

The value of a job match: firm-level evidence on the role of government aid*

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Abstract

Policies that preserve productive employment relationships are particularly important in recessions. The collapse of economic activity during the pandemic was unlike any modern recession. We document the result of a national policy response including publicly subsidized furloughs that allowed workers to keep their jobs through the recession. The policy allowed for low unemployment and for the labor market to stabilize relatively quickly. Such policies are expensive with hard-to-measure benefits. Using novel survey and administrative data from Denmark, we find the policy was effective at a net cost of US\$15 and US\$127 per furloughed day for part- and full-time workers respectively.

Keywords: firm labor responses, furloughs, government aid, recession.

JEL Codes: H12, J3, J63, M54, E32.

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1 Introduction

The collapse of economic activity triggered by the coronavirus pandemic was unlike any recession in modern history. The nature of the economic shock — an abrupt and acute risk to public health — was unique in that, unlike economic-related recessions, nothing else fundamental had changed about the economy in the absence of this shock. As such, business and employment relationships that were productive just before the pandemic would continue to be productive if the pandemic had not happened. However, millions of workers were idled as workplaces closed and social distancing brought a great deal of economic activity to a halt. In response, many national governments developed policies to support both household consumption and business survival.

In Denmark, like many European countries, the government heavily subsidized furloughs: a policy where workers remain employed but do not go to work for a specified amount of time.¹ This allowed firms to hoard labor through the worst phase of the recession and kept workers off the unemployment rolls. Whether the labor hoarding induced by active labor market programs was successful depends in part on the behavior of firm managers, who must apply for aid, decide which workers to furlough or fire, and determine how to rearrange their operations to remain viable. However, there has been limited nationally-representative evidence on how policies to address the pandemic recession affected the behavior of firms. These policies were very expensive, and we do not yet know whether they were well-targeted, whether they significantly affected labor management decisions of firms, and whether they were cost-effective relative to the alternatives.

In this paper, we use novel firm-level survey data linked to administrative data to document how firms responded to Denmark’s coronavirus recession policies. Using these data, we establish several key facts. First, we find that the Danish program was relatively well-targeted: most aid was taken up by firms that experienced severe shocks to their revenue and employment. Second, the program was extremely effective in preventing layoffs and preserving job matches. Our estimates imply that 81,000 fewer workers were laid off and an additional 285,000 workers were furloughed as a result of the policy at the critical starting point of the pandemic. Third, by having firms partially responsible for furlough costs, the Danish policy was reasonably efficient. The furlough policy in Denmark provided 100 percent wage replacement, covered 75 percent by the government and 25 percent by the firm. We find that for 36 percent of furloughed employees, it would have been cheaper for their firms to fire them. It seems many firms actually paid to hold on to their workers, presumably anticipating needing them again relatively soon. A back-of-the-envelope calculation suggests that the “net extra cost” to the Danish government (relative to paying unemployment

¹This can be paid or unpaid — for example, the United States government furloughed over 800,000 of their employees in 2018 for 35 days while the budget was disputed. In Denmark, the government subsidized the furlough payment.

insurance) was approximately US\$15 per furlough day for a part time worker, and US\$120 for a full time worker.

These facts are related to ongoing debates about the effects of policy on the speed of recovery. The Danish labor market has stabilized more quickly than has been the case in the United States, where policy was focused on expanding the generosity of unemployment insurance.² In Figure 1, we show that the share of workers “idled” (either furloughed or unemployed) during the pandemic were very similar in Denmark and the United States. However, the Danish furlough program ended after a few months, and by December 2020, the Danish unemployment rate was already near its pre-recession level, and two percentage points lower than in the United States.

A key difference between the two countries is that the furlough policy helped preserve existing job matches, ensuring that firms could quickly bring workers back on the job as economic circumstances improved. Our paper thus complements other research documenting the difficulty of rebuilding match-specific capital after workers are laid off (Lise and Robin 2017; Friebel, Heinz, Hoffman and Zubanov 2019; Lachowska, Mas and Woodbury 2018). It is also consistent with the observation of Mercan, Schoefer and Sedláček (2020) that recessions may be prolonged when many unemployed workers are trying to match with many vacant jobs. Using U.S. data, Gallant, Kroft, Lange and Notowidigdo (2020) show that the expected speed of recovery depends on the share of workers that were laid off with the expectation of being recalled. Under the Danish policy, almost all workers expected to be recalled, and to be recalled quickly.³

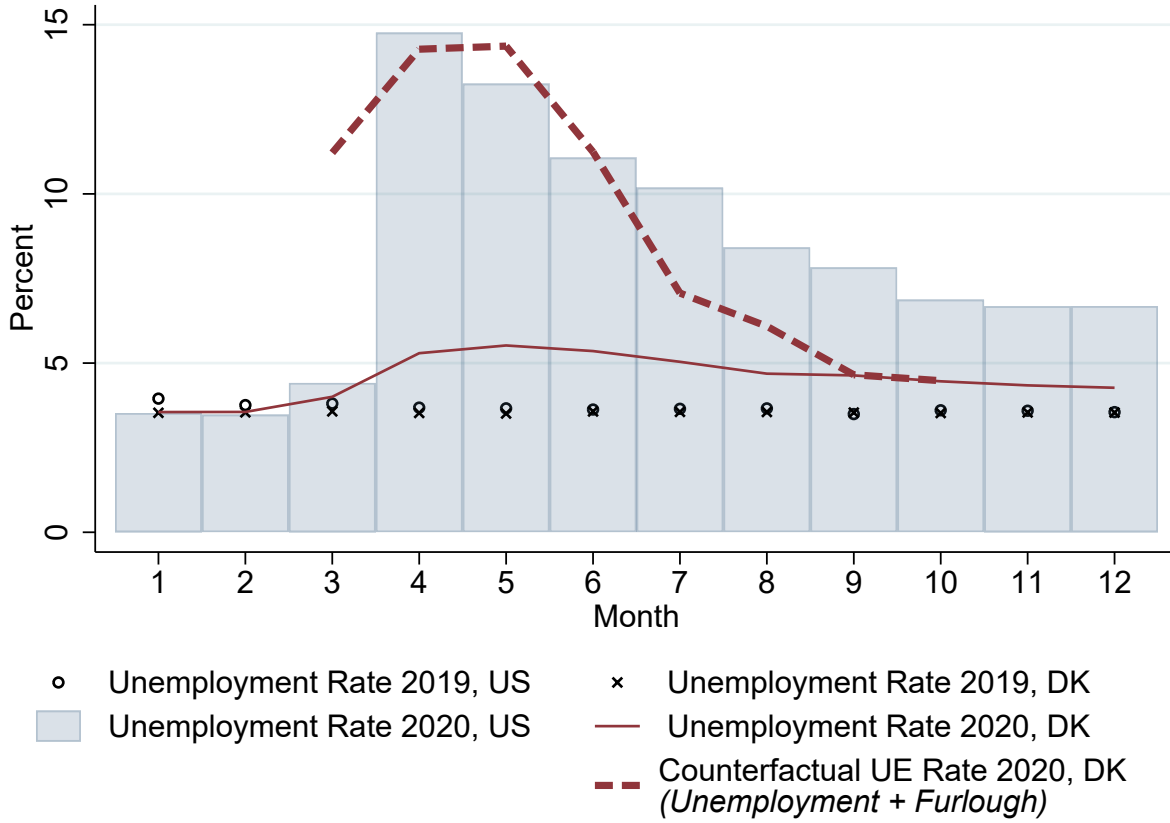
We have assembled the most detailed data available to examine the impact of the seismic economic shock of the pandemic on firms and their responses to government policy, combining new survey and administrative data. In May 2020, we completed a representative survey of over 10,000 Danish firms accounting for one quarter of all firms, and linked their responses to firm accounting data and to administrative register data on all workers that were furloughed under the policy.⁴ The survey collects information on firms’ actual layoff and furlough decisions, but we also elicited the number of workers that firms planned to furloughed or lay off in the absence of the aid program. Those counterfactual decisions were salient for managers since they had made the calculation to

²In the United States, policies intended to “save jobs” such as the Paycheck Protection Program (PPP) had modest effects on employment rates (Chetty, Friedman, Hendren and Stepner 2020) as aid was not reaching the firms that most needed it (Granja, Makridis, Yannelis and Zwick 2020).

