that worker cooperatives decrease within-firm wage inequality. Moreover, I find zero effects on total compensation, which is consistent with other papers in the literature. More recently, the literature on industrial relations has also studied on co-determination [Jäger et al., 2021] and worker voice [Harju et al., 2021]. Worker cooperatives can be seen as an extreme example of worker representation because they confer majority control and ownership rights to workers [Brzustowski et al., 2021].[5] Perhaps unsurprisingly, the effects estimated in this paper are larger compared to the mostly null effects in those papers. Comparing my results to

[5] Co-determination confers minority control rights to workers. For example, the German codetermination model establishes a mandate for firms with 500-2,000 employees to assign 1/3 of seats in the supervisory board to worker representatives.

previous findings in this literature suggests that worker representation is indeed a continuum and that stronger models produce larger effects.

Third, my paper is related to the literature on distressed firms and job displacement [Jacobson et al., 1993; Lachowska et al., 2020; Gravoueille et al., 2023]. In my paper, I compare two different strategies that firms can adopt to restructure and survive. Worker buy-outs are a particular response to firm distress and the threat of displacement that gives workers large control. I find that WBOs have larger short-term employment losses, but that these are very likely voluntary separations. In the long run, effect on employment are zero and there are fewer separations that result in unemployment.

Fourth, this paper contributes to the literature that studies the drivers of within-firm wage inequality, and overall wage inequality in general, both in Italy [Casarico and Lattanzio, 2024] and elsewhere [Lemieux et al., 2009; Song et al., 2019]. I focus on a particular driver of within-firm inequality, the within-firm property rights distribution, and show that it has important consequences: more egalitarian property rights lead to more egalitarian wage distributions. Importantly, I show that this happens through changes in wage policies and not only because of changes in workforce composition.

The rest of the paper is organized as follows: Section 2 explains the relevant details of the institutional context, Section 3 goes over the data, sample construction and presents my empirical approach, Section 4 shows the empirical results, Section 5 presents a model that can rationalize the empirical results. Finally, Section 6 concludes.

2 Institutional Context

In this section, I provide a brief review of the most important differences between worker cooperatives and conventional firms in terms of corporate governance and the fiscal regime. I explain the institutional framework for worker buyouts in Italy and review Italian wage setting institutions. Italy has a relatively large worker cooperative sector: in 2021, there were 17,857 WCs employing 441,897 workers (3% of all private sector workers). By comparison, the US has 364 worker cooperatives that employ 6,734 workers (less than 0.01% of all workers) [Palmer, 2018]. Figure 1 shows the prevalence of worker cooperatives in different countries, both in percentage of private sector employment and in number of employees.

2.1 Comparative corporate governance: conventional firms vs. worker cooperatives.

For the purposes of my analysis, I define conventional firms (*Società per azioni*, *S.p.a*, or *Società a responsabilià limitata*, *S.r.l.*) as all profit enterprises that distribute voting rights to partners according to capital ownership. Cooperatives (*Società a capitale variabile con scopo mutualistico*), on the other hand, generally distribute voting rights to partners according to the 'one-head, one-vote' principle.[6] Apart from the way they confer voting rights in the shareholder assembly, conventional firms and cooperatives share many aspects of corporate governance, which has not seen any major reform during the study period.[7] In both firm types, the shareholder assembly appoints a board of directors, which manages the firm and makes most decisions (hiring and firing, contracts with customers and suppliers, investments) and a supervisory board, which oversees the operations of the board of directors.[8] Worker cooperatives are a specific type of cooperative in which at least two-thirds of voting rights have to be distributed to worker-partners. Non-working partners - financing partners - can have at most one third of voting rights.[9] While there is a floor to worker-partner to partner ratio, there is no direct floor on the worker-partners to worker ratio. However, a worker cooperative must pay at least half of its wages to worker-partners and this indirectly regulates the number of non-partner workers that can be hired.

Figure 2 illustrates the main differences in corporate governance between the two governance types.

2.2 Tax regime.

Worker cooperatives and CO firms do not have differential tax regimes in terms of payroll taxes (social security contributions). Profits are taxed more favorably in worker cooperatives. However, for the purposes of this paper, it is important to keep in mind that worker cooperatives are heavily restricted in how much dividends they can redistribute. In practice, paying out dividends as a return to share capital is very uncommon in worker cooperatives. Instead, worker cooperatives redistribute profits in the form of *ristorni*, which are considered labor earnings, and are taxed similarly to other end-of-year *premia* linked to productivity.

[6] Here I deliberately use the word 'partner' and not 'worker-partner' because cooperatives can be of different types: consumer, credit, producer and worker.

[7] The last major reform to corporate law in Italy was the 2003 Law Decree n. 6.

[8] If they specifically specify so in their charter, CO firms can opt into different corporate structures, which however do not alter the distribution of voting rights among partners. These alternatives to the default option are: the two-tier board system, like in Germany, and the single-board system, where control and supervision are both carried out by the board of directors.

[9] Financing partners can be natural or juridical persons. Each individual worker cooperative can decide to relax the 'one head - one vote' for financing partners, instead rewarding them according to their capital contributions. Again, this is allowed as long as financing partners do not, collectively, have more than one third of voting rights.

2.3 Worker buyouts.

Worker buyouts (WBOs) are transitions to labor management that happen when the owners of a conventional firm sell its assets to a worker cooperative formed by previous employees of the firm. In Italy, this process is regulated by the 1985 *Marcora Law* (L. 49/1985) and usually overseen by a state agency called *Cooperazione, Finanza e Impresa* (CFI).[10] WBOs often happen when a conventional firm is in financial distress and the owners want to liquidate it. For example, a negative productivity shock can arise from bad business decisions by the directors, or from sudden drops in demand due to adverse macroeconomic outcomes in an export market. The empirical strategy will directly account for this negative productivity shock by selecting control firms that will also eventually undergo a restructuring. Workers can finance the buyout by investing their private resources (unemployment benefits, severance payments and savings), which will be augmented by a subsidized loan from CFI. The loan can never exceed twice what the workers contribute, and must be repaid within a maximum of 10 years [CFI, 2022]. The stated objective of the law is to promote entrepreneurship of workers and protect jobs [Dandolo, 2006]. Under this law, the state promoted 310 WBOs between 1986 and 2021. In the main specification, I will focus on the 54 WBOs that (i) happened between 2011 and 2020, (ii) have a predecessor that can be identified with some confidence in the Social Security data, (iii) the predecessor had at least an average of 5 employees during the pre-period. I define the predecessor as the parent firm of the worker cooperative. This analysis considers WBOs happened after 2011 in order to have at least 5 years of data before the transition and because, although CFI started supervising WBO in 1986, they paused supervising new WBOs from 2002 to 2010, resuming in 2011.

2.4 Wage setting in Italy.

Italy is a country with scope for firm-level wage setting, so labor management could have an effect on firm wage policies. Collective bargaining is a very important feature of the Italian labor market and it could in principle limit the scope for firm-level wage setting since it happens at the sectoral level. However, unions and employer associations usually only negotiate wage floors and other non-wage items (holidays, paid sick leave). Therefore, employers can always pay above the minimum. Consistent with scope for firm-level wage setting, Italy has considerable within-sector raw wage dispersion: the variance of log weekly wages is 0.52 (77% of total variance), both within (0.36, 49.51%) and between-firm (0.16, 21.43%) [Briskar et al., 2022].[11] This is true even adjusting for workforce observable characteristics (age, tenure, education, gender): Italy's dispersion in firm pay premia is comparable to Germany's and 85% of the variance is within-sector. Italy and Germany also have comparable firm pay premia estimated using two-way fixed effects model that control for

[10] Not all WBO have to receive support from CFI, but this happens in most cases.

[11] This is calculated using 4-digit sectors, but results are similar when using 2-digit sectors. For example, within 2-digit sector variance is 0.543.

unobservable but fixed worker characteristics, on top of observable ones [Abowd et al., 1999]. Over the period 1997-2003 (the latest period for which these estimates are available), the dispersion in AKM firm pay premia was 0.190 in Italy and 0.194 in Germany (over the period 1996-2002) [Card et al., 2013; Devicienti et al., 2019]. However, to the best of my knowledge, there is no decomposition of firm pay premia into within- and between-sector. Additionally, there is evidence that locality-specific shocks, like negative labor supply shocks, affect wages, which further suggests that there is scope for firms to set wages beyond sectoral agreements [Dicarlo, 2022].

Because cooperatives and conventional firms belong to different employer associations, they can sign different collective bargaining agreements (CBAs). If the wage floors are different, this could explain why cooperatives and conventional firms have a different wage distribution. Data from INPS allow me to observe what CBA regulates the employment relationship. In the majority of cases cooperative association and conventional employers associations are co-signatories to the same CBAs. The five most common CBAs for worker cooperative employees, which cover 66.84% of employee-years, are signed also by both major conventional employer associations (Confindustria and Confcommercio).[12] Among the top 10 CBAs, which cover 78.5% of total employee-year observations, only the metalworking sector has two different CBAs, one for cooperatives and one for conventional firms.[13] However, the minimum wage floors are identical at 1.488,89 euros per month. In conclusion, it does not seem like different CBAs can explain potential differences in the wage distribution in the two types of firms.

3 Data and Empirical Approach

Matched firm-worker data: INPS-Cerved. The main analysis is based on administrative matched employee-employer data from the Italian Social Security Administration (INPS) merged with firm-level balance sheet and income statement data from a private provider (Cerved).

The matched employee-employer data are based on social security records and cover the universe of private sector employees and their employers from 1974 to 2021. It is a panel of yearly employee-employer relationships with information about gross earnings (both fixed and variable), occupation, contract characteristics (fixed term vs. open ended, part-time vs. full-time), worker demographics (age, gender, place of birth, nationality) and some firm characteristics (sector, location, date of establishment). I only keep employment relationships involving workers aged 18-65 and with positive earnings. In a given calendar year, I keep one employment relationship per worker, namely the one with most full-time equivalent weeks worked.[14] I obtain weekly earnings by dividing gross

[12] The information on signatory parties, wage floors and other items is available online from *Consiglio Nazionale Economia e Lavoro* (CNEL): https://www.cnel.it/Archivio-Contratti/Minimi-retributivi.

[13] This CBA covers 2% of employee-year observations for worker cooperative employees.

[14] If there is a tie, I choose one spell randomly. I do this instead of, for example, using the spell with the highest earnings to avoid selectively dropping spells in worker cooperatives, because there might be systematic differences in earnings between WCs and CFs.

annual earnings (coming from the main employment relationship) by full-time equivalent weeks worked (again, in the main relationship); this makes the wages of part-time and full-time workers comparable. I deflate wages by the 2015 CPI. Employment at a given firm in a calendar year is obtained by counting the number of worker-year spells in that firm and year. This data also contains information about the firm's legal form, which I use to separate conventional firms from other types of firms. The concept of founding year refers to the year in which the firm started its relationship with the social security administration. The social security administration assigns a different establishment ID (not firm ID) to establishments within the same firm if they operate in different sectors. For example, if a firm operates a gas station and a coffee shop next to the gas station, these will have two distinct establishment IDs. Since my analysis is at the firm level, I define a firm's sector as the sector of the establishment with most employees in the year before the transition.

The data from Cerved are available at the firm-year level and are based on yearly balance sheet and income statements. They cover the period 1996-2018 and contain information about value added, sales, operating costs, assets and debt. I deflate balance sheet and income statement variables by the 2015 CPI. I set to missing all spuriously negative values of value added, revenues and assets. I winsorize all continuous variables at the 1% level on each tail. WBO predecessors are very likely not to report their income statements the year immediately before the buyout. In order not to lose observations at this critical stage, I impute missing observations for income statement and balance sheet variables by estimating a cohort-specific trend using non-missing observations, separately for WBO predecessors firms and non-WBO predecessor firms. This approach assumes that non-reporting WBO predecessors have, on average, the same trends as reporting WBO firms. I do this imputation mainly to avoid losing treated firms at the matching stage. All the main results are estimated omitting the imputed observations, but results do not change when using imputed observations as well.

Total compensation in worker cooperatives. Worker-partners can receive dividends at the end of the year. Unfortunately, I cannot observe dividends directly because they are not subject to social security contributions. However, since I can observe profits at the firm level from income statements, I can impute the potential dividend that each worker is eligible to receive at the end of the year. For each worker, the main definition of profit-adjusted wages is their weekly wage plus a 'potential dividend', calculated as total firm profits times the share of total wage bill that goes to that worker. I make this adjustment only if firm profits are positive and, following law requirements, I cap the profit share to be at most 30% of the total wage. I define this adjustment as 'unequal sharing adjustment'. I opt to assign profits to all employees of the firm because I cannot reliably observe which ones are worker partners.[15] In alternative scenarios, I also consider 'equal sharing adjustment', where each worker gets an equal share of profits, and both equal and unequal share adjustments going only to

[15] As explained more in detail in Section 2 employment in worker cooperative does not automatically entail partnership in the firm. Worker cooperatives are allowed to employ non-partners, as long as the share of wages they pay to non-partners does not exceed 50%.

worker-partners as identified by an additional variable.[16] This additional variable should identifiy worker-partners and comes from a separate dataset (*Comunicazioni Obbligatorie*), available only from 2010. Due to the large number of missing values and worker spuriously flagged as worker-partners in conventional firms (where by definition they cannot be worker-partners), I do not use it for the main definition of total compensation.

Cooperative type. Both INPS and Cerved data contain information about legal form, so I am able to separately flag conventionally owned firms and cooperatives. However, they have no information on cooperative *type*, which indicates who are the patrons of the cooperative. This information is key in order to distinguish worker cooperatives from other types of cooperatives that are not labor managed (e.g. consumer cooperatives, credit cooperatives, producer cooperatives).[17] To obtain this information, I match the INPS-Cerved database with the Cooperative Registry, which is the official national registry of cooperative firms. This registry was created in 2004 and inscription is mandatory.

Worker cooperatives created via worker buyout and predecessor firms. My empirical approach relies on comparing outcomes for worker cooperatives created via worker buyouts to outcomes of conventional firms that (a.) also underwent a restructuring, and (b.) are similar to bought-out firms before the transition, when both groups of firms were still conventional. I identify worker cooperatives formed through a worker buyout by matching INPS-Cerved data with data from Cooperazione Finanza Impresa (CFI), the government agency that oversees WBOs in Italy. They supervised 91 transitions from 2005 to 2021. The first challenge is to link these worker cooperatives to their predecessor firms, which are legally separate firms, and have a different firm ID in social security records. To do this, I exploit detailed information about the working histories of WBO employees, which I am able to track closely thanks to the INPS data. For each worker cooperative created via WBO, I define the predecessor as the firm who employed the largest number of the post-transition WBO workers. On average, 80% of WBO worker cooperative employees come from the same common employer. To ensure that the match is accurate, I require the predecessor to disappear from Social Security records at most one year after the establishment of the WBO firm and that employees were working at the same plant in the predecessor. I define the founding year of the worker cooperative as the event year c and assign both predecessor and successor firm a common identifier j.

Further sample restrictions. I restrict my analysis to firms that, on average over the pre-restructuring period, have at least 5 employees. This allows me to focus on firms where formal firm organization is likely to play a role beyond informal social ties, and to be able to make meaningful

[16] Profit-adjusted wages that consider all workers with equal sharing has lower within-firm (and year) variance than wages. When considering all workers with shares proportional to wages, profit-adjusted wage have exactly the same within-firm (and year) variance than wages. The definition that considers only partners with equal sharing, had higher variance than both, and the definition that considers only partners with unequal sharing has the highest variance.

[17] In consumer cooperatives, consumers are the partners of the firm. Workers can be partners but only insofar as they are also consumers.

statements about wage inequality.

3.1 What do WBO predecessors look like?

WBO predecessors are firms that eventually experience some form of distress, so how do they compare to other Italian conventional firms? Moreover, how do they compare to the population of distressed firms in Italy? In order to answer this question, I build a yearly panel of conventional firms with more than 5 employees on average, for years 2006-2018. I compare WBO predecessors three years prior to the WBO to the universe, keeping multiple observations for comparison firms. First, I do this unconditionally. In a second step, I balance on broad sector (primary, secondary, tertiary).

Compared to the average Italian conventional firm, WBO predecessors are larger, pay higher wages and are less profitable. WBO predecessors employ 45 workers on average, compared to 34 in conventional firms. Weekly wages are 0.09 log points higher (in euros 498 vs 454). Earnings Before Interest Taxes Depreciation and Amortization (EBITDA) per worker is lower but not statistically different: $9,177$ euros vs. $13,724$ euros. However, when considering overall EBITDA, the difference is large: $124,121$ euros compared to $394,743$ euros for conventional firms. WBO firms have on average, a net profit per capita of $-13,889$ euros compared to $-1,140$ euros for conventional firms. These comparisons are similar when balancing the proportion of manufacturing to service firms. How representative are then WBO predecessors? They can be seen as representative of firms with negative profits and/or negative EBITDA, which represent 28% and 17% of firms in Italy, with very similar proportions when only considering manufacturing. Moreover, firms make negative profits along their whole life cycle as shown in Appendix Figure A.1. The blue line in the graph shows the proportion of firms that report negative profits by age. For any age, at least one fourth of firms make negative profits.[18]

3.2 Selecting the appropriate comparison group

Because WBO predecessors are different from the average Italian firm, I use a matched sampling approach as in Jäger and Heining [2022] to select an appropriate comparison group to WBO firms. I identify a comparison group of firms that are in distress, are undergoing a restructuring, and have, three years prior to the restructuring, characteristics similar to the ones of treatment group of WBO predecessors.