³Of course by preserving job matches, the Danish government may also have prevented the reallocation of labor away from sectors that declined during the pandemic, and also reduced the incentives for Danish firms to implement work-from-home arrangements (Barrero, Bloom and Davis 2020; Alstadsæter, Bratsberg, Eielson, Kopczuk, Markussen, Raaum and Røed 2020). We find that furloughs were concentrated in industries and occupations less likely to accommodate remote work.

⁴Much of the research on firms during the pandemic has focused on small firms (Bartik, Bertrand, Cullen, Glaeser, Luca and Stanton 2020a;b) or uses limited information from transaction or administrative records Granja et al. (2020). As we document, our survey is representative of firms of all sizes and in all sectors of the economy.

Figure 1: Unemployment rate in Denmark and the US



Notes: This figure plots the percentage of workers who were unemployed in 2019 and 2020 in Denmark and the United States. Data from the US from the Bureau of Labor Statistics. Data for Denmark comes from the Danish Statistics agency. A common international comparison measure of unemployment rates uses OECD survey-based data and is slightly different from the Danish register data. For consistency, we use Danish register data here. The black hollow circles and crosses mark 2019 unemployment rates. The red solid line plots the official Danish unemployment rate. The red dashed line plots our counterfactual unemployment rate, calculated as the number of unemployed plus the number of furloughed workers divided by the labor force (from official records). The navy bars show the US unemployment rate for 2020.

apply for aid within days of taking the survey. We compare firms’ actual and stated counterfactual outcomes to estimate the causal effect of different aid packages.⁵ We also match our data to the 2018 Danish Management and Organizational Practices Survey (MOPS), which includes detailed measures of the operational and HR management practices of a set of firms in our sample.

Our paper contributes to a growing body of evidence documenting how firms responded to the pandemic, and on the relative importance of policies that preserved job matches. The effectiveness of aid packages relies on firm managers understanding and responding to the incentives they create. However, the pandemic generated significant uncertainty (Altig, Baker, Barrero, Bloom, Bunn, Chen, Davis, Leather, Meyer, Mihaylov, Mizen, Parker, Renault, Smietanka and Thwaites 2020) and anxiety (Fetzer, Hensel, Hermle and Roth 2020), which could have compromised managerial decision-making. Like Schivardi, Patnaik, Linarello and Lamorgese (2021), we find that well-managed firms were more resilient in the face of the pandemic. Very few papers have studied how those effectively in charge of aid take-up — firm managers — and the quality of management practices have contributed to the effectiveness of public policy. We find that better-managed firms were more judicious in their use of pandemic aid.

2 Institutional setting and aid take-up

In early 2020, businesses across the world were forced to shut down with highly uncertain re-opening dates. Managers introduced remote work arrangements where possible (Dingel and Neiman 2020), otherwise laying off or furloughing their workers. Denmark allocated billions for firm subsidies to retain employees, fixed cost grants and deferrals of tax obligations, publicly predicting they would prevent 100,000 job losses (Finansministerium 2020). We describe the policy types in turn.

2.1 Danish labor-related support: furlough support and sick leave

Furlough is an arrangement where workers are effectively placed on leave — normally unpaid — for a limited period of time. Furloughs are commonly used when organizations want to preserve the job match with the employee but are experiencing short-term liquidity constraints, though this

⁵Our use of stated counterfactuals to estimate the causal effects of aid policy relies on firms being reliable and accurate at predicting their behavior and outcomes under various uncertain settings. This is, of course, consistent with standard theories of the firm, but also with evidence on the ability of firm managers to predict future sales (Bloom, Davis, Foster, Lucking, Ohlmacher and Saporta-Eksten 2020) and layoffs (Barrero et al. 2020). Within our sample, we also find that firms reported layoffs and furloughs are very close to the reports in administrative records. Finally, there is no evidence that firms distort their counterfactual reports toward thresholds used to determine aid eligibility. Details in Appendix A.1.

is most often seen in the public sector. For example, the United States congress failed to pass a budget bill in late 2018 and the government shut down all its operations for 35 days, furloughing 800,000 workers for that period. While this is less common for private firms, the concept is the same and in 2020 it served the dual purpose of maintaining job matches as well as enabling social distancing during the pandemic.

In this instance, furloughed workers *did not work*, even from home, but were still paid their full salary. The Danish government's COVID aid package subsidized 75 percent of salary costs for furloughed workers, subject to a cap. Based on the Danish unemployment insurance system, the cost of the furlough support policy is was more expensive to the government than supporting unemployed workers on the traditional programs, suggesting that the policy goal was clearly to maintain as many job matches as possible. The estimated cost of the furlough policy was US\$2.6 billion, covering over 280,000 unique workers and over 15 million working days.

Figure 1 reports the monthly registered unemployment rate for Denmark in 2019 and 2020, along with the “counterfactual unemployment” rate, if we assume all furloughed workers would have been laid off instead of furloughed. For contrast, the figure also reports the US unemployment rate for each month in 2020. Our counterfactual Danish unemployment rate closely tracks the US unemployment rate through to June, but suggests a substantially quicker recovery as firms no longer rely on government aid for furlough support and the unemployment rate continues to drop in the following months. The US unemployment rate, however, drops at a slower pace and stays over 2 percentage points higher than in Denmark by December 2020.

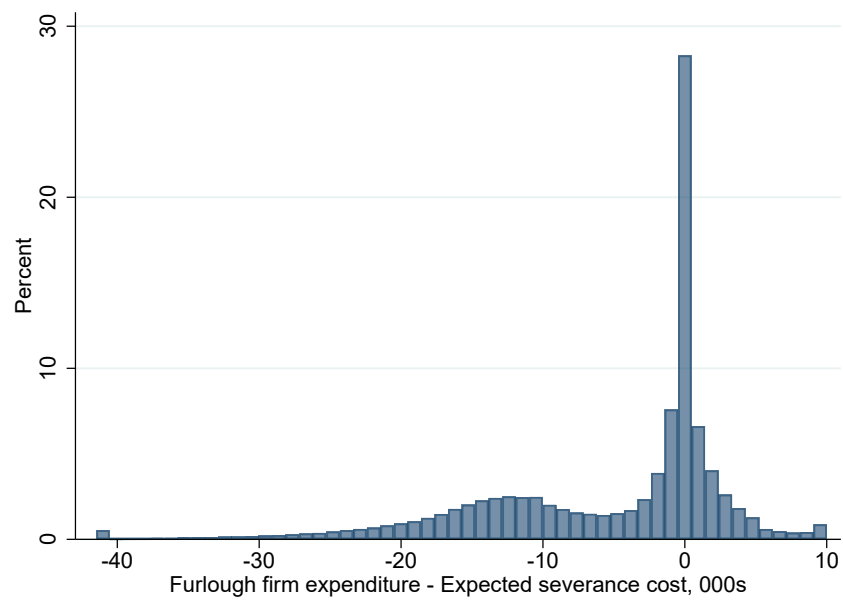
Furlough support was one of six main government aid offerings, all of which were not mutually exclusive and any firm meeting the thresholds of eligibility for a type of policy could apply for aid. The requirement for a company to be eligible for furlough support is that it otherwise would have laid off a minimum of 30 percent of its employees, though this does not seem to have been binding.⁶ The amount of severance payment firms would be liable for if they fire workers varies based on tenure and contract type, and can be as high as low as 2 weeks or as high as six months of full salary.⁷ We estimate that for 36% of the furloughed workers, the firm's bill of their furlough wages exceeded the amount that the firm would have expected to pay in severance (Figure 2).⁸ This suggests that over one-thirds of employees had firms that perceived their job matches being worthwhile maintaining.

⁶We do not observe a discontinuity at 30% in the predicted share of employees that would be laid off without aid.

⁷For most “white-collar” workers employed under 6 months the severance payment is equivalent to 1 month of salary, between 6-33 months severance is 2 months of salary, between 34-68 months severance is 3 months of salary, between 69-103 months severance is 4 months of salary, and over 103 months (8 years and 7 months) severance is 6 months of salary. For “blue collar” workers the severance payment is equivalent to 2 weeks pay.

⁸The average worker in 2019 had between 2 to 3 years of tenure, so we assume firms would have to pay approximately 3 months of severance for “white collar” workers, and 2 weeks of severance for “blue collar” workers.

Figure 2: Furloughs in Denmark: implicit net firm cost of furloughs



Notes: This figure plots the distribution of the implicit net firm cost of furloughing workers for all furloughed workers. We estimate the implicit net cost of furloughing a worker as the total actual amount the firm paid (25% of their wage bill for furloughed days) minus the expected amount of severance pay the firm would have owed the worker if they were fired (winsorized at 0.05%). Data is from the Danish government registry of disbursement of wage support for furloughed workers from March to December 2020.

2.2 Danish non-labor related support: fixed costs and tax payments

Beyond direct payments to support furloughs, governments also provided direct aid for non-salary costs aimed at the hardest-hit firms. Danish firms were eligible for government-guaranteed loans if they incurred losses of more than 30 to 50%, and were eligible for fixed-cost subsidies if they experienced revenue declines of more than 35%. All firms were eligible for 30 days delay of VAT payments (fiscal aid).⁹ A number of countries offered aid to cover a share of fixed costs up to a cap, such as the UK, while others offer a lump sum, such as Germany and France. Tax forgiveness and deferrals have also been a common policy. Our analysis includes the different types of aid as controls, but a more thorough analysis of the effect of these policies is outside the scope of this paper.¹⁰

3 Data and methodology

We combine four datasets for our analysis, including one administrative dataset, one public provider of firm accounts and two representative surveys. We show that our COVID survey sample covering almost one-quarter of the Danish economy is representative of the firms in the universe from the firm accounts in terms of industry and firm size. We also verify that our survey respondents were accurate and truthful in their reports across common variables in the survey and administrative data.

3.1 Administrative datasets and firm public records

Firm financial information

Firm financial information are from Experian, a dataset assembled by a private firm using the annual reports that all limited liability firms are required to file at the Danish Ministry of Economic and Business Affairs. Local regulations mandate disclosure of firm assets and measures of profitability, such as operating results and net income. We have firm accounts data for 40,358 firms between 2016-2018, including annual revenue and employment, which we use for validation and benchmarking.

⁹The threshold for loans was 50% for small firms and 30% for large firms.

¹⁰Table A.2 offers a summary of policies and eligibility requirements across countries.

Government furlough reports

We have the government register of labor aid support requests from March to December 2020. The register data includes a total of 280,162 unique employee furloughed workers from 32,220 firms. We matched 3,002 firms from this register to our COVID survey, described below. The register data provides a rich characterization of the types of jobs that are furloughed, and allows us to verify our survey data. In particular, we address the two main potential issues with our survey data: truthfulness and accuracy of reports.

3.2 Survey data

COVID survey: methodology and descriptive statistics

We developed a self-respondent survey that was sent out on 23 April 2020 to 44,374 firms; effectively the entire population of private-sector firms with more than 3 employees in Denmark.¹¹ We received 10,642 responses by 1 June 2020 yielding a response rate of 24 percent — an unusually high rate for voluntary online surveys.¹² Using the register data, we verify that the respondents are representative of the population of firms with respect to both firm size and industry.¹³ We construct weights from the firm register to build to account for any remaining respondent selection bias, but in general the weighted and unweighted results are similar.

The survey included 23 questions, including basic firm characteristics (such as employment in January, revenue change since January) and a series of questions on government aid take-up and labor demand choices. The survey asked respondents to indicate which aid packages they used from the list of available options. All firms were asked to report the number of employees they furloughed and laid off as a result of the pandemic, and firms that reported taking aid were also asked to report the number of furloughs and layoffs that they would have expected to enact if they had not taken aid. Our main results are based on survey data and the figures reported by the respondents, and we provide further evidence here that our survey data is reasonably accurate.¹⁴

The question of whether people are truthful in surveys is not new (for example, [Bertrand and Mullainathan \(2001\)](#)), but business surveys are now widely used to forecast behavior as methodologies have developed to overcome common pitfalls. For example, people are likely to answer

¹¹Participation was voluntary, and no financial compensation was offered to respondents. The survey was carried out by Epinion, a private survey firm in Denmark that has access to the “government email” inbox.

¹²For example, compare our response rate to [Altig, Barrero, Bloom, Davis, Meyer and Parker \(2020\)](#), [Ben-David, Graham and Harvey \(2013\)](#), [Bloom, Bunn, Chen, Mizen, Smietanka and Thwaites \(2019\)](#), and [Bartik et al. \(2020b\)](#), where response rates in firm surveys range from 0.1% to 13%.

¹³See Section A.3 in the Data Appendix.

¹⁴We include the COVID survey questionnaire in the Data Appendix.

accurately when the questions are specific; our questions are narrow, do not rely on percentages, and ask about choices that managers are imminently making (avoiding, for example, recall bias). Further, our ability to match our survey data to detailed contemporaneous administrative records allows for an in-depth verification exercise, as detailed below.

Survey validation: reported actual values. We can proxy for truthfulness and accuracy by verifying the reported firm characteristics and actual furlough responses against accounting and register data. The June 2020 aid take-up register data lists all employees for which each firm requested government support for furlough payments, allowing for direct verification of our survey reported values. We find that the values reported by managers in terms of their employment and furlough counts as well as aid take-up status match the government records the vast majority of the time, with the median difference between the reported employment count and the accounting records being 1 employee.¹⁵ For the furloughed employee counts, we find that the reported number of workers furloughed relative to the register data is within 5 workers for nearly 80% of firms, and exactly the same for nearly half of the firms. The high level of alignment between the responses in our survey and the government registers suggests the managers were truthful and accurate in their responses.