Time notation. Let t denote a calendar year and c denote the event year, so $k = t - c$ denotes elapsed-time since the event. For each firm j, the event year c_j is defined as the first year after the

[18] This is not the product of sample attrition in the sample because this profile looks very similar if computed only using firms established between 2005 and 2010, as shown in Figure A.2. The same pattern holds for each individual entry cohort, see Figure A.3.

restructuring: the establishment year of the newborn worker cooperative for treated firms, and the establishment year of the newborn conventional firm for comparison firms. So both treated and comparison firms can belong to a cohort c.

Treatment group. I match INPS-Cerved data with data from CFI to learn which worker cooperatives were formed through one of the 91 WBOs that they supervised since 2005. Importantly, INPS assigns a new firm ID to a firm if it changes legal form, so I need to link each WBO worker cooperative to the conventional firm that was bought-out, the *predecessor*. To do this, I use the working histories of WBO employees in the first two years since the foundation of the worker cooperative. I define as the predecessor the firm that previously employed most workers of the WBO firm. On average, 80% of WBO worker cooperative employees come from the same common employer. Moreover, I check that this employer ceases to exist in the Social Security records at most one year after the establishment of the WBO firm. Finally, I also check that employees are working at the same plant. If these conditions are met, I link the two firms, consider them the same firm for the purposes of the analysis. I also drop WBO firms if they had less than 5 employees per year on average before they became a worker cooperative. This leaves me with 53 WBOs for which I find a good predecessor match and have at least one observation before and after the WBO (this excludes all WBOs in 2005 (4) and 2021(6) for lack of data before and after the WBO, respectively).

Pool for comparison group. I sample firms that undergo a restructuring, similarly to WBOs, but remain conventionally owned. I define conventional restructuring firms as follows: the firm is (i) conventionally owned, (ii) established in the same years as WBO firms (2009 to 2020), (iii) at least 60% of its employees in the year of establishment come from the same previous employer and (iv) this previous employer is conventionally-owned and ceased to exist in INPS records at most one year after the establishment of the new firm. I link flagged firms that satisfy the requirements to their predecessor (the previous employer) and consider them the same firm for the purposes of the analysis. Using this definition, I find 13,240 restructuring firms in the years 2009-2020.[19] The event that leads to a firm getting a new ID is the closure of the predecessor firm and the consequent opening of a new firm. The closure may be due to bankruptcy or sale of the predecessor and the newly created firm may have the same owners or different ones. Notice that I am excluding mergers by specifying that the new firm must be founded in the year of the transition.

Matched sampling to select comparison group. I implement a 1-to-many coarsened matching procedure separately for each cohort c, with replacement. For each WBO predecessor, I select firms that have exactly the same following characteristics in $k = -3$: quintile of employment, quintile of the hiring rate, quintile of EBITDA, a dummy variable for manufacturing, as well as quintiles of EBITDA in $k = -1$.[20] I use these variables to ensure that firms are comparable in terms of size, turnover, profitability (and thus equally palatable to an outside investor) and sector. The matching

[19] For 91% of control firms, the predecessor and the successor are in the same province.

[20] Other papers using coarse exact matching bin continuous variables by deciles [Jäger and Heining, 2022] or pentadeciles Arnold et al. [2023]. Because I have few units in the treated group, I prefer quintiles so that I do not lose too many observations.

period is $k = -3$ to ensure that this is before the distress starts, or otherwise becomes irreparable. I keep at most 5 matched comparison firms for each WBO firm. If there are more than 5 potential matches, I choose firms in the comparison group with the closest propensity score, estimated using a rich set of covariates.[21] Results are robust to using different matching variables, and to keeping only 1 matched comparison firm. I find a match for 26/51 WBO firms. The comparison group is made up of 92 firms in total, so that on average there are 3.5 comparison firms for each treated firm (median 4). I denote each matched group with g (or pairs in the 1:1 matching).

3.3 Summary statistics

This section provides summary statistics for firms in the treatment and comparison group to assess to what extent the matching procedure was successful in balancing key variables between the two groups. It should be noted that the difference-in-differences design allows for differences in average levels of outcome variables between the treatment and comparison group and instead relies on a common trend assumption. The parallel trends assumption can be evaluated by assessing pre-treatment trends and the test is informative because I have not matched on trends but only levels. Moreover, in the main specification I only exploit within matched group variation. Table 1 contains all the statistics discussed in the paragraphs below.

Wages, employment and worker demographics. Comparison firms have higher weekly wages: the average is .119 log points higher in the comparison group, with 6.23 among WBO firms, corresponding to 508 euros and 6.349 in the comparison group, or 572 euros. The 10th percentile of the within-firm distribution (P10) is .09 log points higher in the comparison group, the median is .096 higher and P90 is .119 log points higher. WBO predecessors are considerably smaller, employing 46 workers on average, whereas comparison firms employ 94. Albeit statistically significant, this difference should not be a concern because there are no labor market regulations affecting firms of these sizes differently.[22] There are no statistically significant differences in hiring or separation rates. Both are higher in WBO firms. Gender balance, average age and average tenure at the firm are balanced, and so is the use of part-time and fixed-term contracts. Comparison firms have, in proportion, almost twice as many managers.[23]

[21] I compute the propensity score by estimating a linear probability model for each cohort c that includes a degree-2 polynomial of the log of average wage, average worker age and gender proportion, linearly the standard deviation of age, the Herfindahl–Hirschman index (HHI) of municipality of origin and collective bargaining agreement (CBA), the proportions of foreign workers, managers, hiring rate, log revenues, log value added, EBITDA and indebtedness (measured as debts over EBITDA) and indicators for employment, firm age and two-digit sector.

[22] The most important threshold in firm size in the Italian labor market is at 15 employees, beyond which firms pay higher firing costs, are required to hire at least one worker with a disability and workers have a right to establish a works council. One of the two main short time work schemes (*Cassa Integrazione Guadagni Straordinaria*) is available only for firms above 15 employees in some sectors, most notably manufacturing, which is by far the most common sector in my sample. For other sectors, like wholesale and retail trade, it becomes available for firms above 50 employees. The other main short time work scheme (*Cassa Integrazione Guadagni Ordinaria*) is available for all manufacturing firms irrespective of size. For more info about Italian short time work schemes see the review in Giupponi and Landais [2023].

[23] As a reminder, I defined as managers both middle managers (*quadri*) and executives (*dirigenti*).

Firm characteristics and outcomes. There is balance in broad sector: manufacturing accounts for 84.6% of WBO firms and 82.8% of comparison firms. The percentages are different even if I do exact matching because the matching is 1-to-many. Comparison firms are 3 years older (17%) on average, but the difference is not statistically significant. Importantly, both groups make negative profits on average, which resonates with the fact that they will eventually experience distress. Overall, comparison firms seem slightly more productive and profitable, which could be because they are larger. They have higher log value added per worker, the difference is marginally significant. They also have higher log revenues per worker, log assets per worker, EBITDA per worker and profit per worker (both measured in 1,000 EU), but these differences are not statistically significant.

3.4 Estimating equation and identification strategy

I estimate the effect of labor management by comparing outcomes for WBO firms to outcomes of comparison firms after the transition using a dynamic difference-in-differences specification. I estimate the following specification via OLS:

$$Y_{jt} = \alpha_{gt} + \eta_j + \sum_{k=-5, k\neq -3}^{k=5} \beta_k \big(\mathbb{1}\{k = t - c_j\} \times WBO_j\big) + \big(\beta_{>5}\mathbb{1}\{k > 5\} + \beta_{<5}\mathbb{1}\{k < 5\}\big) \times WBO_j + \varepsilon_{jt} \tag{1}$$

where α_{gt} indicate calendar year times matched group fixed effects, η_j are firm fixed effects, $\mathbb{1}\{\cdot\}$ is the indicator function, WBO_j is a dummy variable equal to 1 if the firm is in the treatment group, c_j indicates cohort, that is the year of founding of the new firm, ε_{jt} is the error term, clustered at the firm level. The coefficients of interest are β_k and capture the effect of labor management k years after the transition. I normalize the coefficients to be zero at $k = -3$, because that is the matching period, and to be able to evaluate potential anticipation effects. By estimating year FE separately for each matched group, I only exploit the variation within each matched group and elapsed time. This is more restrictive than within-cohort comparisons common in the labor economics literature (e.g. Jäger and Heining [2022]; Schmieder et al. [2023]). I do this to avoid comparing firms that are in the same cohort, but potentially have very different characteristics.[24] Furthermore, I define as short-run effect the set of β_k when $k = \{0, 1, 2\}$, and long-run effect the set of β_k when $\beta_k = \{3, 4, 5\}$. I estimate the coefficients as follows:

$$\begin{aligned} Y_{jt} = \alpha_{gt} + \eta_j + \beta_{SR}\big(\mathbb{1}\{k \in \{0,1,2\}\} \times WBO_j\big) + \beta_{LR}\big(\mathbb{1}\{k \in \{3,4,5\}\} \times WBO_j\big) + \\ + \sum_{k=-5, k\neq -3}^{k=-1} \beta_k \big(\mathbb{1}\{k = t - c_j\} \times WBO_j\big) + \big(\beta_{>5}\mathbb{1}\{k > 5\} + \beta_{<5}\mathbb{1}\{k < 5\}\big) \times WBO_j + \varepsilon_{jt} \end{aligned} \tag{2}$$

[24] This approach is similar to the one in Greenstone et al. [2010] where they estimate the effect of opening a large plant on county-level total factor productivity but only exploit within-case variation, i.e. comparing counties that won the assignment case to counties that lost it.

I cluster standard errors at the firm level to account for potential serial correlation of outcomes across periods.

Identification assumptions and potential threats to identification. The main assumption for identification of treatment effects is that outcomes would have evolved similarly in treatment and comparison group absent the treatment. Because of the availability of pre-treatment data, and because I have matched only on levels, not trends, this assumption can be evaluated by looking at coefficients on pre-treatment periods $k < 0$. Coefficients should be close to zero if the two groups follow parallel trends before the treatment. Any shock that simultaneously affects outcomes and selection into a WBO is a threat to identification.

I examine six potential sources of selection: financial situation, trust levels, worker homogeneity, political connections, firm-specific human capital and access to subsidies. First, the financial situation of WBO predecessors may have a worse trajectory than comparison firms. This would mean that outside investors are unwilling to buy the firm, and therefore a WBO is an option of last resort for workers. Figure 3 shows that EBITDA and net profits are evolving more negatively in WBO firms compared to comparison firms. EBIT, indebtedness and returns on assets (ROA) have negative point estimates, even if they are not statistically significant. Therefore WBO firms appear to be negatively selected. I take this evidence to mean that the estimated effects are to be taken as a lower bound because it is likely that if firms with a flatter decline in profitability were to carry out a WBO, they would be more productive and pay higher wages. Instead, the effects on inequality should not be affected.

Second, workers in WBO predecessors may have higher levels of trust. Trust refers to the ability to coordinate on socially optimal equilibria, the ability to sustain these equilibria over time and the expectation that others will do the same. Higher levels of trust would explain the ability to overcome the collective action problem that underlies a WBO. This would be a threat to identification if trust affects outcomes, for example labor productivity, both when the firm is conventionally managed and when it is a worker cooperative. I proxy trust using two measures: the share of foreign workers to total employees and the concentration of employees' birth municipality. I use the share of foreign workers as a proxy of trust because research in psychology and political science has shown that people tend to trust people from their same ethnicity more.Birth municipality, which I measure by computing the Herfindahl–Hirschman index (HHI), is relevant because workers from the same town are more likely to share social ties and have higher levels of trust.[25] As shown in Panel B in Table 1, the foreign share in WBO predecessors is about the same as in conventional predecessors. Moreover, although birth municipality is significantly more concentrated in WBO firms, the size of the difference is not quantitatively large.[26]

[25] I chose municipality of origin over province because Italy has a large degree of fractionalization and there can be rivalries between towns a few kilometers apart.

[26] For reference, if employees came from 4 birth municipalities in equal shares, the HHI would be 0.25. If they came from 5 birth municipalities in equal share, it would be 0.2.

Third, a related issue, workers in WBO predecessors may be more homogeneous in terms of economic preferences. We would expect this because homogeneity of preferences helps making more timely and less conflictual decisions. Therefore, more homogeneity could increase the expected value of a WBO for workers. I measure preference homogeneity with two proxies: the concentration of collective bargaining agreements (CBA) that cover workers' employment relationship, and the standard deviation of age. CBA dispersion is relevant because workers covered by different CBAs could belong to different unions and be subject to different rules regarding wage floors, job protection and other non-wage amenities. The standard deviation of age is relevant because older worker-partners have fewer incentives to invest in the firm compared to younger ones. I find substantial balance on both of these dimensions.

Fourth, WBO workers may have better access to information about the possibility of carrying out a WBO. If they acquired this information randomly, as for example through the assignment to a particular bankruptcy administrator, this would not be problematic.[27] It could be problematic if it is related to better connections to politicians and bureaucrats because political connections may smooth regulatory and bureaucratic frictions for connected firms [Akcigit et al., 2023]. Firms' political connections, measured as employing at least one politician in the firm, are not common: Akcigit et al. [2023] find that this probability is 3.5%, which however increases to 45% among firms with more than 100 employees. In my sample, the great majority of firms, 88%, has less than 100 employees (the median is 30). Therefore, it is unlikely that political connections play a role in this context.

Fifth, workers may have stronger incentives to carry out a WBO if they have acquired more firm-specific human capital. To proxy for this, I measure in-sample tenure (that is starting from 2005). Workers in WBO predecessors have roughly the same tenure as workers in conventional firms, 4.1 vs. 4.3 years, a 4.7% difference.

Sixth, WBO firms have access to subsidized loans. A potential worry is that the WBO is effectively a bundle of two interventions, the transition to labor management and the subsidy. However, subsidized loans are widely available to firms in my control group, that is small and medium enterprises (SMEs), especially in manufacturing. There are two large schemes that the Italian government put in place to ease credit conditions for SMEs: the Guarantee Fund (*Fondo di Garanzia*) and the Capital Goods (*Beni Strumentali*) schemes.

4 Empirical Results

In this section, I first examine effects on firm survival. Second, I then present results from the event studies on average wages, wage percentiles and hierarchy. Third, I show results on employment, job stability and worker sorting. Lastly, I examine differences in value added per worker, sales per

[27] This was the case for the WBO of Cartiera Pirinoli, a firm in the paper sector in the Piedmont region.

worker, assets per worker and profits per worker.

4.1 Firm survival

WBO firms have a higher survival rate than conventional firms. This can be seen from Figure 4, which shows the ratio of firms in my sample at $k = -3$ that are still active at each elapsed time k. For each elapsed time k, the numerator is the number of firms active at period k, and the denominator is the number of firms that were active at the baseline period $k = -3$ and are not mechanically out of the sample because they are from a late cohort. For instance, the 2018 cohort, i.e. for which $k = 0$ in 2018, cannot be in the sample at $k = 4$ because the observation period ends in 2021. Hence the denominator at $k = 4$ will be the number of firms in cohorts 2017 and earlier. Notice that survival rates are 1 in the window $k \in [-4, 0]$ because the panel is balanced in these elapsed time periods. Survival rates are virtually identical in the two groups in $k = 1, 2$, whereas they are 5 p.p. (6%) and 9 p.p. (11%) higher for WBO firms in $k = 3$ and $k = 4$, respectively, and finally 1.5 p.p (2%) higher in $k = 5$. These findings are consistent with the idea that worker-partners prefer to take on less risk than conventional firm owners because they concentrate both their human and financial capital in the same firm [Bonin et al., 1993].[28] Overall attrition is identical in the two groups, see Appendix Figure A.4.

4.2 Wages distribution

Weekly wages. Figure 5 shows the event study estimates of the effect of labor management on average weekly wages (blue dot) and average weekly wages adjusted by profit per worker (red diamond). Panel A of Table 2 shows the aggregated coefficients β_{SR} and β_{LR} for both measures of compensation. The results show that labor management decreases average weekly wages by about 10%, but that this effect is less negative and statistically indistinguishable from zero when adjusting for profits. Results are quantitatively similar when applying the adjustment to worker-partners only, as shown in Appendix Figure A.5. As explained in Section 3, I do not consider the worker-partner identifiers to be sufficiently reliable and therefore my preferred definition of total compensation augments the wage by a share of profits proportional to wage for all workers. The coefficients on the periods before treatment can be used to assess the parallel trends assumption. All pre-treatment coefficients are statistically zero. However, the coefficient β_{-1} is negative and large. This could be due to anticipation effects, as WBOs take more time to be carried out than a conventional restructuring. WBOs implicate extra layers of negotiation: on top of the previous owners, trade unions and, if the predecessor is insolvent, the insolvency administrator, WBOs involve the workers, the cooperative employer associations and CFI (the government body). Additionally, compared to a traditional restructuring, the process is more salient to employees because most workers will be

[28] This idea is supported by one experiment, where managers of LMFs were found to be more risk averse than managers of conventional firms [Alves et al., 2022].

actively involved or at least aware that the WBO is happening. When I estimate effects on stayers only, I find similar effects, which suggests that firms are adjusting wages even before the WBO. In later paragraphs, I will present the full set of results estimated on stayers only and discuss them more in detail.