Survey validation: reported counterfactual expectations. While it is inherently impossible to test whether the counterfactual statements on furloughs and layoffs are accurate, we can consider the respondent's decision authority and the resulting distribution of responses to infer expected accuracy. Over 90 percent of the respondents were owner-managers or CEOs and thus know — or make — the financial and labor choices in the firm, so it is a reasonable assumption that these managers are in the best position to make these sorts of predictions for their firms.¹⁶

Asking managers to report counterfactuals is not unheard of; for example, [Shapiro and Slemrod \(2003\)](#) did so when studying consumer responses to tax rebates. More in line with our type of survey, [Bloom et al. \(2020\)](#) use the U.S. Management and Organizational Practices to show that managers' own forecasts of sales growth are the single most predictive factor of *actual* sales growth relative to all other measured firm characteristic. Further, this relationship persists even in turbulent times. [Barrero et al. \(2020\)](#) ran a similar business survey contemporaneous to ours with a follow-up a year later, asking US managers about layoffs, the expected permanence of these layoffs and shifts to working from home. They find that the managers' forecast behavior have been exceedingly

¹⁵The 10th percentile difference is -2 (lower employee count reported in the survey) and the 90th percentile difference is 16 (higher employee count reported in the survey). Section [A.1](#) in the Data Appendix includes details on the verification process.

¹⁶The remainder of the respondents were non-managing owners or other administrative staff.

accurate despite the uncertainty induced by the pandemic.

Finally, we can also verify whether managers were defaulting to the ‘threshold of eligibility’ for government aid when responding to the questions on their counterfactuals. Furlough aid in Denmark was offered to those firms that expected they would have to lay off at least 30% of their workforce. If managers were not being truthful or relatively accurate, we would expect to see bunching around the policy threshold. We do not find any evidence of this in the data.¹⁷ Finally, we provide an estimate of the counterfactual unemployment rate if all furloughed workers were laid off, and we find that it closely tracks that of the United States, a country that primarily relied on unemployment insurance instead of furloughs (Figure 1).

4 Results

4.1 Was aid well-targeted?

We find that the bulk of firms taking up government aid in Denmark are, in fact, those in the most need. Figure 3a plots the distribution of revenue change for the population of similar firms between 2016-2017 in the outlined bars, and for the surveyed firms from January to April in the shaded bars.¹⁸ While in any given year many firms experience revenue declines, the hit in April 2020 was a substantial shock. Overall, 30 percent more firms faced declines in revenue relative to 2017, and one quarter more firms face declines in revenue beyond 35 percent (a common threshold for aid). The pattern is similar across firm size bands, though the magnitude of the reported impact is heterogeneous across industries (Figure 3b).

While nearly all industries have over half of the firms reporting expected decreases in revenue, some industries are particularly hard hit — such as accommodation and food services, arts and entertainment and retail. These were also the firms most likely to take-up aid. Most firms reporting no expected change in revenues also report not being aid recipients.¹⁹ Approximately 56 percent of firms in our survey reported taking advantage of one or more government aid programs, with nearly all firms experiencing revenue decreases beyond 50 percent taking some form of aid.

Several non-mutually exclusive aid packages were available to firms, and Table 1 reports the set of firm characteristics that correlate with aid take-up of each type and combination of packages. Linear probability models estimate which characteristics predict take-up of each type of package, starting with general aid take-up, and iterating through the possible package combinations. Column

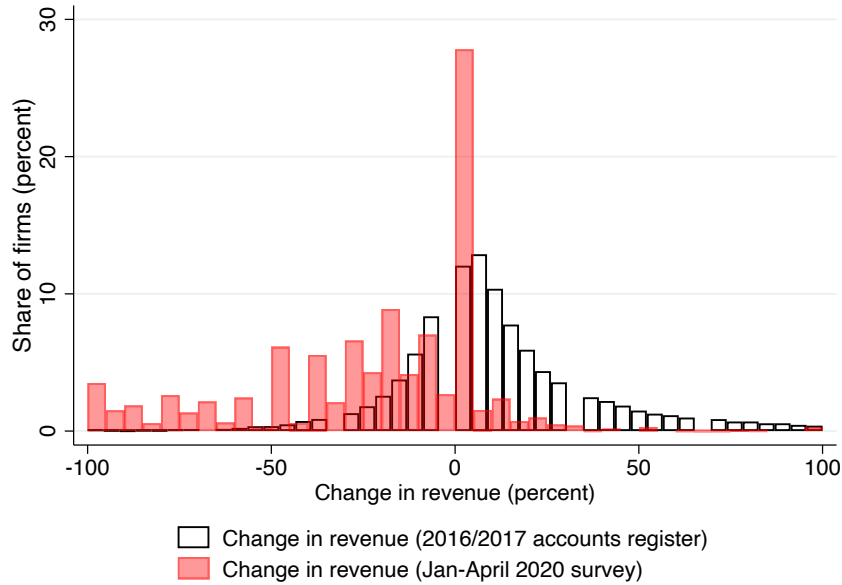
¹⁷In particular, considering the distribution of the expected layoffs, the McCrary (2007) test of the continuity of the density at the policy cutoff of 30% is not significant (Figure A.4).

¹⁸The “normal times” data is the latest available date in Danish Statistics firm employment and accounts data.

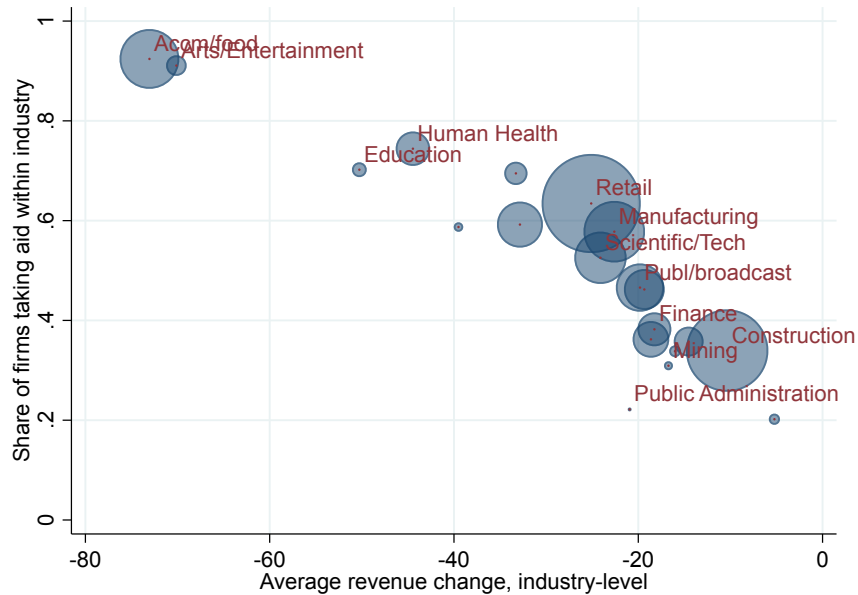
¹⁹The median firm reporting not receiving any aid has an expected revenue change of zero.