Within-firm inequality. I am interested in the distributional effects of labor management. Hence, I estimate an event study specification using different percentiles of the within-firm wage distribution as outcomes. Figure 6 shows the event study for percentiles 10, 50 and 90, both unadjusted (top panel) and adjusted for profits (bottom panel). Within-firm inequality decreases significantly after a WBO. When I estimate aggregate coefficients for short and long run, I find statistically significant differences between the effects on the median wage and the effects on the 90th percentile, as can be seen from Panel A in Table 2. In the short run, there is a clear gradient in the effects, as shown in Appendix Figure A.6. This gradient disappears in the long run, with the exception of the 90th percentile, which remains substantially lower. This can be seen from Appendix Figure A.7

Estimation using only stayers. The effects on wages at the firm level could be due to changes in worker composition caused by worker mobility, or to changes in wage policies. Assessing the mechanism is important to understand if the somewhat negative wage effects are caused by the outflow of high-wage workers and/or the inflow of low-wage workers, as opposed to lower wages for the same worker types. Moreover, it is important to establish if worker cooperatives reduce inequality overall because they pay more egalitarian wages to the same group of workers, or if they only reduce within-firm inequality by inducing changes in the worker composition. To understand this mechanism, I estimate the same event studies using stayers only. I define a stayer as a worker that is employed at the firm continuously from 3 years before the event to 2 years afterwards. I choose to focus on a narrower time window in order to have enough stayers. I find that wage effects for stayers are very similar to the ones in the firm overall, which provides strong evidence for the wage policy channel. Table 3 shows the results. Appendix Figure A.8 shows event study estimates on average weekly wages, both unadjusted and adjusted. They are remarkably similar to estimates using all workers. Similarly, Figure 7 shows estimated effects at percentiles 10, 50 and 90. By definition, effects here can only be driven by changes in wage policies at the firm, and not by changes in worker composition. Notice that the effects are more negative for P90, even when adjusting for profits. There is evidence of an anticipation effect: the coefficient on β_{-1} is negative and significant. Looking at results separately by percentiles it looks like wages for low earners are being adjusted downwards even before the WBO. There are two potential explanations. First, in anticipation of a WBO, the firm might decide to use short-time work schemes, this would explain the drop in wages, as workers on short-time work receive only 80% of their salary. It would also be consistent with the distributional effects, because it is reasonable to think that low wage workers are more likely to be put under short-time work. The second explanation is that workers accept wage cuts in anticipation of the WBO, but do so according to their bargaining position under conventional management, where high wage workers have more bargaining power. This would

explain both the wage cuts and their distribution. Hence, changes in wage policy are important to understand effects on wages and within-firm inequality. This is not to say that there are no changes in worker composition, an issue that I will explore more in detail later. However, changes in composition alone cannot explain the whole of wage effects.

Hierarchy. I find that firms become less hierarchical once they are labor managed. I proxy hierarchy using two inter-related measures: the probability of having 0 managers, and the number of layers in the firm. I say that a firm has 1 layer if there are only blue-collar workers or only white-collar workers, 2 layers if there are both blue- and white-collar workers but no managers, and 3 layers if there are both blue- and white-collar workers and managers. Managers are defined as both middle-managers (*quadri*) and executives (*dirigenti*). I also measure managerial intensity as the proportion of managers among the total number of employees. Figure 8 shows the event study estimates for the three outcomes, while Panel D of Table 2 shows aggregated short-run and long-run coefficients. Labor management reduces the probability of having at least one manager by 20 percentage points, it reduces the number of layers by .2 and, although not statistically significant, the ratio of managers over total employees by .02, a 11.1% reduction given the baseline mean of .018 for WBO predecessors. As I will explain show in subsection 4.3, this change in hierarchy comes from separations with managers of the predecessor firm and the lack of replacement hires. Consistent with this idea, the effect is zero if I re-estimate the event study using stayers only, as shown in the top right panel of Figure 8.[29]

4.3 Employment, job stability and worker sorting

Employment. The top panel of Figure 9 shows event study estimates on the logarithm of full-time equivalent employees. Pre-treatment coefficients are close to zero, which is evidence that the parallel trends assumption holds. Effects on employment are negative and significant for the first two years, but not afterwards. When aggregated, coefficients are negative and large in the short-run and, while still negative, not distinguishable from 0 in the long run. This can be seen from the coefficients in Panel B of Table 2. The effects in period $k = 0$ are driven by more separations and not less hiring, whereas the recovery in employment in period $k = 3$ is driven by a combination of lower separation rates and higher hiring rates. This is shown in the bottom panel of Figure 9, which plots event study estimates for hiring and separation rates. With this data, I cannot separate quits from layoffs because firms in the post periods are new entities for Social Security and therefore stayers are considered new hires, whereas quitting or fired workers are simply non-hired workers. However, there are good reasons to think that non-hires in WBO firms are due to voluntary quits rather than layoffs. First, there is financial risk involved because workers are asked to invest their private resources: unemployment benefits, severance pay and savings. Second, joining a WBO involves considerable uncertainty about firm performance and most workers are not familiar with

[29] A negative effect on stayers could be interpreted as an actual 'downgrading' to white-collar or blue-collar occupations, or simply as a re-labeleling, whereby they keep operating as managers.

being employed at a worker cooperative, let alone being members of one. Third, one of the stated aims of WBO is to protect jobs, so any coalition of worker-partners will face pressures from the government agency to include as many previous employees as possible. On the other hand, there are competitive pressures to reduce the workforce and these could be compounded by pressures from lenders (banks or cooperative funds), so there is potentially scope for some employees to be excluded.[30]

Job stability. As already noted for firm survival, workers may have different risk preferences than conventional firm owners. For example, they may favor more job stability over higher revenue growth. Since the labor-managed firm maximizes worker preferences, we might expect jobs in worker cooperatives to be more stable. I capture this notion by measuring two outcomes: the probability of having a job (extensive margin) and the number of weeks worked (intensive margin). For each worker at year t, I measure these two outcomes for both $t+1$ and $t+2$ (1 and 2 years into the future), irrespective of the firm that employs them; then, I take the average for firm j in year t. Panel E in Table 2 shows aggregated coefficients. Appendix Figure A.10 shows the corresponding event studies for outcomes in $t+1$ (top panel) and $t+2$ (bottom panel). For both employment probability and number of worked weeks, coefficients at $t+1$ are positive but not significant. For $t+2$, coefficients for both variables are positive and significant, suggesting higher job stability. For example, a worker in a WBO firm is about 15 percentage points more likely to be employed in 2 years time. Looking at pre-treatment coefficients on the probability of being employed supports the common trends assumptions for both the one-year and two-year forward-looking outcome: the point estimates for elapsed time periods $k = -2, -4, -5$ are very close to zero, which means that there is no anticipation or differential trends. This is true for one-year forward looking weeks worked, but not for two-years. In particular, it looks like workers in WBO predecessors are working fewer weeks in $k = -1$, which can be seen from the coefficient on $k = -2$ coefficient in the top panel of Appendix Figure A.10. Since the normalization in $k = -3$ is affected by what happens in $k = -1$ in the two-year forward looking outcome ($t+2$), the coefficients should not be interpreted as causal for this outcome.

Movers: leavers and newcomers. Given the large changes in employment in the early years after the transition, it is interesting to document the characteristics of movers. Labor management may causally induce sorting of workers out of the firm and into the firm. To study whether there is systematic selection of workers, I compare the differences in labor market outcomes and fixed characteristics between movers and stayers in WBO firms to differences between movers and stayers in comparison firms. To ensure that labor market outcomes are not influenced by the WBO, I base these comparisons on workers' characteristics in year $k = -2$, before the transition. This difference-in-difference approach enables me to isolate the effect of labor management on worker sorting, while controlling for the impact of firm restructuring.

[30] Checking whether leavers go to some other job or unemployment could give a hint on whether the separations are voluntary or not. However, this is not a perfect solution because searching for a job while receiving unemployment benefits is a valid strategy.

Leavers. Leavers are movers that were employed in a sample firm before the transition and switch firm after it. For each worker i employed in firm j in $k = -2$, I am going to assign them a dummy variable L_i equal to 1 if they do not work for the same firm j in $k = 1$ (leavers), and equal to 0 otherwise (stayers).[31] Since I am interested in the different characteristics that determine sorting, I use pre-treatment outcomes in my analysis. I estimate the following regression:

$$y_{it} = \gamma_1 L_i + \gamma_2 \big(L_i \times WBO_{j(i)t}\big) + \gamma_3 X_{it} + \eta_{j(i)} + \alpha_t + \varepsilon_{it} \tag{3}$$

where L_i is a dummy equal to 1 if the worker is a leaver, $WBO_{j(i)}$ is a dummy equal to 1 if firm j employing worker i is a WBO predecessor, X_{it} are worker controls, $\eta_{j(i)}$ are firm FE, α_t are calendar year FE, ε_{it} are standard errors clustered at the firm-year level. A clarification is in order: even if the characterization of leavers exploits the panel structure of the data, this regression is a cross-sectional because, for each firm and worker, I only consider outcomes in $k = -2$.

Compared to leavers in conventional firms, leavers in WBO firms earn higher yearly wages, higher weekly wages (but not significantly so) and are more likely to be managers, as shown in Figure 10. This is consistent with the idea that the prospect of redistribution drives high earners out of the firm. It is also consistent with workers with better outside options being more likely to leave WBO firms, but that depends on the model of wages that one assumes.[32] Just looking at average wages may miss heterogeneous effects across the distribution. Because of this, I run the same regression with deciles of the within-firm distribution as an outcome. Results are shown in Appendix Figure A.12. Compared to leavers in conventional firms, leavers of WBO firms are more likely to come from the top of the wage distribution. Therefore, part of the results on wages in Section 4.2 can be explained by changes in worker composition.

How does a leaver compare to a stayer? To answer this question I run a regression as in (3) using only comparison firms and look at the coefficient on L_i. Results are shown in Appendix Figure A.11. In comparison firms, leavers are negatively selected in terms of wages, both weekly and yearly, work fewer weeks, are less tenured, older and more likely to be women.

Newcomers. Newcomers are movers that join a sample firm only after the transition. For each worker i employed in firm j in $k = 1$, I am going to assign them a dummy variable N_i equal to 1 if they did not work for the same firm j in $k = -2$ (newcomers), and equal to 0 otherwise (incumbents). Since I am interested in the different characteristics that determine sorting, I am going to use pre-treatment outcomes in my analysis. I estimate an identical regression as for leavers, still using outcomes in $k = -2$.

$$y_{it} = \gamma_1 N_i + \gamma_2 \big(N_i \times WBO_{j(i)t}\big) + \gamma_3 X_{it} + \eta_{j(i)} + \alpha_t + \varepsilon_{it} \tag{4}$$

[31] Notice that since the number of firms in the sample small, each worker experiences at most one restructuring, so the elapsed time variable is unique for each worker, and so is the dummy L_i.

[32] For example, this is true if one assumes that firm-specific human capital is either negatively correlated with wages, or not correlated at all.

where N_i is a dummy equal to 1 if the worker is a newcomer, $WBO_{j(i)}$ is a dummy equal to 1 if firm j employing worker i is a WBO predecessor, X_{it} are worker controls, $\eta_{j(i)}$ are firm FE, α_t are calendar year FE, ε_{it} are standard errors clustered at the firm-year level.

Newcomers in WBO firms are not different to newcomers in comparison firms, as shown in Figure 11. In comparison firms, newcomers were earning lower yearly wages because of fewer weeks, were younger, less experienced and less tenured, as shown in Appendix Figure A.13.

4.4 Productivity, investment and profits

In this section, I present results on productivity, revenues, profitability and investment. To do this, I use income statement and balance sheet data from Cerved (available in the Social Security databases) for the period 2005-2018. An important caveat of results using this data is that I loose observations for firms after 2018 and that it is common for firms not to report their income statements and balance sheets in the year before the transition, likely from a combination of not being able to meet the administrative costs of producing the necessary documentation and not having incentives to report.

I measure productivity using the natural logarithm of value added per worker, a measure commonly used in the labor economics literature. Value added is computed as sales minus cost of goods (and services) sold. I then divide value added by the number of full-time equivalent workers and take its natural logarithm. Overall, I find that worker cooperatives are as productive as conventional firms. The top right panel in Figure 12 shows event study estimates for this measure of productivity. Pre-period coefficients are zero, which is evidence that the common trends assumption holds. Post-transition coefficients are also close to zero. When the coefficients are aggregated, as in Panel A of Table 4 they are negative, both in the short run and in the long run, but not statistically different from 0. Overall value added is lower in WBO firms, at least in the short run, but this can be explained by lower employment, which recalling from Table 2 in Section 4.3 is -.414 log points lower (or 38.2% lower) in the short run. In the long run, the coefficient is still negative but not statistically different from 0.[33] Compare these results with the -.350 (s.e. 0.006) coefficient from a 'naive' regression of log value added per worker on a worker cooperative dummy and both sector-year and province-year FE estimated on the full sample of firm-year observation in Cerved-Social Security registry.[34]. My results are consistent with previous literature, which found either no effect of being a worker cooperative on productivity, or negative effect for the production of some type of goods, but positive effects for others [Fakhfakh et al., 2012; Montero, 2022].

Log revenues per worker are lower in worker cooperatives. Taken together with the results on value added per worker, it looks like WBO firms produce less, but not less efficiently. They cut

[33] For employment, the long run coefficient is -.160 (p-value: .307).

[34] This sample is simply the aggregated version of the full worker-year sample that I mentioned before. It contains 5,567,969 firm-year observations.

material costs to produce less output. Pre-trends coefficients are zero except for $k = -1$. This suggests strong anticipation effects. Because employment and value added are stable in $k = -1$, this suggests that WBO predecessors either stop producing and instead sell their inventories of final goods, or alternatively that they keep producing by using the stock of intermediate goods.

Worker cooperatives do not seem to underinvest in the long run, but they somewhat do in the short run, as can be seen from Figure 13 and Panel A of Table 2. The coefficient on log assets per worker is negative and significant in the short run, but although negative, not significant in the long run. Anecdotally, WBO firms tend to rent out machinery at the beginning, to then gradually buy them out. This suggests that, although worker cooperatives might be constrained at the beginning in the amount of capital that they can buy, they do not persistently underinvest in capital, as implied by some theories of the firm [Alchian and Demsetz, 1972].

Results on profitability are shown in Figure 3 and Panel B of Table 4. WBO firms are as profitable as conventional firms. Coefficients on EBITDA are negative, whereas coefficients on EBIT and net profits are positive. None of them are significant.

4.5 Robustness checks

A potential concert is that the results presented in the sections above are particular to the particular choice of matching variables. To alleviate this concern, I perform robustness checks by varying the matching variables. These checks demonstrate that the main results are robust to different matching specifications. In this section I present results of two series of robustness checks. In the first, I perturb matching variables. In the second, I build a counterfactual using synthetic difference-in-differences [Arkhangelsky et al., 2021].

Other matching specifications. Matching is subject to an arbitrary selection of the matching variables. In order to show that the main empirical results do not rely on the particular choice of matching variables, I show estimates under three different matching specifications. As a reminder, the main matching specification (M1, for short) selects units in the control group via coarsened exact matching with the following variables: quintiles of number of employees, hiring rate, EBITDA in $k = -3$, EBITDA in $k = -2$ and a manufacturing dummy. The alternative matching specifications are as follows:

M2: $\pm 10\%$ number of employees, quintiles of hiring rate, EBITDA in $k = -3$, EBITDA in $k = -2$ and manufacturing dummy. This specification is the same as M1 except it more aggressively targets balance on employment.

M3: quintiles of number of employees, hiring rate, EBITDA $k = -3$ and manufacturing dummy. This specification is M1 without EBITDA in $k = -2$. This is done to ensure that there is no targeting of trends.

M4: quintiles of number of employees, hiring rate, EBITDA in $k = -3$, revenues in $k = -2$ and manufacturing dummy. This specification is M1 but it swaps EBITDA in $k = -2$ for revenues in $k = -2$ to achieve better pre-treatment trends on sales.

Overall, results are similar when using different matching specifications. The significance and sign of the main estimates does not change. Hence the interpretation of the results does not change. Importantly, the interpretation of the estimates does not change. Figures A.14, A.15, A.16 show results using matching specifications M2, M3 and M4, respectively.

Synthetic differences-in-differences. Another potential concern is that results may be driven by the use of matching itself. There are reasonable alternatives to matching, like synthetic control methods. To alleviate concerns related to the uniqueness of matching, I show estimated results using synthetic differereces-in-differences (SDID) Arkhangelsky et al. [2021]. As the name suggests, SDID combines synthetic control methods to differences-in-differences. It chooses a set of weights for units in the donor pool that best matches the trends in the outcome variables for the treated group. Unlike matching, SDID works for a balanced panel of firms. Therefore, I estimate coefficients using 14 WBO firms and 66 control firms that I observe from 4 years before the transition ($k = -4$) to 4 years after the transition ($k = 4$). It should also be noted that SDID selects a different set of weights for each outcome variable. Hence, the control group is effectively different in each estimation. Figure A.17 shows the results for average wages, employment and productivity using SDID. Results are very similar to the ones obtained using matching for average wages and employment. Qualitatively they are similar for productivity, as both coefficients are negative, but they are larger and statistically significant when using SDID.

5 Model

The model serves three purposes. First, it clarifies the mechanisms through which labor management induces changes in the wage distribution and in productivity. Second, it clarifies under what conditions LMFs are more productive than conventional firms. Third, it allows me to do a calibration using moments of the data to evaluate these conditions.

The model features two types of firms: conventional firms and labor-managed firms. When employed by a firm, workers decide optimally how much effort to exert depending on their wage. In the conventional sector, a worker's wage is equal to a fraction $\mu \in (0, 1)$ of her marginal product of labor. Because of this markdown, effort is inefficiently low. Following work from Kremer [1997] and Montero [2022], wages for employees in LMFs depend by a fraction $\gamma \in (0, 1)$ on worker's marginal productivity and by the remaining fraction $1 - \gamma$ on average output in the firm. Because of profit-sharing, effort will also be inefficiently low in LMFs. I assume that the median worker

sets γ to maximize her utility.[35] Workers optimally decide whether to stay in the firm or take the outside option of going to the conventional sector and how much effort to exert taking γ as given.

5.1 Setup

Primitives. There are 3 types of workers: blue-collar, white-collar and managerial workers: $\theta_i = \{B, W, M\}$. Let B, W, M be real numbers such that $B < W < M$. A firm can employ all three types of workers. The size of a firm is given by $n = n_B + n_W + n_M$. For now, we will focus on the case where blue collar workers are the majority and managerial workers are the minority: $n_B > n_W > n_M$.[36] Additionally, we are going to focus on the case $n_B > n_W + n_M$, so that the median worker is of type B. [37] Each worker i of type θ_i produces $y_i = \theta_i + g(e)$, where e is effort and $g(e)$ is a conve function. Utility is given by $u_i = w_i(\theta_i, e) - c(e)$, where $c(e)$ is a concave function of effort. Together, the assumptions on $g(\cdot)$ and $c(\cdot)$ ensure that the optimization problem of the worker has an interior solution.

Conventional sector. In the conventional sector, each worker is paid $w_i^{cf} = \mu * y_i = \mu * (\theta_i + g(e))$, where $\mu \in (0, 1)$ represents the inverse wage markdown, that is the ratio of wage to marginal product of labor, and the cf superscript indicates that the worker is employed by a conventional firm. The level of wage markdown is exogenous, but could be made endogenous by adding moving costs or firm-specific amenities. Workers choose e to maximize utility $u_i^{cf} = \mu * (\theta_i + g(e)) - c(e)$. For any type, the optimal choice of effort in the conventional sector $e^*(\mu)$ satisfies $\mu g'(e^*) = c'(e^*)$. Therefore, the markdown distorts the choice of effort. The lower μ, the higher the markdown, the lower worker productivity. Let $\bar{Y}$ denote average output:

$$\bar{Y}(e^*) = n^{-1}\left[n_B(B + g(e^*)) + n_W(W + g(e^*)) + n_M(M + g(e^*))\right] =$$

$$\underbrace{g(e^*(\mu))}_{\text{Worker production due to optimal effort}} + \underbrace{n^{-1}(n_B B + n_W W + n_M M)}_{\text{Average type}}$$

.

Worker cooperatives. In worker cooperatives, workers vote to redistribute part of the firm's output. They do so by making total compensation equal to a fraction γ of their marginal product of labor plus a fraction $(1-\gamma)$ of the firm's average output: $w_i = \gamma(\theta_i + g(e)) + (1-\gamma)\bar{Y}(e^*)$, where now optimal effort $e^*(\gamma)$ depends on the level of redistribution and satisfies $\gamma g'(e^*) = c'(e^*)$. The median worker sets the level of redistribution by choosing γ. When optimizing, the median worker

[35] Given the assumptions on worker types that I make later on, this is equivalent to assuming that the level of redistribution is decided by majority voting.

[36] This structure reflects the firms in my sample: the sample proportions of blue-collar, white-collar and managerial workers are 0.64, 0.34, 0.02, respectively.

[37] Evidently, this feature is also consistent with the data. More generally, most firms have a pyramidal structure. For example, one can obtain a realistic representation of firms in the service sector by relabeling B workers as white-collar, and W workers as middle managers.

internalizes two things. First, lower γ (more redistribution) is going to depress output by making optimal effort lower. Second, if she wants a type of worker to remain in the firm, she has to satisfy their participation constraint. In practice, the choice of the median worker can be written as a discrete choice between having M as the highest type or W as the highest type, where the value of each option is the outcome of a constrained maximization problem.[38] Her maximization problem can be written as follows, where I will omit that $e^*(\gamma)$ is a function of γ for notational simplicity, instead writing e^*:

$$max\{V_M, V_W\} \tag{5}$$

where:

$$V_M = \max_{\gamma} U_M = \gamma[B + g(e^*)] + (1-\gamma)[g(e^*) + \bar{\theta}_M] - c(e^*) \tag{6}$$

$$s.t.\ \ \gamma[M + g(e^*)] + (1-\gamma)[g(e^*) + \bar{\theta}_M] - c(e^*) \geq w_M^{cf} - c(e^*(\mu)) \qquad (PC_M)$$

and

$$V_W = \max_{\gamma} U_W = \gamma[B + g(e^*)] + (1-\gamma)[g(e^*) + \bar{\theta}_W)] - c(e^*) \tag{7}$$

$$s.t.\ \ \gamma[W + g(e^*)] + ((1-\gamma)[g(e^*) + \bar{\theta}_W] - c(e^*) \geq w_W^{cf} - c(e^*(\mu)) \qquad (PC_W)$$

where $\bar{\theta}_M = n^{-1}(n_B B + n_W W + n_M M)$ is the average type given that type M workers are in the firm (3 layers) and $\bar{\theta}_W = (n_B + n_w)^{-1}(n_B B + n_W W)$ is the average type given that type M workers are not in the firm (2 layers).

5.2 Comparative statics

In this section I derive comparative statics on the main model parameters under which LMFs will have higher output per worker than conventional firms. I derive two clear comparative statics for the case in which $g(x) = x, c(x) = \frac{1}{2}x^2$. First, LMFs will be relatively more productive than conventional firms the higher the level of wage markdown. Second, the higher the proportion of blue-collar workers in the firm.

It is useful to define the 4 possible values of γ in equilibrium: γ_M^*, the unconstrained argmax of U_M; γ_W^*, the unconstrained argmax of U_W; γ_M, which satisfies PC_M with equality; γ_W, which satisfies PC_W with equality. The necessary and sufficient condition that determines if LMFs are is more productive is the following:

$$1 - \gamma_M^* < 1 - \mu$$

This condition asks that the level of redistribution that maximizes the unconstrained maximization

[38] We do not need to consider B as the highest type because the median worker, who is type B, strictly prefers to have a higher type in the firm so that she can appropriate some of their productivity.

problem of the median worker is lower than the markdown. For example, this implies that we would expect LMFs to be more productive in labor markets with higher monopsony power. This could explain the prevalence of producer cooperatives in developing economies, where employer monopsony power is large [Amodio and De Roux, 2024]. Moreover, we would expect LMFs to be more productive in sectors with a higher proportion of blue-collar workers, because this lowers the optimal level of redistribution.

To see that this is sufficient, notice that $\mu > \gamma_M$, so if $\mu < \gamma_M^*$, then PC_M is not binding and $\gamma^* = \gamma_M^*$. Since $\gamma^* > \mu$, workers in LMFs will exert more effort.

To see that this condition is necessary, suppose $\mu > \gamma_M^*$. In this case, either PC_M binds or it does not. If it does not bind, then $\gamma^* = \gamma_M^*$ and effort is lower in LMFs compared to conventional firms. If PC_M binds, $\gamma^* \in \{\gamma_M, \gamma_W, \gamma_W^*\}$. If $\gamma^* \in \{\gamma_M, \gamma_W\}$, we know that $\gamma^* < \mu$ because it is always the case that $\gamma_M < \gamma_W < \mu$. If $\gamma^* = \gamma_W^*$, then it must be that $\mu > \gamma_W^*$.[39] In all three cases, $\gamma^* < \mu$.

The assumptions on $g(x), c(x)$ allow to obtain a simple expression for γ_M^*, γ_W^* from the first order conditions of equations 6 and 7 w.r.t. γ:

$$\gamma_M^* = B + 1 - \bar{\theta}_M \qquad \gamma_W^* = B + 1 - \bar{\theta}_W$$

This condition allows us to make some comparative statics.

Markdown. Decreasing the inverse markdown μ can have ambiguous effects on relatively productivity. This is because although it does not affect γ_M^*, γ_W^*, it shifts γ_M, γ_W towards zero. If $\gamma^* \in \{\gamma_M^*, \gamma_W^*\}$, decreasing μ will make LMFs relatively more productive. If $\gamma^* \in \{\gamma_M, \gamma_W\}$, the effect of decreasing μ is ambiguous. Therefore, if the participation constraints are not binding, LMFs will be relatively more productive in labor markets with higher employer monopsony power. If the participations constraints are binding, higher monopsony will make both firm types less productive. For conventional firms this is mechanic because higher markdown causes less effort provision, and for LMFs there will me more redistribution because it is easier to keep high types in the firm. Hence the overall effect is ambiguous.

Workforce composition. The parameters that determine workforce composition n_B, n_W, n_M can also affect the relative productivity of the two firm types. Increasing n_B, will unequivocally make LMFs relatively more productive. This is because increasing n_B shifts all four possible equilibrium levels of γ^* closer to 1. Increasing the number of white-collar workers n_W and managers n_M will have ambiguous effects. To begin with, this will increase the average types $\bar{\theta}_M$ and $\bar{\theta}_W$, and hence lower γ_M^*, γ_W^*. If we are in a situation where $\gamma^* = \gamma_M^*$, then decreasing the proportion of blue-collar workers will increase the average type, increase redistribution and make LMFs relatively less productive than conventional firms. In other cases, the opposite is true. For example, if we are in a

[39] This is shown in the model appendix in Lemma C.3.

situation where the participation constraints are binding and it is optimal to have no managers in the firm ($\gamma^* = \gamma_W$), increasing the proportion of managers can make it optimal to have managers in the firm, and therefore to redistribute less (moving γ^* up to γ_M), increasing productivity for LMFs but not for conventional firms.

5.3 Calibration exercise.

I choose the numerosities of workers to match the proportion of blue-collar, white-collar and managerial workers in the data : $n_B = 33, n_W = 16, n_M = 1$, so that $n_B/n = .66, n_W/n = .32, n_M/n = .02$. I set the inverse markdown conservatively to $\mu = 0.95$.[40] Let $B = 1, W = 2, M = 3$.

Conventional sector. The first order conditions of the workers' maximization problem imply that optimal effort in the conventional sector is $e^*(\mu) = \mu$. Hence, for each worker i of type θ_i, wages will be equal to $w_i = 0.95 * (\theta_i + 0.95)$: for $\theta_i = \{B, W, M\}, w_i = \{1.85, 2.80, 3.75\}$. The average wage $\bar{w}^{cf} = 2.19$. Average output $\bar{Y}^{cf} = \bar{\theta}_M + \mu = 2.317$. The P90/P50 ratio equals 1.51.

Worker cooperative. In the worker cooperative, optimal effort is $e^*(\gamma) = \gamma$. Plugging the parameters into the optimality conditions for γ^*_M, γ^*_W yields: $\gamma^*_M = B + 1 - \theta_M = 0.64$ and $\gamma^*_W = B + 1 - \theta_W = 0.673$. The levels of γ that satisfy the constraints PC_M and PC_W with equality are $\gamma_M = 0.88$ and $\gamma_W = 0.81$, respectively. Since the median worker cannot attain the unconstrained maximum of neither U_M nor U_W, she compares $V_M(\gamma_M) = 1.353$ to $V_W(\gamma_W) = 1.544$, and therefore sets $\gamma^* = \gamma_W = 0.81$. Managers leave the firm. Wages will be equal to $\{w_B, w_W\} = \{1.87, 2.68\}$. Notice that the wage for type Q workers is lower than in the conventional sector, but they are indifferent because of lower cost of effort in worker cooperatives. Average compensation is $\bar{w} = 2.13$. Average output is $\bar{Y}(e^*) = \bar{Y}(\gamma^*) = \gamma + \bar{\theta}_W = 2.13$. In the worker cooperative the labor share is 1 by definition, therefore average wage always equals average output. The P90/P50 ratio equals 1.43.

Relative productivity. In this parametrization, $\gamma^*_M = 0.63$. Hence, LMFs are more productive than conventional firms for $\mu < 0.63$. This level is close to estimates for the US manufacturing sector in Yeh et al. [2022], who find an inverse markdown of 0.65, and Peru in [Amodio and De Roux, 2024], who find an inverse markdown of 0.71. To the best of my knowledge there are no available estimates for Italy. Speculatively, I expect the inverse markdown to be higher (closer to 1) in Italy than both US and Peru, due to higher union density, higher collective bargaining coverage and lower employer concentration. However, monopsony power can differ across sectors and local labor markets, so it is possible that the inverse markdown is lower than the critical level in some sectors and not others.

Comparison to the empirical results. The predictions from the model match the empirical

[40] Estimates of the inverse markdown in the literature on the US range from 0.82 in Azar et al. [2022] to 0.65 in Yeh et al. [2022]. They are estimating using two different approaches

estimates shown in Tables 2 and 4. Table 5 summarizes the prediction of the model compared to the empirical predictions. The percentage change in average compensation is -2.7%, which is consistent with the negative but insignificant effect on that I estimate in the data $\beta_{SR} = -0.014, \beta_{LR} = -0.054$. The percentage change in average output (productivity per worker) is -8.1%, which is similar to the (insignificant) coefficients on value added per worker: $\beta_{SR} = -0.060, \beta_{LR} = -0.097$. The reduction in inequality, as measured by percentage change in the $P90/P50$ ratio is equal to -5.3%, similar to the significant decreases I find in the data: $\beta_{SR} = -0.108^{**}, \beta_{LR} = -0.085^{**}$. The percentage change in employment is -2%, which is consistent with the insignificant long run effect, even if it is different in magnitude ($\beta_{LR} = .160$).

Table 5: **Theoretical prediction vs. empirical results.**

Outcome	Model prediction	β_{LR}	β_{SR}
Compensation, $\bar{w}$	~ 0	~ 0	~ 0
Avg. Output, $\bar{Y}$	–	~ 0	~ 0
P90/P50	–	–	–
Employment	~ 0	~ 0	–

6 Conclusion

Understanding the implications of labor-management is important because labor-managed firms are present all over the world, and other forms of worker representation and cooperative property rights are widespread. Despite a rich theoretical literature [Alchian and Demsetz, 1972; Holmstrom, 1982; Kandel and Lazear, 1992], the empirical evidence is scant.

This paper studies the effect of labor management on a series of firm-levels outcomes. I find that average wages decrease by about 10% and that this decrease is stable over time, but that the effect on total compensation is not distinguishable from zero. Wage cuts are larger at the top of the distribution and smaller at the median and lower percentiles. This implies a reduction in within-firm inequality. I find that changes in wage policies are important to explain my results, and that therefore the reduction in within-firm inequality translates into a reduction in overall inequality. These results are consistent with theories about worker cooperatives and with previous empirical results. Moreover, I show that there is a strong disemployment effect in the short run, but not in the long run. I do not find evidence that worker cooperatives are less productive or profitable than conventional firms, nor that they invest less.

In sum, transitions to labor management seem to increase equity without harming efficiency. Policy makers interested in reducing wage inequality could consider promoting more transitions to

labor-management, or formation of new labor-managed firms from scratch. However, it is not clear whether the current level of LMF formation is inefficient. Future research could use test predictions of theoretical papers to empirically establish if there are market failures that are preventing more conversion to labor management, or the formation of LMFs from scratch. Also, given the prominence of LMFs in some local labor markets, like the Basque Country in Spain or the Emilia-Romagna region in Italy, there is an interesting avenue for future research to establish the macro implications of labor management on monopsony power and the labor share.

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Main Tables

Table 1: **Pre-transition summary statistics.** Summary statistics for the estimation sample computed using observations at $k = -3$. P-values are for t-test of the difference in means, with standard errors clustered at the firm level. Return to Section 3.3.