Figure 3: Revenue shock and aid take-up by Danish firms

(a) Distribution of revenue change in “normal” and COVID times



(b) Aid take up aid by industry and expected change in revenue



Notes: The graph in Panel (a) plots the the distribution of the firm level change in revenue. The outlined black bars represent the change between 2016 and 2017, using Danish register data for the universe of firms with more than 3 employees in both 2016 and 2017 (N = 40,077). The shaded bars plot the change reported in the authors’ survey of firm managers responding to the effect of COVID-19 on their firms (N = 10,642). The COVID-19 survey was sent to over 44,000 firms with more than 3 employees, had a 24 percent response rate and yielded a representative sample along firm size and industry categories. The graph in Panel (b) reports the industry-level average revenue change (x-axis) and the industry-level average aid take-up (y-axis), weighted by industry size. Each circle represents an industry at the 1-digit NACE level, and the size of the circle shows the relative share of the economy accounted for by each industry. Observations weighted by the inverse probability of responding to the survey relative to the population of firms.

(1) includes all firms in the sample, while the remaining columns include only the firms that took on aid, with the outcome variable taking on a value of one if the firm took on each type of aid bundle. The last rows in the table indicate the share of firms and employment that account for each of the policy types.

Over half of the firms in our representative sample took on aid, and these firms were more likely to have experienced decreases in revenue (Column 1).²⁰ Larger firms and firms in harder-hit industries were more likely to take on aid. About 10 percent of all firms (20 percent of aid-taking firms) took on all three aid types (Column 2), and this was again more common for hard-hit sectors. Considering firms that only took on one of the three types of aid, a fifth of aid-takers took labor-aid only or fiscal-aid only, with only 5 percent taking on cost-aid only. Revenue change is not correlated with take-up of labor-only aid when controlling for industry, as the industries experiencing the steepest declines in revenue tended to take on labor aid in conjunction with either cost aid, fiscal aid, or both. Firms that were least affected in terms of revenue decrease and in least-affected industries were most likely to take advantage of the fiscal aid, unless bundled with other aid types.

4.2 How did aid affect firms' layoff and furlough decisions?

Aid-taking firms had more furloughs and fewer layoffs relative to non aid-takers, with the share of furloughed workers increasing with revenue losses.²¹ A simple comparison between aid takers and non-takers is problematic, however, as taking aid is naturally a choice and not a random assignment. If firms taking aid were more likely to furlough workers in response to a revenue shock instead of laying them off, the observed differences in employment decisions could overstate the policy's effects.

Estimates based on stated counterfactuals

To address the self-selection of firms into the different aid packages, we asked respondents to report their expected counterfactual choices. Among firms that took aid, we asked the number of workers they would have laid off and furloughed if aid was not available.

²⁰Firms that took aid and those that did not were performing similarly in terms of employment growth, sales, profits, and short term debt in the years leading up to the pandemic (see Appendix Figure A.3).

²¹Figure A.6 plots this simple relationship between revenue change, actual furloughs and layoffs across all firms, and counterfactual reported expected furloughs and layoffs for aid-taking firms.

Table 1: The characteristics of firms choosing each aid policy package

	All types		Only one type			2 types		
	(1) Any aid	(2) Labor+Cost + Fiscal	(3) Only Labor	(4) Only Cost	(5) Only Fiscal	(6) Labor + Cost	(7) Labor + Fiscal	(8) Cost + Fiscal
Revenue change								
Increase	-0.466*** (0.016)	-0.180*** (0.013)	0.034 (0.031)	-0.034*** (0.008)	0.341*** (0.037)	-0.137*** (0.007)	0.015 (0.030)	-0.038*** (0.012)
No change	-0.439*** (0.011)	-0.171*** (0.008)	0.019 (0.018)	-0.047*** (0.004)	0.384*** (0.021)	-0.126*** (0.007)	-0.004 (0.016)	-0.055*** (0.004)
Characteristics								
Ln(employment)	0.023*** (0.003)	0.009** (0.004)	0.006 (0.004)	-0.014*** (0.002)	0.006 (0.004)	-0.036*** (0.003)	0.042*** (0.004)	-0.012*** (0.002)
Industry								
Most affected (top 5)	0.196*** (0.011)	0.227*** (0.019)	-0.094*** (0.012)	0.009 (0.009)	-0.172*** (0.007)	0.147*** (0.017)	-0.115*** (0.010)	-0.002 (0.010)
Least affected (bottom 5)	-0.116*** (0.012)	-0.084*** (0.011)	0.057*** (0.020)	0.008 (0.009)	0.108*** (0.021)	-0.063*** (0.011)	-0.022 (0.015)	-0.003 (0.009)
# firms	10504	5868	5868	5868	5868	5868	5868	5868
Share of firms (total)	0.555	0.107	0.106	0.023	0.124	0.077	0.092	0.027
Share of empl (total)	0.569	0.101	0.141	0.006	0.159	0.028	0.127	0.007
Share of firms (aid-takers)	1.000	0.193	0.190	0.041	0.223	0.138	0.165	0.049
Share of empl (aid-takers)	1.000	0.177	0.248	0.010	0.280	0.049	0.223	0.012
Sample	All firms	Aid takers	Aid takers	Aid takers	Aid takers	Aid takers	Aid takers	Aid takers

Notes: ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels. Robust standard errors in parentheses. Column (1) includes all firms in the sample, while Columns (2) to (8) include only aid-takers. All columns are linear probability models, estimated with OLS. Each outcome variable is an indicator for each type of aid. The omitted category from revenue impact is “experienced a decrease in revenue”. Log of employment is calculated based on reported employment in January. Regressions include industry dummies at the 1-digit NACE level, reporting only selected industries based on relevance (share of the economy) and relative impact.

Our analysis requires an assumption that the reported counterfactuals are correct. While inherently un-testable, as discussed in the earlier section, we provide evidence that this is a reasonable assumption: managers provide accurate information on the verifiable reported data, and also do not bunch their reported counterfactuals near the policy threshold. Economic models of selection are predicated on the notion that firms know their business, and as such should be able to foresee immediate alternative outcomes. In this sense, our approach can be at least as informative as a quasi-experimental design as we do not have to rely on a proxy for counterfactual outcomes of aid takers using non-aid takers with similar characteristics. Still, in this section we use both data on the within-firm reported counterfactuals and more conventional between-firm actual reported outcomes to estimate the likely impact of government aid on furloughs and layoffs. Comparing the various methods allows for a rich set of estimates that shed light on different possible biases and help, at a minimum, set bounds on the true effect.

Table 2 reports estimates of the effects of taking up labor aid and non-labor aid (cost aid and/or fiscal aid) on the share of workers furloughed and laid off.²² Across all panels, Columns (1) and (2) report the effects on furlough outcomes and Columns (3) and (4) report the effects on layoffs. Panel A include only aid-takers and the outcome variable is the difference between the reported actual share of furloughed and laid off workers versus reported counterfactual outcomes that the firm expected to enact if they had not taken up aid. In Panel B we decompose the difference and explicitly include indicators for both the actual and counterfactual states for each firm.²³ As such, the number of firms for this exercise is 5,261 and the number of observations is 10,522. The two panels are not direct analogues to each other because in Panel A the outcome variable is the first difference at the firm level. Using these data, we estimate the following model:

$$Y_{jT} = \alpha + \theta^L L_j + \theta^{NL} NL_j + T \times (\beta_0^L L_j + \beta_0^{NL} NL_j) + X_j \gamma + \varepsilon_{js} \quad (1)$$

where firms are indexed by j , and $T = 0$ if the observation measures the firm's reported outcomes in the absence of aid, and $T = 1$ if it measures the firm's actual outcomes. The key variables are binary indicators for firms that took labor aid (L_j), or non-labor aid (NL_j). These aid packages are not mutually exclusive; firms can take up any combination of labor and non-labor aid. The coefficients θ^L and θ^{NL} measure differences in counterfactual outcomes for firms that took up particular aid packages. The coefficients β_0^L and β_0^{NL} measure the difference in observed outcomes, relative to counterfactuals, for a given aid package. Firm-specific controls, X_j , include log of employment

²²We repeat the exercise including controls for the firm's 5-year (2013-2018) average employment growth and average-wage growth in Table A.6.

²³The data is organized such that each firm has two observations: one corresponding to their actual furloughs and layoffs, and one corresponding to their counterfactual furloughs and layoffs.

(January), revenue change size, and 2-digit industry. The term ε_{jT} captures idiosyncratic reporting error and other factors that affect layoff and furlough decisions.

The two methods estimate similar average effects, but help shed light on the source of the variation. The simple model with the difference between actual and counterfactual outcomes as the dependent variable (Panel A) suggests that, relative to other aid-taking firms, those that took on labor aid increased their share of furloughs by about 27 percentage points and decreased their layoffs by about 19 percentage points. The fully specified model in Equation 1, however, decomposes the relationship into the effect driven by what the firms did (reported outcomes) and what they would have done without aid (reported counterfactuals). Specifically, we interpret β_0^L and β_0^{NL} as effects of treatment on the treated — that is, the average effect of each policy on the firms that take them up.

Panel B then suggests that firms taking labor aid increased the share of furloughs by about 27.5 percentage points, but only decreased layoffs by about 8 percentage points. Our estimates of θ^L and θ^{LC} measure selection into treatment on the basis of counterfactual outcomes, and suggest that firms taking labor aid would have expected to only furlough about 3.7 percentage points more workers, but expected to layoff about 16 percentage points more workers relative to firms that also took aid but chose different packages. In short, the higher furlough difference share is driven by firms enacting furloughs they did not expect to do, and not enacting layoffs they had expected to do.

Non-labor aid had much less of an impact on furloughs, but did have some impact on layoffs. Controlling for the magnitude of the revenue shock, Panel A suggests that at the firm level firms that took on non-labor aid furloughed 4.3 percentage points more workers than they would have otherwise, and laid off 5.4 percentage points fewer workers. Panel B, however, suggests that the average effect of non-labor aid is not significant after controlling for the size of the revenue shock, but the effect on layoffs is still significant and just under one-third of the magnitude of the coefficient on labor aid.

Estimates based on selection on observables

Panel C of Table 2 is based on comparisons of actual reported outcomes between firms that took aid and firms that did not. These are identified under the assumption that firms' counterfactual outcomes in the absence of aid are well-proxied by the actual outcomes of the firms that did not take aid. While not our preferred specification, this is a useful benchmark model to compare against our analysis based on stated counterfactuals.

Table 2: Relationship between aid type and labor decisions

Panel A: Aid takers only	(1)	(2)	(3)	(4)
Difference in share of workers...	Furloughed		Laid off	
Labor aid = 1	0.278*** (0.011)	0.270*** (0.012)	-0.248*** (0.009)	-0.193*** (0.009)
Non-labor aid = 1	0.049*** (0.013)	0.043*** (0.013)	-0.104*** (0.010)	-0.054*** (0.009)
<i>Controls</i>				
Industry FE	✓	✓	✓	✓
Revenue shock		✓		✓
Observations	5261	5261	5190	5190
# Firms	5261	5261	5190	5190
Panel B: Aid-takers only	(1)	(2)	(3)	(4)
Total share of workers...	Furloughed		Laid off	
<i>Reported actuals</i>				
Labor aid = 1	0.325*** (0.008)	0.275*** (0.009)	-0.046*** (0.006)	-0.083*** (0.006)
Non-labor aid = 1	0.038*** (0.009)	-0.008 (0.009)	0.006 (0.004)	-0.027*** (0.005)
<i>Reported counterfactuals</i>				
No labor aid = 1	0.087*** (0.009)	0.037*** (0.009)	0.197*** (0.008)	0.161*** (0.008)
No non-labor aid = 1	0.059*** (0.009)	0.013 (0.009)	0.092*** (0.007)	0.059*** (0.006)
<i>Controls</i>				
Industry FE	✓	✓	✓	✓
Revenue shock		✓		✓
Observations	10522	10522	10380	10380
# Firms	5261	5261	5190	5190
Panel C: All firms	(1)	(2)	(3)	(4)
Total share of workers...	Furloughed		Laid off	
<i>Ref category: non-eligible non-aid takers</i>				
Labor aid = 1	0.336*** (0.006)	0.290*** (0.007)	-0.037*** (0.003)	-0.048*** (0.004)
Non-labor aid = 1	0.047*** (0.006)	0.005 (0.006)	0.018*** (0.002)	0.008*** (0.002)
Aid eligible=1	-0.016*** (0.004)	-0.022*** (0.004)	0.016*** (0.003)	0.015*** (0.003)
<i>Controls</i>				
Industry FE	✓	✓	✓	✓
Revenue shock		✓		✓
Observations	9279	9251	9279	9251
# Firms	9279	9251	9279	9251

Notes: ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels. Standard errors clustered at the firm level. The outcome variables for Columns (1) and (2) refer to share of workers who are furloughed, while Columns (3) and (4) refer to share of fired workers. The sample in Panels (A) and (B) include only firms that took at least one type of aid, and we duplicate each firm observation to include their actual outcome response as well as their reported counterfactual response. The coefficient estimates for labor, cost, and fiscal aid in these panels correspond to firms' reported actual outcomes. Panel (C) includes all firms in our survey sample. All columns are estimated with OLS and include controls for revenue loss, log of January employment, and industry (2-digit NACE level).

For this analysis, we are estimating a standard cross-sectional model:

$$Y_j = \alpha + \beta_1^L L_j + \beta_1^{NL} NL_j + X_j \gamma + \varepsilon_j \quad (2)$$

where the variables and parameters have interpretations analogous to equation (1). We assume $E[\varepsilon_j | L_j, NL_j, X_j] = 0$.

This model includes the same set of firm and industry controls, and also an indicator for whether the firm was eligible for aid. This is because the aid indicators are mutually exclusive and some firms that were eligible for aid opted not to take aid. Firms that were eligible to take aid but chose not to do so had lower furloughs and higher layoffs. The omitted category in this model is firms that were not eligible and did not take up aid.

The estimated effects are similar to those estimated based on stated counterfactuals in Panel B. The exercise of comparing the two sets of estimates is useful to help us understand the nature of the selection bias introduced by firms' choice of aid packages. Under both models, labor aid leads to large increases in the share of workers furloughed and substantial, albeit smaller, reductions in the share of workers laid off. This is what the policy is intended to do: firms cut layoffs and substantially increased furloughs. If the counterfactuals are accurate, firms furloughed significantly more workers than they had planned to lay off, suggesting that the policy not only saved employment matches, it also encouraged firms to put workers on leave who might have otherwise stayed on the job. While under normal circumstances inducing furloughs would be undesirable, it is certainly not so in the context of the pandemic, where a key goal is to encourage social distancing.