	WBO pred.		Conventional pred.		p-value
	Mean	Median	Mean	Median	Diff. in mean
Panel A: Wages, employment and worker characteristics					
Log wages, avg.	6.230	6.217	6.349	6.341	0.016**
Log wages, p50	6.140	6.133	6.236	6.220	0.041**
Log wages, p10	5.849	5.883	5.939	5.990	0.195
Log wages, p90	6.551	6.575	6.670	6.646	0.075*
Employment, F.T.E.	45.89	29.5	93.86	67	0.001***
Hiring rate	0.183	0.040	0.106	0.035	0.328
Separation rate	0.127	0.077	0.097	.072	0.328
Age	42.37	42.34	41.67	41.83	0.395
Woman	0.290	.264	0.267	.197	0.619
Manager	0.018	0	0.035	.017	0.061*
Zero manager	0.578	1	0.398	0	0.107
Tenure	4.108	3.555	4.296	4.037	0.757
Fixed-term	0.058	.026	0.058	.025	0.976
Part-time	0.071	.060	0.055	.038	0.226
Employed, $t+1$	0.836	0.898	0.883	0.930	0.157
Employed, $t+2$	0.710	0.756	0.814	0.882	0.024**
Panel B: Trust and preference homogeneity proxies					
HHI municipality	0.243	.202	0.186	.147	0.049**
HHI CBA	0.980	1	0.959	1	0.104
Age, s.d.	8.966	8.801	8.907	8.686	0.869
Gender, s.d.	0.393	0.443	0.378	0.383	0.581
Foreign, mean	0.093	0.049	0.099	0.069	0.832
Panel C: Firm characteristics and outcomes					
Manufacturing	0.846	1	0.828	1	0.824
Firm age	17.46	18.00	20.81	20.00	0.233
Log value added per worker	3.588	3.777	3.953	4.071	0.061*
Log value added	7.134	7.031	8.108	8.211	0.000***
Log revenues per worker	5.190	5.168	5.434	5.362	0.142
Log revenues	8.737	8.795	9.617	9.590	0.000***
Log assets per worker	4.261	4.484	4.424	4.695	0.614
Log assets	7.807	7.738	8.591	8.819	0.047**
EBITDA per worker (1,000 EU)	8.643	6.345	17.90	14.41	0.206
EBITDA (1,000 EU)	264.3	261.7	1308	867.4	0.003***
Profits per worker (1,000 EU)	-16.78	0.357	-0.239	-6.760	0.210
Profits (1,000 EU)	-867.2	-9.006	-321.0	12.037	0.159
N, firms	26		93		

Table 2: **Wages and employment.** Event study coefficients aggregated by short run ($k = 0, 1, 2$) and long run ($k = 3, 4, 5$). The coefficients are normalized relative to period $k = -3$. Standard errors are clustered at the firm level. Return to subsection 4.2 or subsection 4.3.

	β_{SR}	β_{LR}
Panel A: Wage distribution		
Log wages,	$-.086^{**}$	$-.098^{**}$
mean	(.036)	(.038)
Log wages,	$-.068^{*}$	$-.074^{**}$
p50	(.035)	(.037)
Log wages,	-.001	-.103
p10	(.060)	(.063)
Log wages,	$-.185^{***}$	$-.159^{***}$
p90	(.047)	(.050)
Log tot. compensation,	-.014	-.054
mean	(.036)	(.038)
Log tot. compensation,	-.002	-.022
p50	(.035)	(.037)
Log tot. compensation,	.060	-.051
p10	(.060)	(.064)
Log tot. compensation,	$-.120^{**}$	$-.107^{**}$
p90	(.047)	(.050)
Panel B: Employment		
Log employment,	$-.414^{***}$	-.160
F.T.E.	(.149)	(.157)
Hiring rate	.145	.022
	(.092)	(.098)
Separation rate	.039	-.018
	(.044)	(.046)
Panel C: Workforce characteristics		
Age, mean	-.637	-.571
	(.575)	(.608)
Woman, mean	.011	$.047^{**}$
	(.018)	(.019)
Experience	-.516	-.860
	(.639)	(.676)
Fixed-term, mean	.017	.037
	(.035)	(.037)
Panel D: Hierarchy		
Manager	-.003	-.017
	(.010)	(.010)
Number of layers	$-.240^{***}$	$-.225^{**}$
	(.092)	(.097)
P(Zero managers)	.126	$.224^{***}$

	(.079)	(.083)
Panel E: Job stability		
Employed,	.066	.057
$t+1$	(.052)	(.052)
Weeks worked,	1.07	-.789
$t+1$	(1.66)	(1.78)
Employed,	.141**	.128**
$t+2$	(.056)	(.060)
Weeks worked,	10.39***	9.671***
$t+2$	(1.72)	(1.92)

Table 3: **Wages.** Event study coefficients for outcomes measured for stayers only. The coefficients are normalized relative to period $k = -3$. Standard errors are clustered at the firm level. Return to subsection 4.2 or subsection 4.3.

	β_{SR}	β_{LR}
Panel A: Wage distribution - Stayers		
Log wages,	−.092**	
mean	(.044)	
Log wages,	−.078*	
p50	(.045)	
Log wages,	-.071	
p10	(.066)	
Log wages,	−.176***	
p90	(.046)	
Log tot. compensation,	-.009	
mean	(.044)	
Log tot. compensation,	-.005	
p50	(.046)	
Log tot. compensation,	.012	
p10	(.066)	
Log tot. compensation,	−.092*	
p90	(.047)	

Table 4: **Income statement outcomes.** Event study coefficients aggregated by short run ($k = 0, 1, 2$) and long run ($k = 3, 4, 5$). The coefficients are normalized relative to period $k = -3$. Standard errors are clustered at the firm level. Return to subsection 4.4.

	β_{SR}	β_{LR}
Panel A: Productivity, revenues and investment		
Log VA, p.w.	$-.060$	$-.097$
	(.162)	(.140)
Log VA	$-.338^{**}$	$-.182$
	(.140)	(.161)
Log revenues, p.w.	$-.345^{***}$	$-.335^{**}$
	(.127)	(.143)
Log revenues	$-.690^{***}$	$-.427^{***}$
	(.136)	(.155)
Log assets, p.w.	$-.699^{**}$	-.298
	(.307)	(.350)
Log assets	-1.01^{***}	-.352
	(.321)	(.366)
Panel B: Profitability		
EBITDA, p.w	-8.01	-6.10
in 1,000 EU	(7.08)	(8.07)
EBIT, p.w.	2.87	.474
in 1,000 EU	(7.15)	(8.14)
Profit, p.w.	4.86	3.29
in 1,000 EU	(7.69)	(8.76)
Debt / EBITDA	-5.79	8.26
	(30.12)	(34.26)
ROA	.559	-3.28
	(3.108)	(3.542)

Main Figures

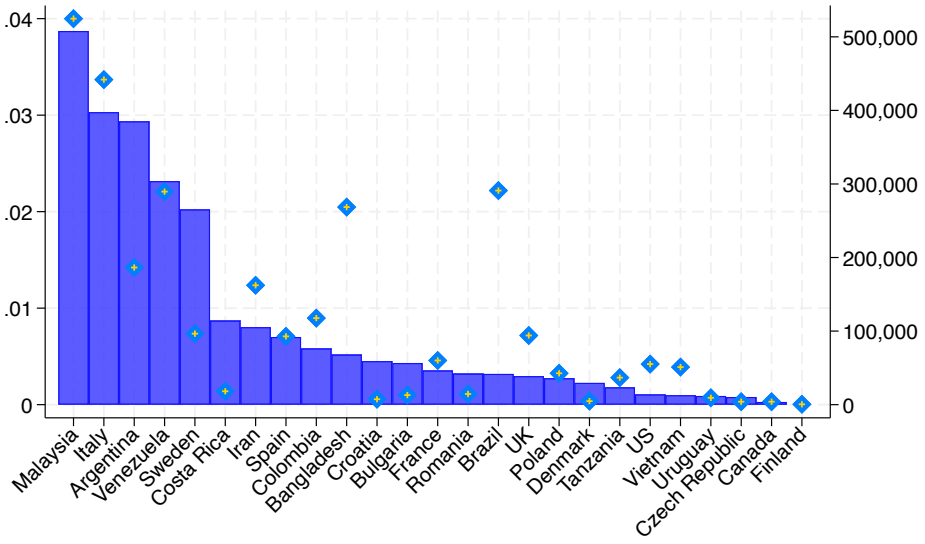

Figure 1: Prevalence of worker cooperatives in different countries. The bars show the percentage of total private sector employment taken up by worker cooperatives (left axis). The diamonds show the absolute number of workers. Return to Section 2.

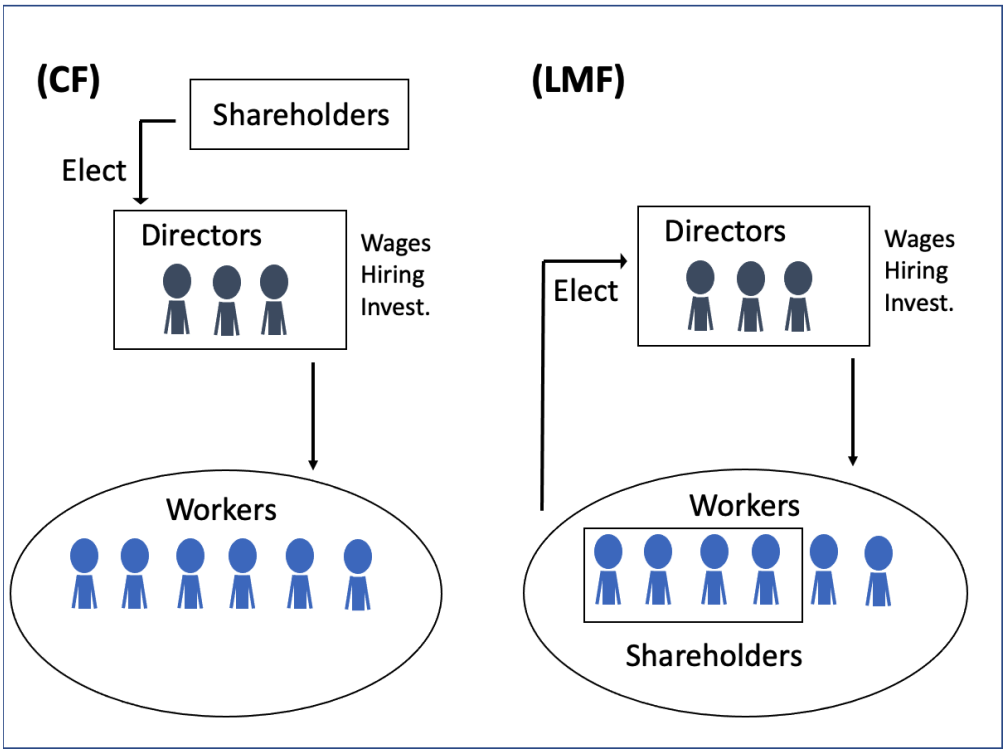

Figure 2: Comparative corporate governance in conventional firms (CF) and labor-managed firms (LMF). CFs distribute voting rights to partners according to capital ownership, whereas LMFs distribute voting rights to partners according to the 'one-head, one-vote' principle. Moreover, at worker-partners must have at least two-thirds of votes and be paid at least 50% of the wage bill. Return to Section 2.

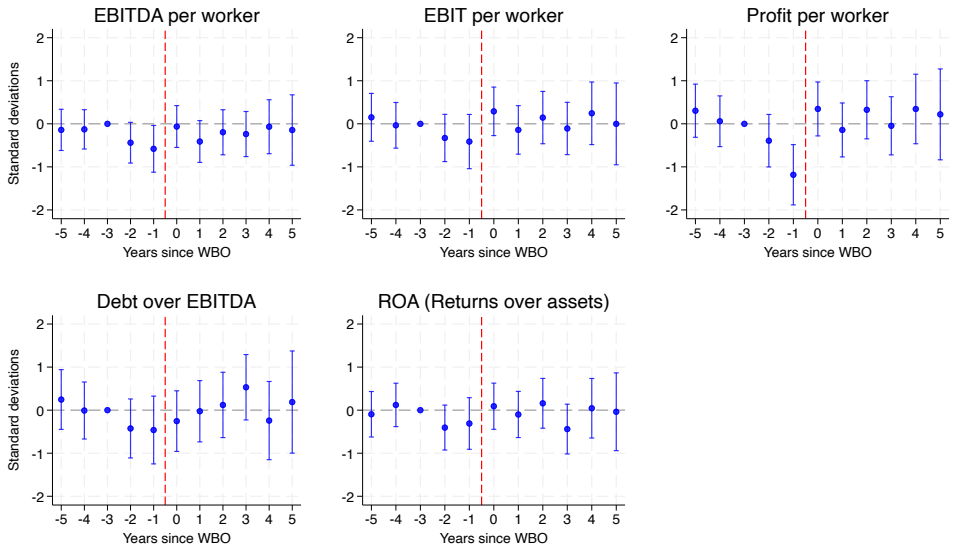

Figure 3: Event study coefficients of the effect on different measures of profitability and indebtedness. Earnings before interest, taxes, depreciation and amortization (EBITDA) in the top right panel, earnings before interest and taxes (EBIT) in the top center panel, net profits in the top left panel, debt over EBITDA the the bottom left panel and returns on assets (ROA) in the bottom center panel. Return to Section 3.1 or to Section 4.4

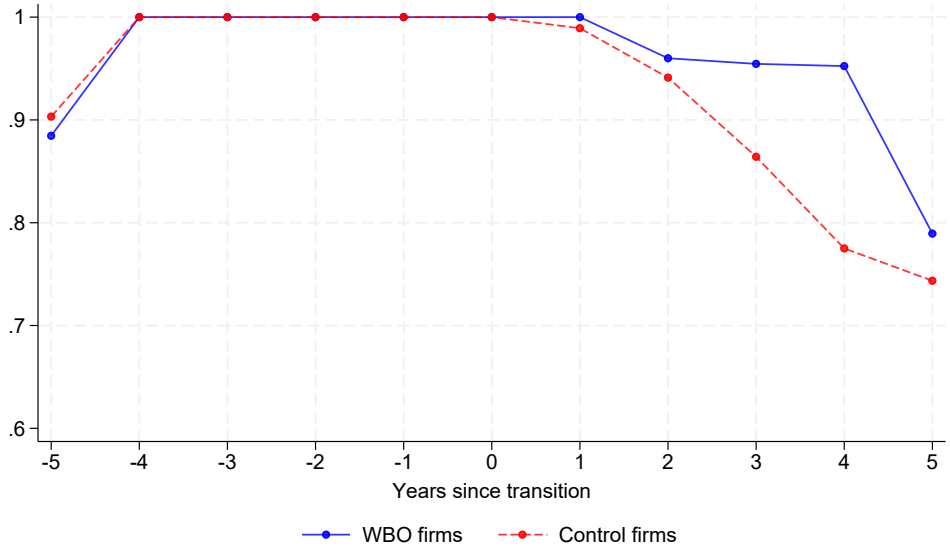

Figure 4: Survival probability by firm type: WBO firms (blue solid line) vs. comparison firms (red dotted line). For each elapsed time k, the numerator is the number of firms active at period k, and the denominator is the number of firms that were active at the baseline period $k = -3$ and are not out of the sample because of their cohort. For example, the 2018 cohort (for which $k = 0$ in 2018), cannot be in the sample a $k = 4$. Return to Section 4.1.

Figure 5: Event study of the effect of labor management on average wages. The red dotted line indicates the timing of the WBO event. Coefficients are normalized at $k = -3$. Return to Section 4.1.

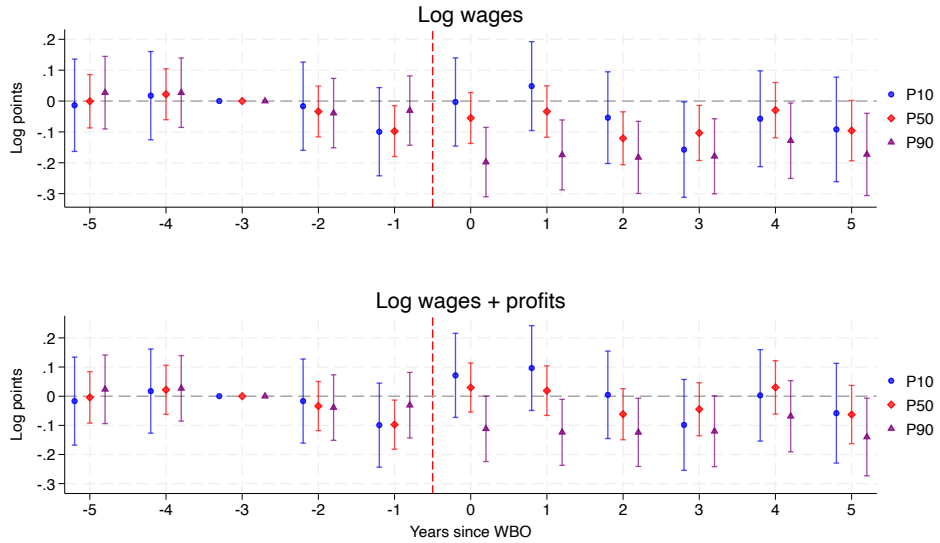

Figure 6: Event study of the effect of labor management on weekly wage percentiles (top panel) weekly wage percentiles adjusted by profits (bottom panel). The red dotted line indicates the timing of the WBO event. Coefficients are normalized at $k = -3$. Return to Section 4.2.