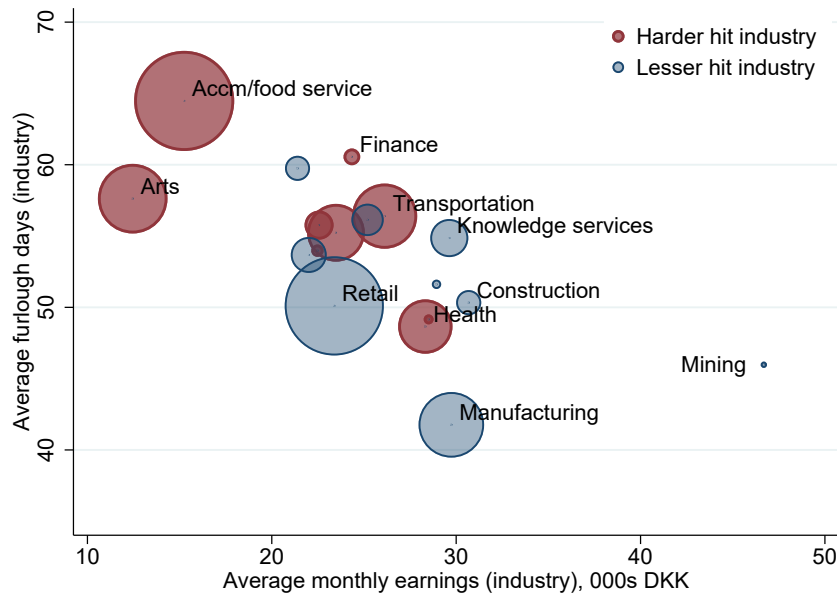
With regard to non-labor aid, both models suggest no significant effect on furloughs, but disagree about the effect on layoffs. The model based on stated counterfactuals in Column (4) of Panel B suggests non-labor aid reduces layoffs by 2.7 percentage points. In the model of selection on observables, Column (4) of Panel C suggests non-labor aid increases layoffs by 0.8 percentage points. One interpretation is that, relative to other aid-taking firms, those that took up non-labor aid to offset payments of rent or other fixed costs may have been able to re-direct funds to keep workers on the job whom they might have otherwise been forced to lay off. Relative to firms that were not eligible for aid and conditional on taking labor aid, however, taking non-labor aid is correlated with laying off slightly more workers.

4.3 Cost-effectiveness and distributional consequences

For the majority of firms, the structure of the furlough support was set up in such a way that it would be beneficial for the firm to furlough at least some of their workers. That is, the firm paid one-quarter of a worker's salary on the days they were furloughed while the government paid the

other three-quarters. Severance costs vary with type of job broadly defined as “blue-collar” or “white-collar/office” work, with the former generally being entitled to two weeks of severance pay and the latter depending on tenure (on average, severance would be about 3 months’ pay). Our data allows us to estimate the expected severance pay for each employee that was furloughed under Denmark’s policy, and compare the expected cost of firing each employee with how much the firm paid for their furlough costs (Figure 2). About one-quarter of all workers in Denmark who were furloughed cost about the same to the firm *in total* furlough costs as it would have cost the firm to fire them.²⁴ The majority of workers cost less to furlough than to fire, which is expected, but one-third of furloughed employees cost *more* to furlough than it would have cost the firm to fire them. This is striking, and suggests that the furlough policy may have saved a substantial share of good job matches that might have otherwise been severed.

Figure 4: Furloughs in Denmark: type of worker and days furloughed



Notes: This figure plots the industry-level average number of furlough days relative to the industry-level average monthly earnings of workers. Each circle represents an industry at the 1-digit NACE level, and the size of the circle shows the relative number of furloughed employees accounted for by each industry. Harder-hit industries are defined as those with above median revenue hit, as reported in the authors’ COVID survey. All other data is from the Danish government registry of disbursement of wage support for furloughed workers from March to December 2020.

In all, a little over 280,000 unique workers participated in the furlough scheme between March and September 2020. Almost 60 percent of furloughed workers were full time, who had an average monthly pay of just under DKK30,000 (~ US\$4,800). Full-time workers accounted for about 55

²⁴We use the threshold of about $\pm US\$500$ for this estimate. One third of workers are within US\$1,000.

percent of all furlough days paid under the scheme, while the remaining 45 percent of days were taken by part-time workers. The average monthly salary of furloughed part-time workers was about DKK12,000 (~ US\$1,900). At the industry level, Figure 4 summarizes the relationship between average furlough days and average monthly earnings. The size of the circle indicates the sum of the number of furloughed workers in the industry.²⁵ Firms in harder-hit industries tend to have lower wages and larger average number of furloughed days. Firms in less hard hit industries furloughed fewer workers but for a similar length of time to other lesser-hit firms. We also see that furloughs are more concentrated in service and direct-contact industries, such as accommodations and food services, arts and transportation. Unlike the evidence from other countries that layoffs have been more likely among female workers (Montenovo, Jiang, Rojas, Schmutte, Simon, Weinberg and Wing 2020), we do not see a difference across gender in the likelihood of being furloughed.²⁶

4.4 Do better-managed firms use aid more effectively?

For approximately 20% of our sample, we can merge aid take-up and furlough reports from our COVID survey to measures of management practices from the Danish Management and Organizational Practices Survey (higher scores imply “better” management, as in Bloom, Brynjolfsson, Foster, Jarmin, Patnaik, Saporta-Eksten and Van Reenen (2019)). This allows for a unique characterization of policy-take up and labor demand choices, as any firm-based policy effectiveness is ultimately determined by these choices made by firm managers. We summarize the marginal “effects” (in a correlational sense) across the distribution of management scores in Figure 5. Panels (a) through (d) include all firms matched into the sample, while Panels (e) and (f) include only aid-takers.

Panel (a) suggests that better managed firms are more likely to take up aid, conditional on the size of the revenue shock and industry. Panel (b), however, suggests that the initial revenue shock was felt equally across all levels of management, conditional on industry. One interpretation is that better managed firms are better able to take advantage of government support, perhaps as a result of being more organized or able to comply with requirements.

For Panels (c) and (d), we ran a regression of the reported share of actual workers furloughed or laid off on the management score interacted with aid status: circles represent firms that did not take aid, diamonds represent firms that took labor aid, and squares represent firms that took other types of aid (but not labor aid). Better managed firms were more likely to take on aid, but those who took labour aid furloughed a *smaller share* of their employees. Better managed firms that took on other aid furloughed more employees relative to worse-managed firms, but still at a substantially

²⁵Appendix Figure A.7 repeats the exercise separating workers by full time and part time status.

²⁶The share of male and female furloughed workers is almost exactly 50-50.

lower level. In terms of layoffs, firms that took on labor aid were no different from those that took aid across the whole management distribution. However, we see a steep negative slope for firms that took on non-labor aid. This provides an important characterization to the results in Panel C of Table 2, as the level difference in higher layoffs seems to be driven by badly managed firms.