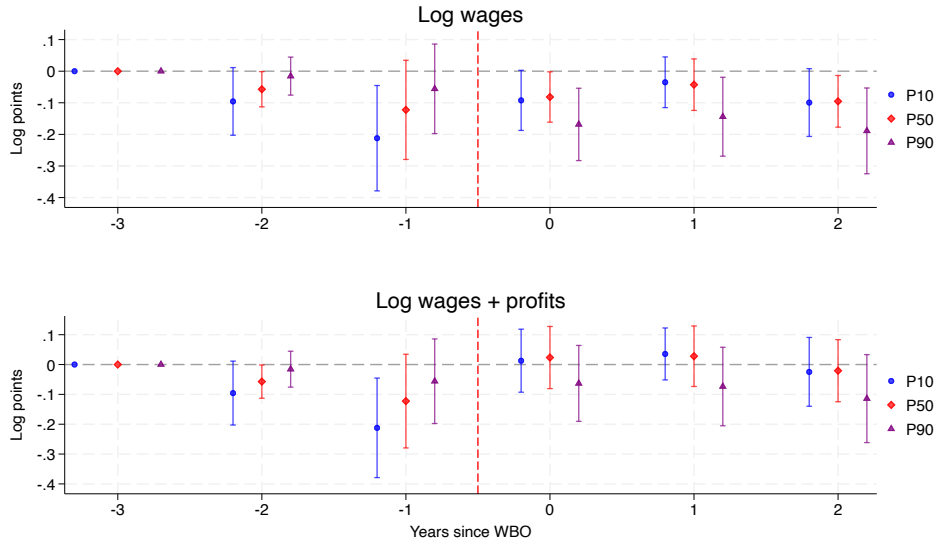

Figure 7: Event study estimates of the effect on log weekly wages using stayers only at different percentiles of the within-firm wage distribution. The base definition of weekly wages (top panel), and adjusted with profits per worker (bottom panel). Coefficients are normalized at $k = -3$. Return to Section 4.2.

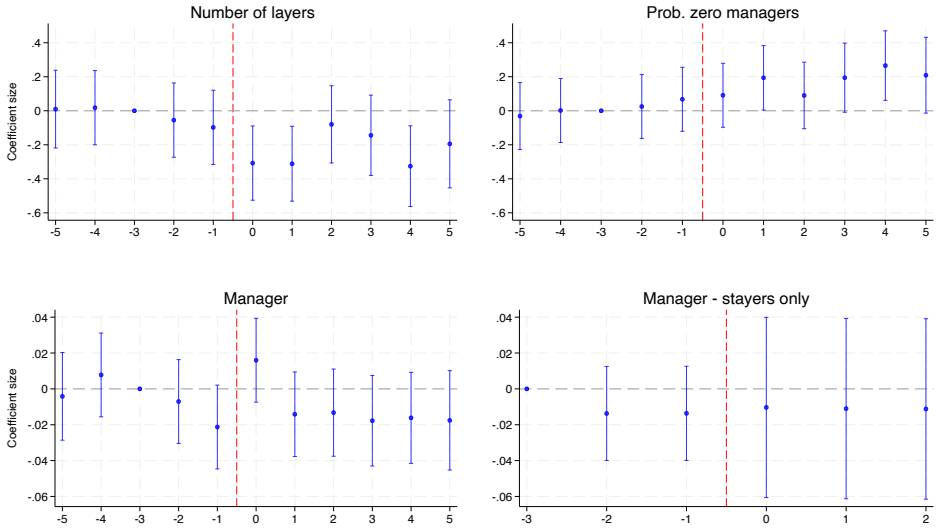

Figure 8: Event study of the effect of labor management on firm hierarchy. The outcomes are the proportion of managers over total employees (top left panel), the proportion of managers over total stayers (top right panel), the number of organizational layers in the firm (bottom right panel) and the probability that the firm has zero managers (bottom left panel). Coefficients are normalized at $k = -3$. Standard errors are clustered at the firm level. Return to Section 4.2.

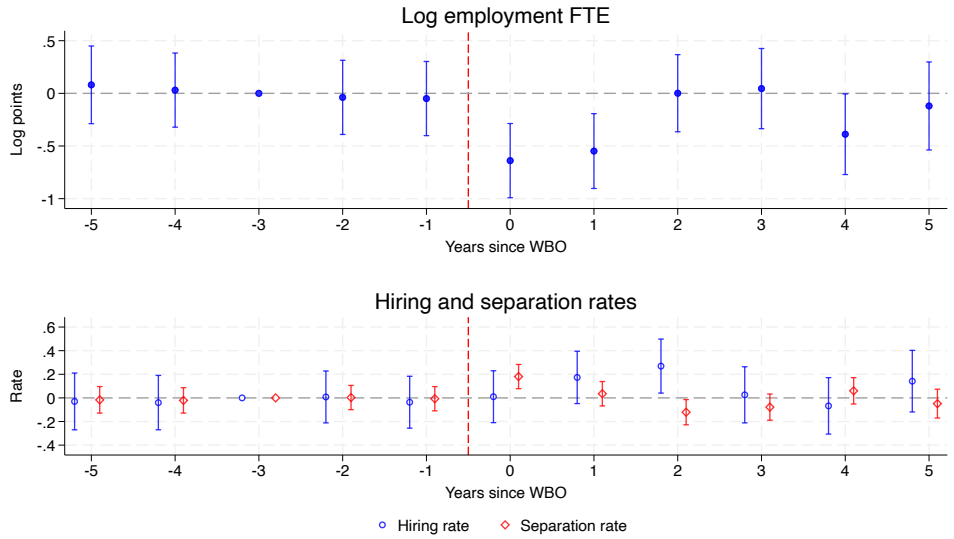

Figure 9: Event study of the effect of labor management on log employment. The red dotted line indicates the timing of the WBO event. Coefficients are normalized at $k = -3$. Return to Section 4.3.

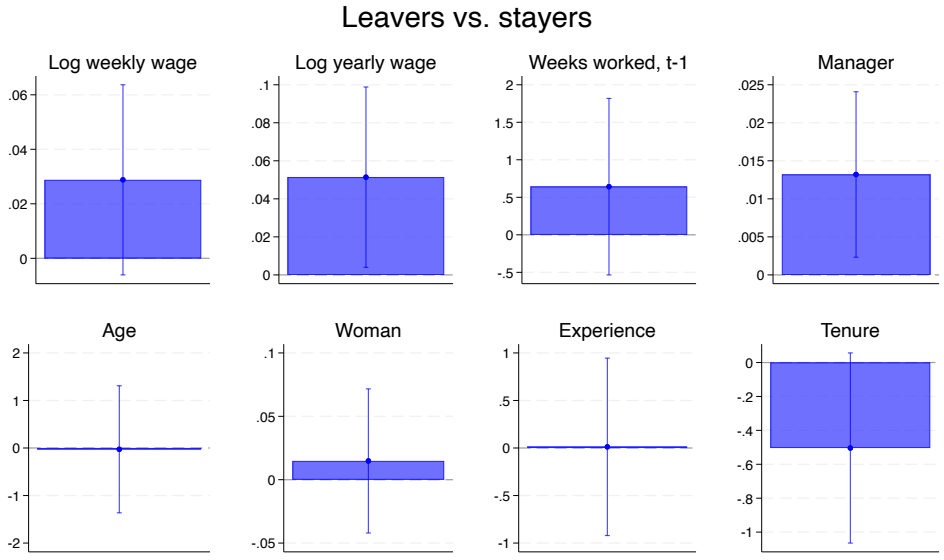

Figure 10: Characteristics of leavers vs. stayers in WBO firms vs. comparison firms. Outcomes are measured at $k = -2$. A leaver is defined as an employee in a firm that is not employed by that same firm in $k = 1$. Return to Section 4.3.

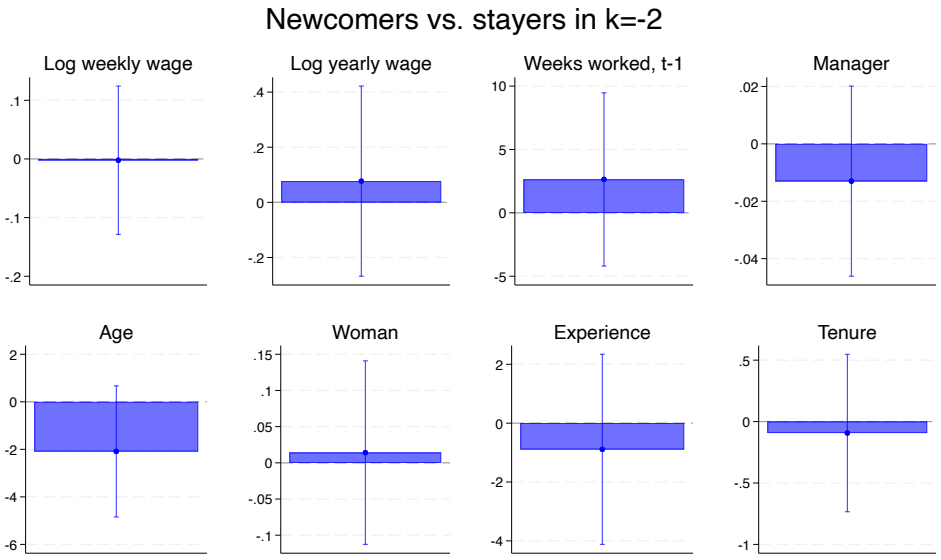

Figure 11: Characteristics of newcomers vs. stayers in WBO vs. comparison firms. Outcomes are measured at $k = -2$. A newcomer is defined as an employee in a firm in $k = 1$ that was not employed by that same firm in $k = -2$. Return to Section 4.3.

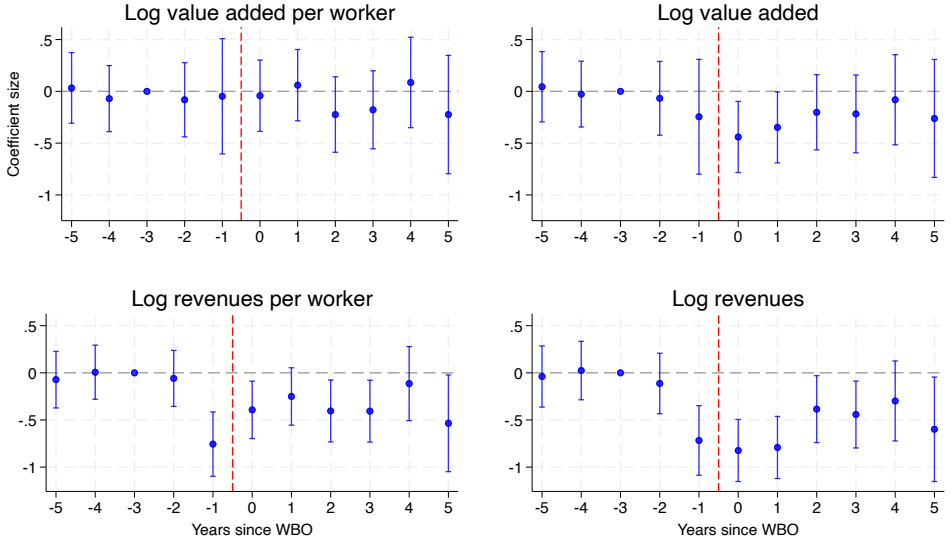

Figure 12: Event study estimates of effects on productivity and revenues. The outcomes are log value added per worker (top left panel), log value added (top right panel), log revenues per worker (bottom left panel) and log revenues (bottom right panel). Coefficients are normalized at $k = -3$. Standard errors are clustered at the firm level. Return to Section 4.4.

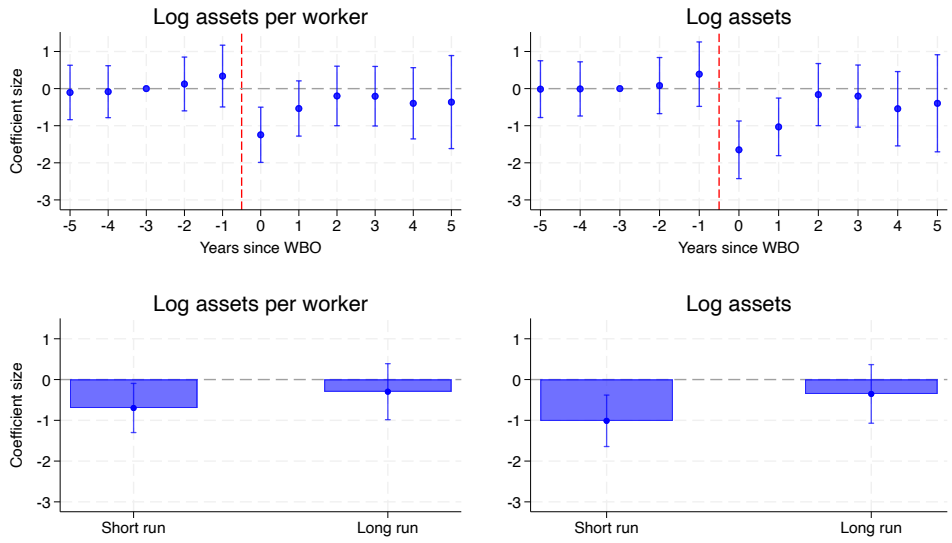

Figure 13: Event study estimates of effects on capital in the firm. The outcomes are log assets per worker (left panels) and log assets (right panels). Coefficients are elapsed time in the two top panels and aggregated in the two bottom panels. Coefficients are normalized at $k = -3$. Standard errors are clustered at the firm level. Return to Section 4.4.

A Appendix Tables and Figures

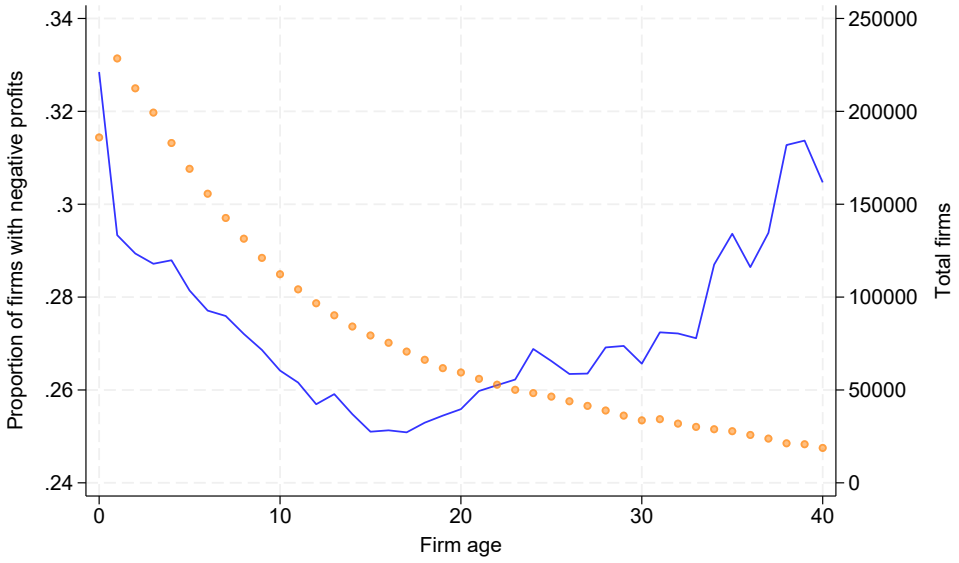

Figure A.1: Proportion of firms that report negative profits by age in years (blue line), and number of firms in the INPS-Cerved dataset by each age (orange dots). Return to Section 3.1.

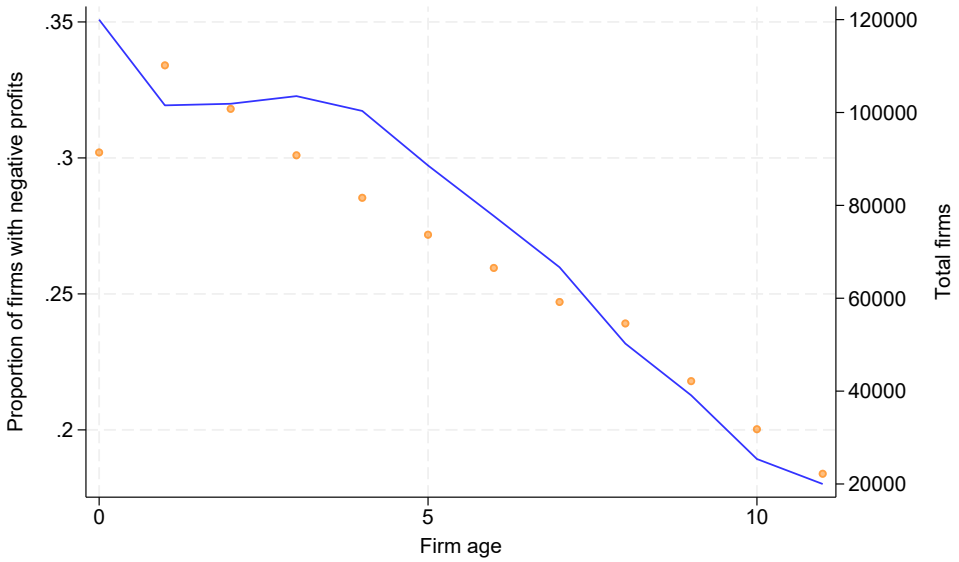

Figure A.2: Proportion of firms that report negative profits by age in years only for firms established in the period 2005-2010 (blue line), and number of firms in the INPS-Cerved dataset by each age in that group (orange dots). Return to Section 3.1.

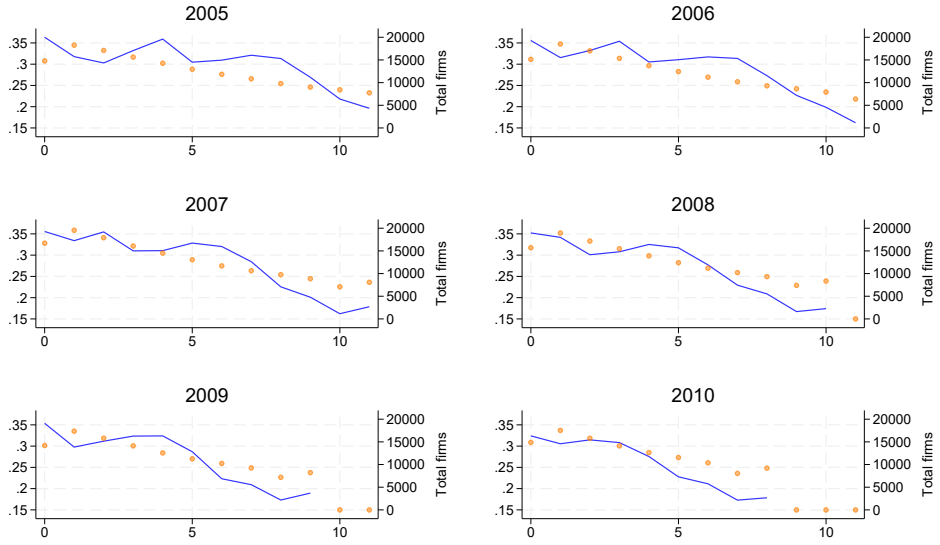

Figure A.3: Proportion of firms that report negative profits by age in years only for firms established in the period 2005-2010 broken down by each individual cohort (blue line), and number of firms in the INPS-Cerved dataset by each age in that group (orange dots). Return to Section 3.1.

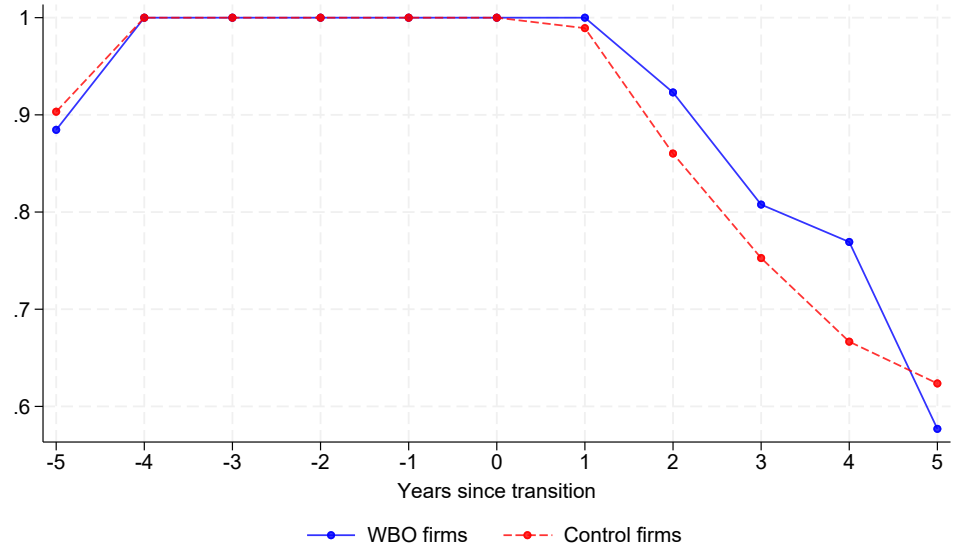

Figure A.4: Attrition probability by firm type: WBO firms (blue solid line) vs. comparison firms (red dotted line). Return to Section 4.1.

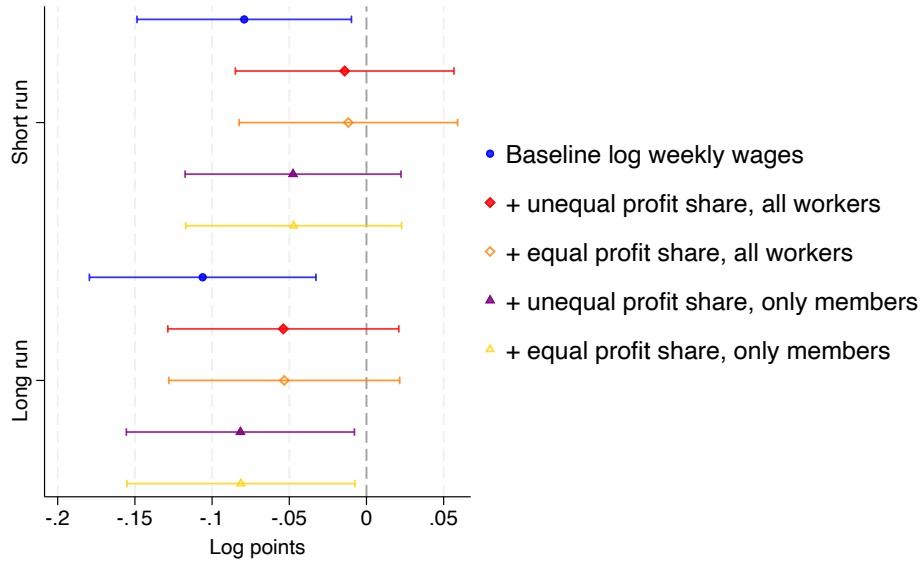

Figure A.5: Aggregated event study coefficients of the effect of labor management on average wages with different scenarios for profit adjustment. Coefficients are normalized at $k = -3$. Return to Section 4.2.

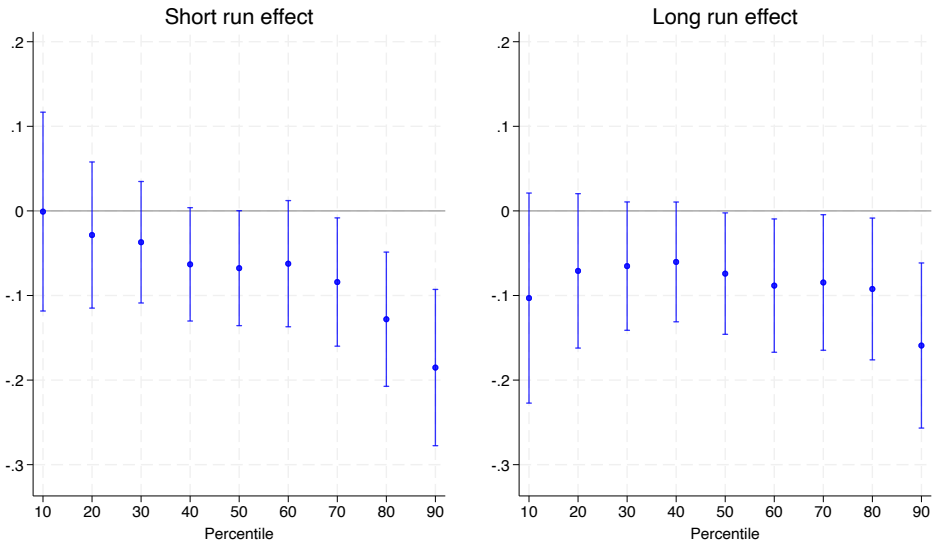

Figure A.6: Estimates of short and long run effects of labor management on wage percentiles across the distribution. Coefficients are normalized at $k = -3$. Return to Section 4.2.

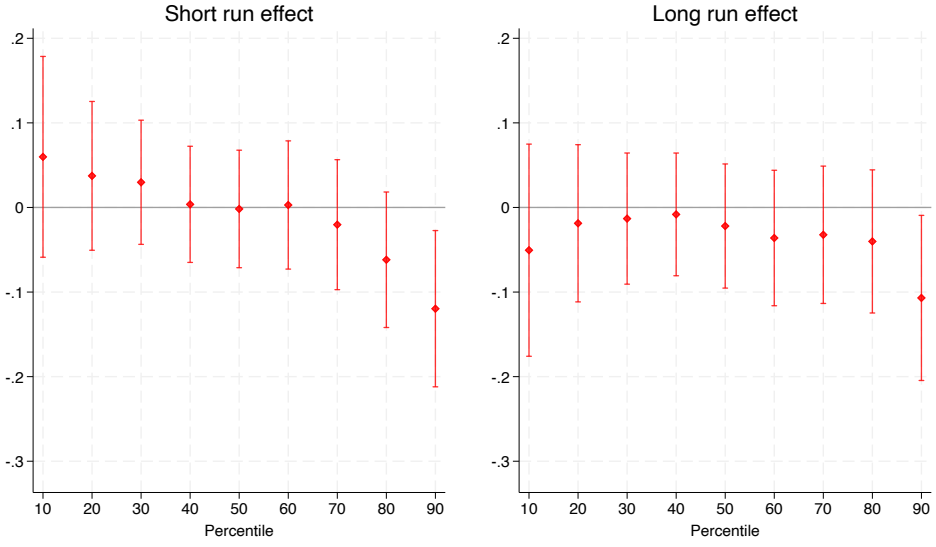

Figure A.7: Estimates of short and long run effects of labor management on wage percentiles adjusted by profits across the distribution. Coefficients are normalized at $k = -3$. Return to Section 4.2.

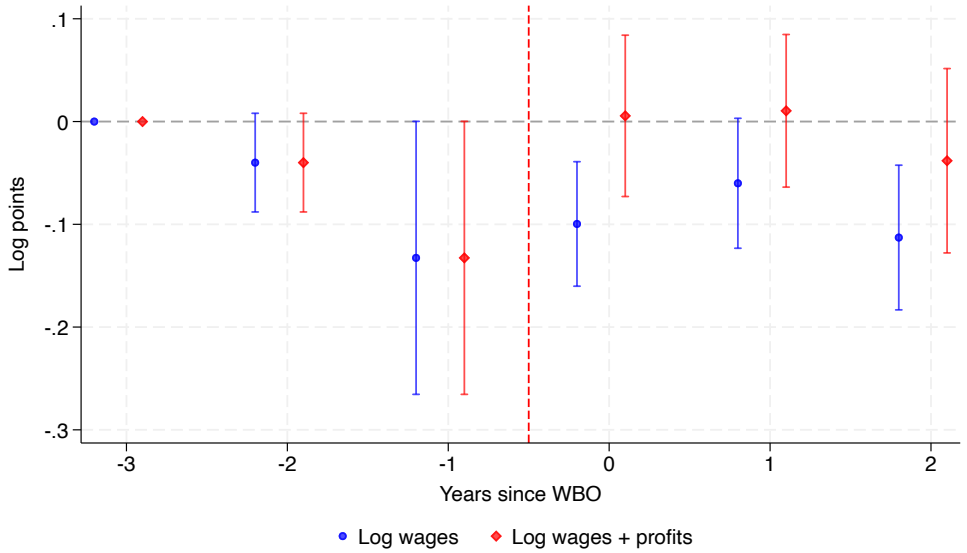

Figure A.8: Event study estimates of the effect on log weekly wages using stayers only. The base definition of weekly wages (blue dot), and adjusted with profits per worker (red diamond). Coefficients are normalized at $k = -3$. Return to Section 4.2.

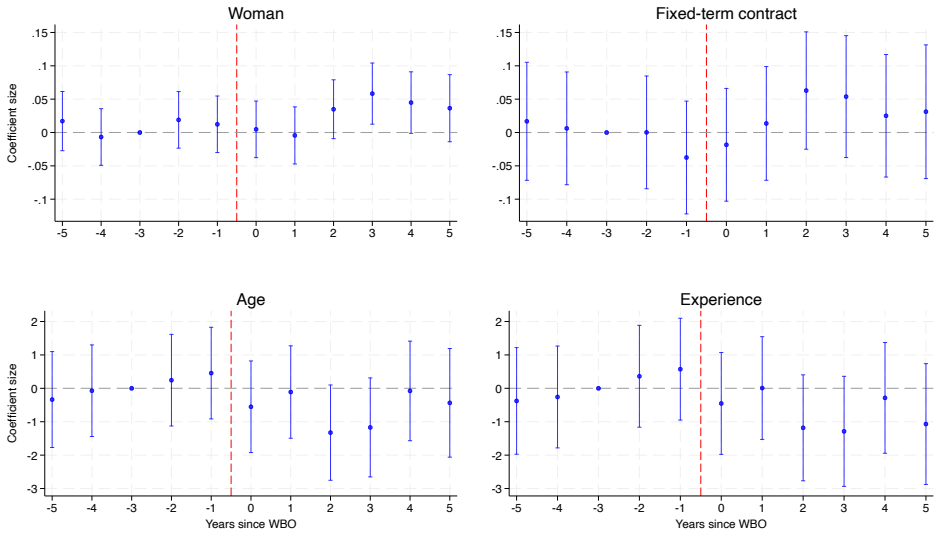

Figure A.9: Event study of the effect of labor management on workforce composition: proportion of women, proportion of workers on a fixed-term contract, average age and average labor market experience. The red dotted line indicates the timing of the WBO event. Coefficients are normalized at $k = -3$. Return to Section 4.3.

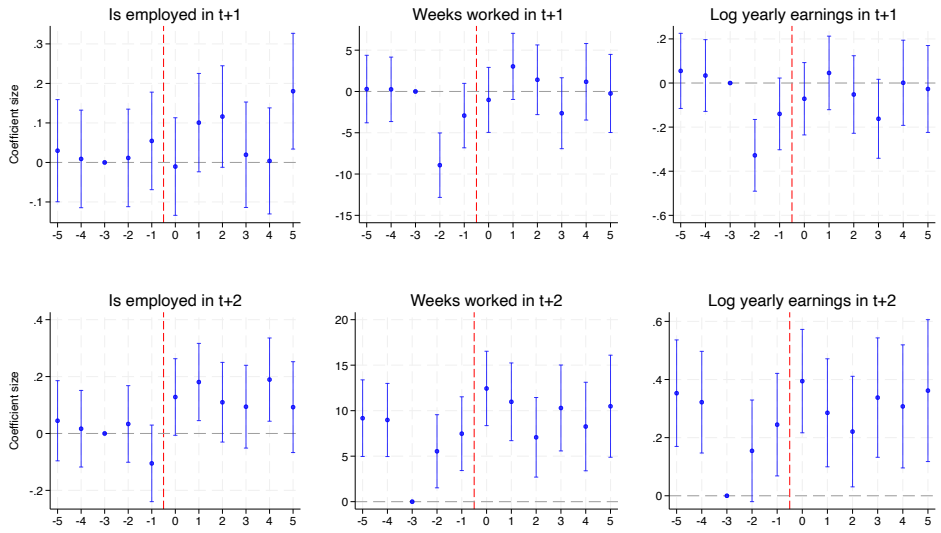

Figure A.10: Event study estimates of the effect of labor management on measures of job security: average probability of having a job at any firm, weeks worked (at any firm), yearly earnings (at any firm), both in $t+1$ (top panel) and $t+2$ (bottom panel). Coefficients are normalized at $k=-3$. Standard errors are clustered at the firm level. Return to Section 4.3.

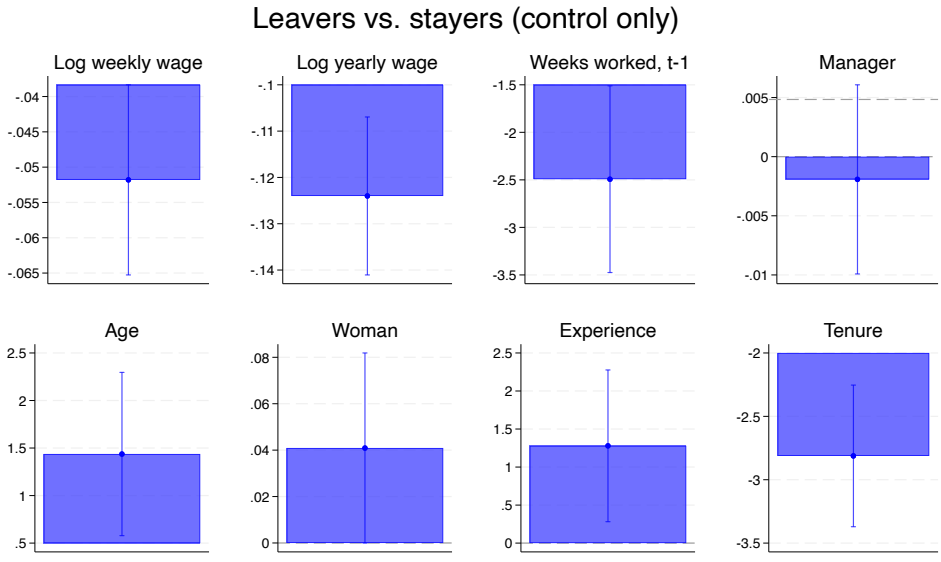

Figure A.11: Characteristics of leavers vs. stayers in comparison firms. Outcomes are measured at $k=-2$. A leaver is defined as an employee in a firm that is not employed by that same firm in $k=1$. Return to Section 4.3.