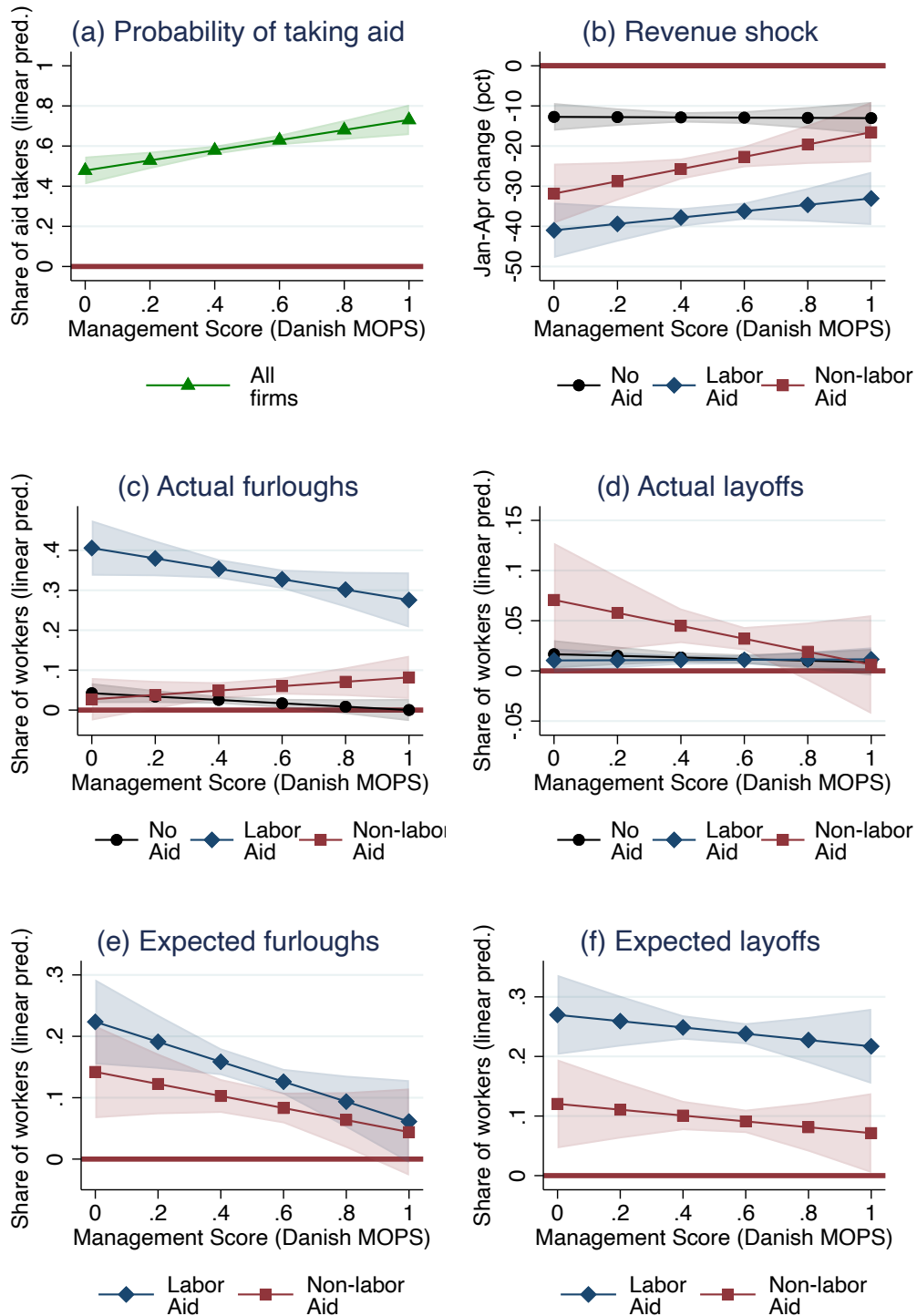
Panels (e) and (f) include only aid-takers and report the relationship between the reported counterfactuals expected by the managers if they had not taken aid. The slopes are relatively similar across the types of aid takers, though firms that chose to take on labor aid report a significantly higher *level* of expected layoffs in the absence of aid. This is consistent with better managed firms being more likely to seek and secure the appropriate aid they needed, and also use it more appropriately.

5 Conclusion

The COVID-19 pandemic has caused widespread disruption to lives and livelihoods across the world. On many margins, Danish policies intended to mitigate the economic damage have worked as intended. Firms that took aid were also those in the most need, and their decisions bolstered business survival and consumption of their employees. Because furlough aid covered 75 percent of the salary firms paid to workers, employers still had non-trivial financial commitments to consider when deciding who to lay off and who to put on temporary leave. They were more likely to furloughed those whose productivity was temporarily reduced by the pandemic, as well as allowing a large share of the most at-risk employees to remain home. These outcomes stands in contrast with evidence from the United States' Paycheck Protection Program, where [Chetty et al. \(2020\)](#) report "little impact on employment rates at small businesses". They attribute this lack of impact to aid being taken up by firms that did not experience large job losses. The differences across the two countries have many sources, but certainly illustrate the importance of managerial decision-making and the need to bear it in mind when designing policy.

During the Great Recession, government programs encouraged firms to find alternative work arrangements rather than lay workers off ([Cahuc, Kramarz and Nevoux 2018](#)). While these short-time work policies are effective in preserving employment, they can also prevent workers from being reallocated to more productive jobs ([Giupponi and Landais 2018](#)). In a more standard business cycle downturn, active labor market programs may prevent unproductive matches from dissolving and obstruct the reallocation of employment toward more productive uses. In the early phases of the pandemic, such concerns are less relevant as the economic shock is unrelated to productivity or other market fundamentals. Further, the public health benefits make it optimal to borrow against the future to preserve job matches while providing people uninterrupted payments facilitates com-

Figure 5: Firm management practices, outcomes and labor choices



Notes: Data from the authors' COVID-19 survey and the Danish MOPS. All panels estimated with OLS including industry fixed effects, reporting coefficients at each quintile of the management quality (0 to 1). Panels (a) to (d) include all matched firms, N=1,888. Panel (a) outcome variable is an indicator of whether the firm took aid, including a control for the revenue shock. Panel (b) plots the reported magnitude of the revenue shock (pct change in revenue between January and April). Panel (c) through (f) include the size of revenue shock as a control and interact the management score with an exhaustive aid status variable: no aid, labor aid or non-labor aid. Panels (e) and (f) include only aid-takers: N=1,081. Outcome variables are: Panel (c) % actual furloughed workers. Panel (d) % actual layoffs. Panel (e) % expected furloughed workers in the absence of aid. Panel (f) % expected layoffs in the absence of aid.

pliance with stay-at-home orders.

This calculus is evolving as the pandemic moves into the next phase and countries attempt to take their economies “off pause”. [Barrero et al. \(2020\)](#) argue that the COVID-19 shock will ultimately lead to reallocation of employment both across and within sectors, and that as a result policies that prevent workers from moving to new employment opportunities are increasingly distortionary. As the social cost of going to work decreases, such policies are being re-evaluated and perhaps become more targeted to minimize distortions to the labor market reallocation decisions. For instance, firms should be creative in finding new ways to provide services and keep workers safe on the job, and over the medium run, workers may be in greater demand in certain sectors. Policy might adjust to facilitate some reallocation while supporting consumption and longer-run job matches; our results suggest that the aid packages in Denmark significantly hastened the return to the pre-pandemic unemployment level.

Our results also suggest it is important to take firm heterogeneity seriously when devising policies that need take-up and ultimately rely on managerial actions. [Cornwell, Schmutte and Scur \(2019\)](#) find that better managed firms are more effective at creating and destroying employee matches according to employee and match quality. Our results are consistent with these firms being more likely to preserve their job matches as labor aid-takers as well as non-takers. As governments pivot to shoring up their economies after the health crisis, tailored approaches to government policy can be a responsible way forward. More generally, our work adds an important piece of evidence to the understanding of the effects of short-time work government policies on firm decision-making and, ultimately, labor and economic outcomes.

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