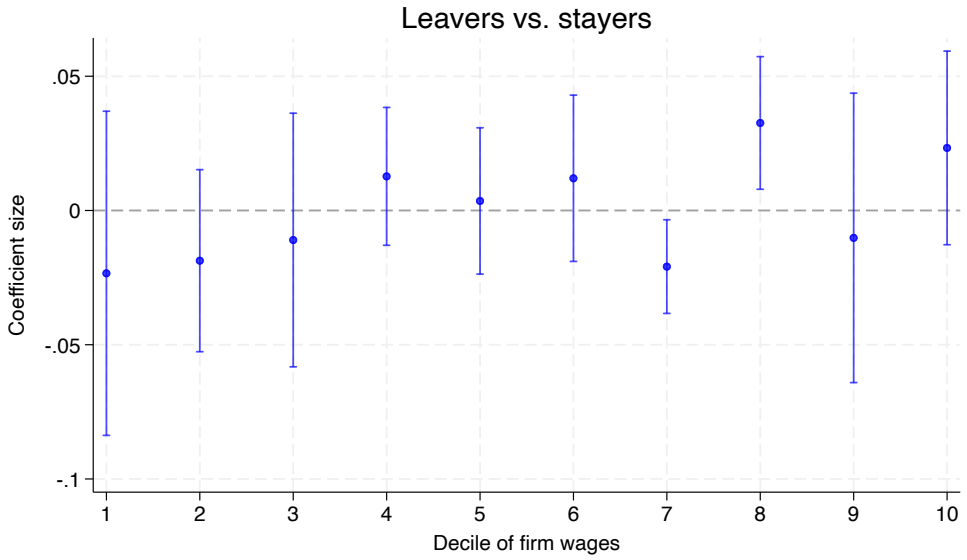

Figure A.12: Probability of coming from different deciles of the firm's wage distribution for leavers vs. stayers in WBO firms vs. comparison firms. Deciles are measured at $k = -2$. A leaver is defined as an employee in a firm that is not employed by that same firm in $k = 1$. Return to Section 4.3.

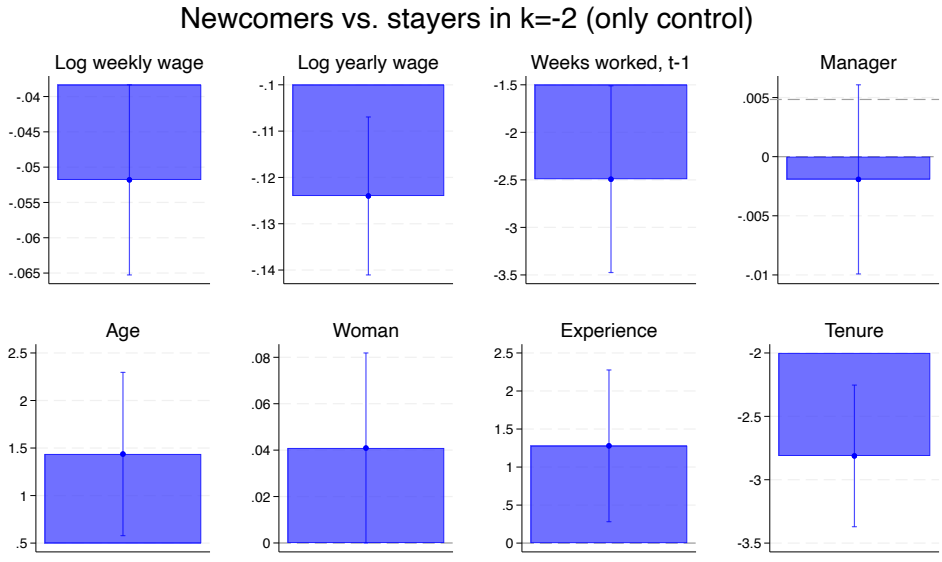

Figure A.13: Characteristics of newcomers vs. stayers in comparison firms. Outcomes are measured at $k = -2$. A newcomer is defined as an employee in a firm in $k = 1$ that was not employed by that same firm in $k = -2$. Return to Section 4.3.

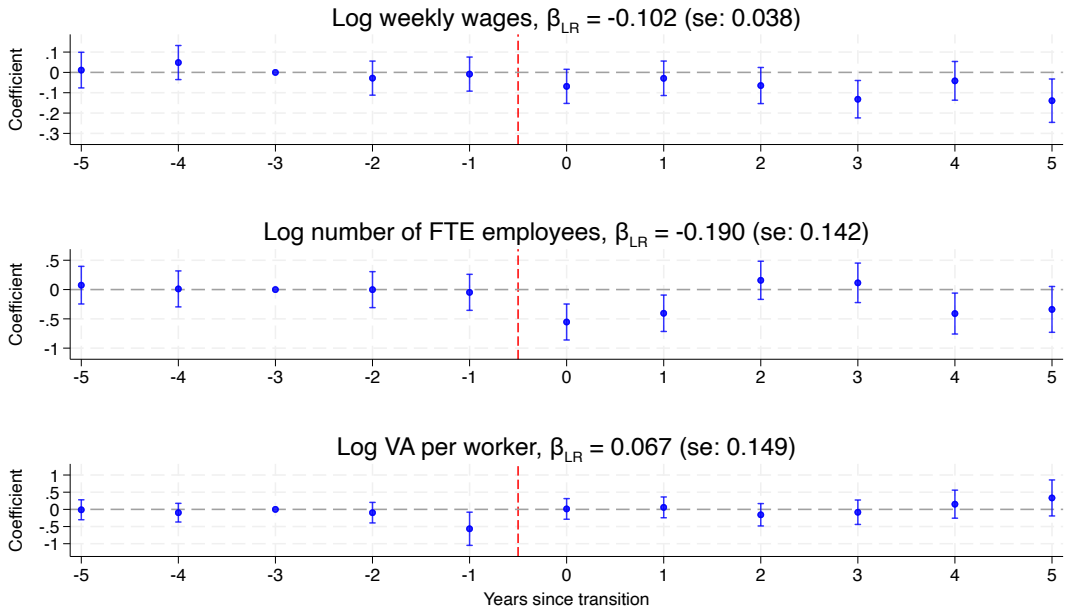

Figure A.14: Event study coefficients using matching specification M2. Outcomes are average log weekly wages, log number of employees and log value added per worker. Sample size is $N_{treatment} = 27, N_{control} = 66$. Return to Section 4.5.

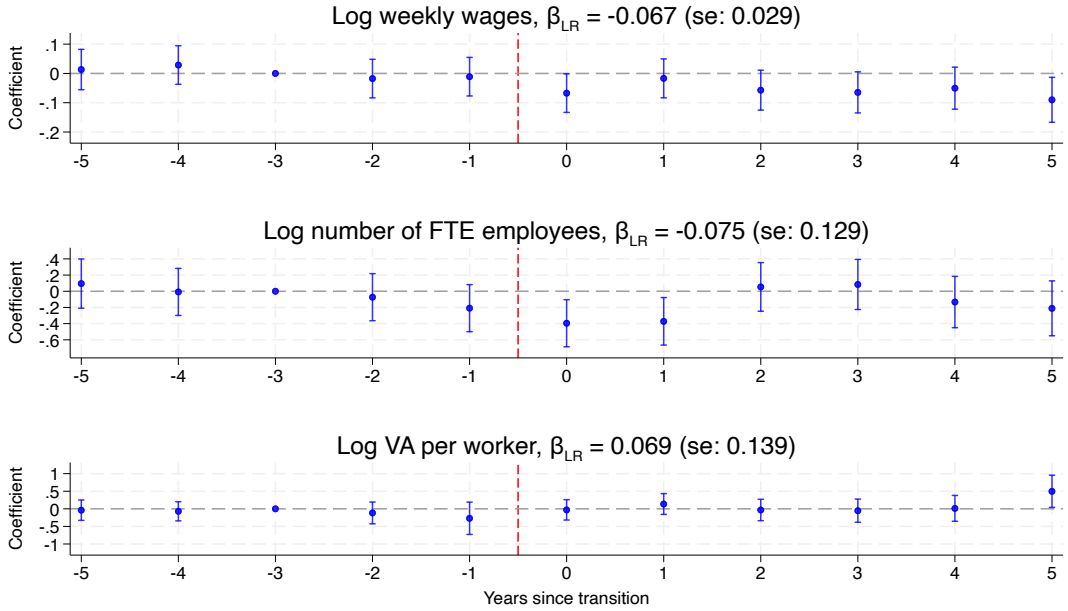

Figure A.15: Event study coefficients using matching specification M3. Outcomes are average log weekly wages, log number of employees and log value added per worker. Sample size is $N_{treatment} = 36, N_{control} = 182$. Return to Section 4.5.

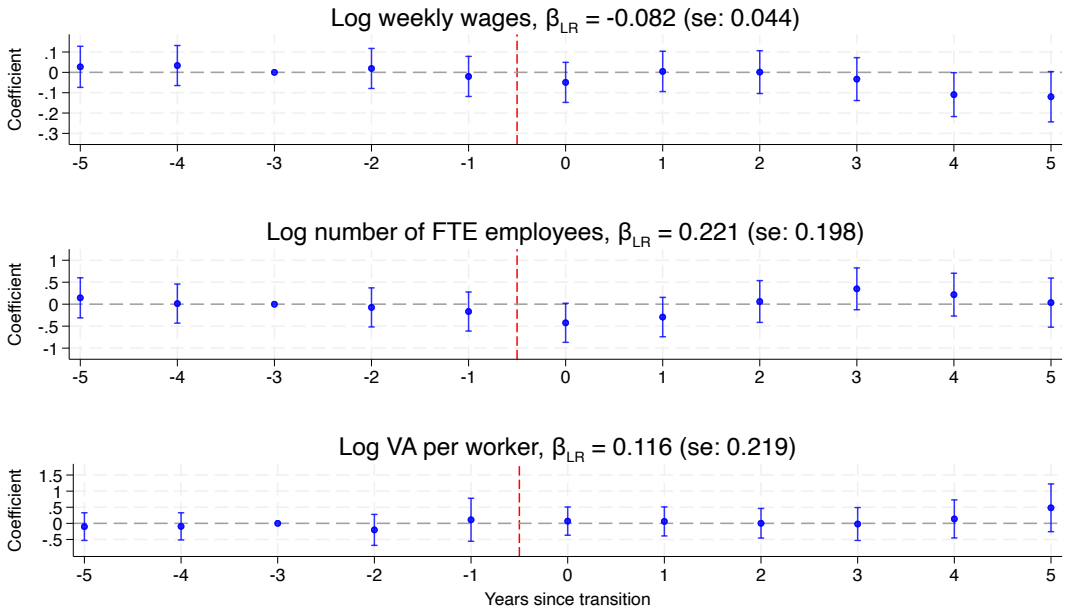

Figure A.16: Event study coefficients using matching specification M4. Outcomes are average log weekly wages, log number of employees and log value added per worker. Sample size is $N_{treatment} = 22, N_{control} = 43$. Return to Section 4.5.

Figure A.17: Event study coefficients using synthetic differences-in-differences (SDID). Outcomes are average log weekly wages, log number of employees and log value added per worker. Sample size is $N_{treatment} = 14, N_{control} = 73$. Return to Section 4.5.

B Prevalence of worker cooperatives and labor-managed firms, other types of employee-ownership or employee-control, and other types of cooperatives.

A worker managed firm is characterized by being owned primarily by its workers and by being controlled democratically by them according to the one-head, one-vote principle. Worker cooperatives are the most common form taken by worker managed firms, but not the only one. In Italy in 2021, worker cooperatives *cooperative di produzione e lavoro* took up 3% of private sector employment, employing 441,897 workers out of 14,579,764 total employees in private firms. Cooperatives had 1,049,409 employees (7% of the total). ([41] In Spain in 2018, worker cooperatives (*cooperativas de trabajo asociado*) took 0.7% of private sector employment: there were 92,849 workers employed in worker cooperatives, out of 241,923 employees in cooperatives and 13,242,600 private sector employees. Including the 63,626 workers employed in *sociedades laborales*, the percentage becomes 1.2%.[42] In France, worker coops (SCOP, or *Société coopérative et participative*) employed 60,056 workers, which accounts for 0.35% of the 16,982,000 private sector employees.[43,44] In Argentina in 2021, there were 8140 worker cooperatives, employing 186,460 workers, accounting for 2.9% of the total 6,350,000 private sector workers.[45]

[41] The number of worker cooperative employees comes from INPS data; the number of total private sector employees comes from ISTAT and refers to employees of private firms: https://www.istat.it/en/enterprises?data-and-indicators

[42] Source for worker coop employees and total coop employees: https://www.mites.gob.es/es/sec_trabajo/autonomos/economia-social/estadisticas/index.htm. The source for total number of employees is INE: https://www.ine.es/dynt3/inebase/es/index.htm?padre=10905&capsel=10908.

[43] Data on coop employees comes from https://www.les-scop.coop/chiffres-cles-2023. Data on the total number of private sector employees comes from https://www.insee.fr/en/statistiques/7763770

[44] Interestingly, 51% of jobs in SCOPs and SCIFs (another type of cooperative) come from business conversions. The French coop association classifies conversions into: conversion of associations, rescue of a distressed firm and handover of a healthy firm.

[45] Data on the number of worker cooperatives and their employees comes from [Vuotto, 2022], who elaborated data from the *Instituto Nacional de Asociativismo y Economía Social* (INAES) in 2021. Data on the total amount of private sector employees comes from the government website https://www.argentina.gob.ar/sites/default/files/trabajoregistrado_2302_informe.pdf.

C Model Appendix

Back to the main model in Section 5.

C.1 Proofs

Lemma C.1. *In the case with $g(x) = 2\sqrt{x}$ and $c(x) = \frac{1}{2}x^2$, the unconstrained argmax of U_M is smaller than the unconstrained argmax of U_W:* $\arg\max_\gamma(U_M) = \gamma_M^* < \arg\max_\gamma(U_W) = \gamma_W^*$.

Proof. For the case in which $g(x) = 2\sqrt{x}$ and $c(x) = .5x^2$, the first order conditions imply:

$$\frac{3}{2}(\bar{\theta}_M - B) = (\gamma_M^*)^{-2/3} - (\gamma_M^*)^{1/3}$$

$$\frac{3}{2}(\bar{\theta}_W - B) = (\gamma_Q^*)^{-2/3} - (\gamma_Q^*)^{1/3}$$

The claim follows from the fact that $\gamma^{-2/3} - \gamma^{1/3}$ is decreasing in γ and $(\bar{\theta}_M - B) > (\bar{\theta}_W - B)$. For the general case, one needs to show that $g'(e(\gamma))e'(\gamma) - c'(e(\gamma))e'(\gamma)$ is decreasing in γ. □

Lemma C.2. *In the case with $g(x) = x$ and $c(x) = \frac{1}{2}x^2$, the unconstrained argmax of U_M is smaller than the unconstrained argmax of U_W:* $\arg\max_\gamma(U_M) = \gamma_M^* < \arg\max_\gamma(U_W) = \gamma_W^*$.

Proof. For the case in which $g(x) = x$ and $c(x) = .5x^2$, the first order conditions imply:

$$\gamma_M^* = B + 1 - \theta_M$$

$$\gamma_W^* = B + 1 - \theta_W$$

The claim follows from the fact that $\theta_W < \theta_M$. □

Lemma C.3. *In the case with $g(x) = x$ and $c(x) = \frac{1}{2}x^2$, it cannot be that $\gamma_W^* > \mu$ and $\gamma_M > \gamma_M^*$.*

Proof. Together, the two conditions imply that $\gamma_W^* - \gamma_M^* > \mu - \gamma_M$. Then, to prove the claim it is sufficient to show that $\gamma_W^* - \gamma_M^* < \mu - \gamma_M$. We know that $\gamma_W^* - \gamma_M^* = \theta_M - \theta_W$ and that

$\mu - \gamma_M = \mu - (\theta_M - M - 1 - \sqrt{\Delta_{PCM}})$. Since we know that $\sqrt{\Delta_{PCM}}$ is positive and that $\mu < 1$, it is sufficient to show that $\theta_M - \theta_W < M - \theta_M$. This condition says that the difference between managers' type and the average type when managers are in the firm should be larger than the average type when managers are in the firm and the average type when managers are not in the firm. This is true whenever $B < W < M$. □