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Unemployment insurance benefits and firms' profitability – The impact of labor productivity

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Abstract

This paper analyzes the effects of unemployment insurance benefits on firms' profitability and the impact of labor productivity changes in this relation. Using panel regression analysis with data from heterogeneous firms across multiple industries and US states, we find that there is no statistically significant relation between unemployment subsidies and firms' profitability, except when we narrow our analysis to specific industries or dimensions. Additionally, our findings suggest that higher unemployment benefits lead to increased labor productivity in firms.

Keywords

Unemployment insurance; Firm profitability; Unemployment risk; Labor productivity.

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Unemployment insurance benefits and firms' profitability – Group part

Introduction

The unemployment insurance (UI) system of the USA was created in 1935, as an element of the Social Security Act, as a consequence of the Great Depression of 1929. The program's aim is to provide an adequate replacement of income to unemployed people while they search for a new job, and to serve as a mechanism that contributes to the stabilization of the economy and of employment (Luigjes, Ficher and Vandenbroucke, 2019).

The UI program can play an important role on companies' profitability, since it can have a significant impact, both positive and negative, in many different variables on which profitability depends. The positive effects include a much studied one that has to do with the fact that this system leads to a decrease of the wage premiums demanded by employees (Topel, 1984 and Agrawal and Matsa, 2013), which consequently contributes to the increase of companies' operating profits. UI benefits can also bring consumption smoothing benefits to workers (Gruber, 1997), which may be beneficial for companies' net sales. Additionally, it can bring increases in labor productivity, due to improved job-match quality either because of increased job search efforts by unemployed workers or the creation of better and more productive jobs by employers to attract more prudent talent. However, there are also negative impacts that need to be taken into consideration. First and foremost, companies are responsible for UI benefits financing, through state payroll tax rates and taxable wage bases (Vroom and Woodbury, 2014). Each state defines its own method to calculate the payroll tax rates, but all are based on an experience rating system, which means that the payroll tax rate each company is charged with depends on its recent layoff history. Furthermore, the UI program can lead to a decrease of the incentive to do income smoothing, (Ng, Ranasinghe, Shi and Yang, 2019), resulting in a higher volatility of earnings. Due to these contradictory effects, it remains uncertain whether UI benefits have a positive or negative impact on companies' profitability.

Ultimately, this matter depends on which effect dominates over the other and, as literature on this topic is still somewhat scarce, this paper's goal is to reach a definitive conclusion.

In order to analyze the relation between UI benefits and companies' profitability, net income (loss) is used as an indicator of profitability. As for the UI benefits, they are calculated through reports, from 1980 to 2019, that can be found on the US Department of Labor. Various regressions are run in order to be able to ascertain the effect of each set of controls and assumptions added, however, all the results obtained through panel data regression are reported as statistically insignificant.

As inconclusive results are reached with the first regression analysis conducted, further studies are proceeded to get a clearer insight on the relation of UI benefits and companies' profitability. This is done by separately analyzing industries and companies according to the following dimensions: industries with high and low annual layoffs and discharges levels, companies with positive and negative net income, companies with high and low leverage and larger and smaller companies in firm size, as measure by the logarithm of total assets. Additionally, we also investigate whether considering different time periods, alternative measures for profitability and inflation-adjusted figures influences the results. Panel data regression is once again used, and the results confirm that there is a statistically significant and economically meaningful relation between the natural log of maximum UI benefits and profitability for companies with a positive net income. The results from the regression conducted for companies with low leverage indicate the same, there is a statistically significant and economically meaningful relation between the net income (loss) of firms with low leverage and the natural log of maximum UI benefits. The same happens when regressing for larger companies only and when analyzing the period between 2000-2009.

After analyzing the overall association between unemployment subsidies and firms' profitability, one of the main channels that is most likely to affect the main result in that relation

is explored in this paper. This is the relation between UI benefits and firms' labor productivity, given that labor productivity is one of the main benefits that the unemployment insurance system has on firms, as suggested by existing literature.

Most existing literature suggests that there is a positive association between these two variables (namely, but not limited to, Acemoglu and Shimer, 2000; Kumar, 2002; Zhang, 1996), which reinforces the belief that labor productivity plays a fundamental role in explaining the positive effects of unemployment insurance benefits on firms' profitability. Nevertheless, all these studies focus on quantitative economic models using a general equilibrium framework, some of them at a macroeconomic level and recurring to homogeneous workers and firms, whereas the analysis done in this research follows a more heterogeneous and labor market realistic approach using panel regression analysis to investigate this relation.

Empirical analysis conducted in this paper shows that increases in unemployment insurance benefits increase firms' labor productivity. For this study, new controls are used to account for variables that are seen as the main drivers of labor productivity and fixed effects kept being considered. The results obtained are statistically significant and economically meaningful. In order to reinforce the importance of the selection of an appropriate proxy for labor productivity, it is proceeded with an equivalent analysis, but with a different and worst measure for the chosen dependent variable, and completely different results are obtained, as expected. To further explore the significant results obtained and improve the reliability of the reached conclusions, the effect that three different dimensions (labor intensity, time and inflation) have on the relation between UI benefits and firms' labor productivity is then analyzed, to reach the conclusion that the results are robust to inflation and to labor intensity and that the impact of UI changes on labor productivity may take more than 1 year to show effect.

Theoretical framework

In the past few decades, the impact of unemployment on companies and workers has been thoroughly discussed. It has already been established that when involuntarily fired, employees face great costs, therefore, in order to compensate for the unemployment risk they face, employees demand higher salaries and improved working conditions. These wage premiums, referred to as "compensating wage differentials", represent a significant cost that companies must bear in order to increase labor supply. As examples, Abowd and Ashenfelter (1981) empirical analysis supports the theory that estimated compensating differentials can range from less than 1 percent where workers experience little anticipated unemployment, to over 14 percent in industries that experience substantial anticipated unemployment and unemployment risk. Agrawal and Matsa (2013), estimate that in the absence of UI benefits, the cost of compensating wages for unemployment risk for BBB-rated firms can be of about 154 basis points, and as much as 301 basis points for BB-rated firms. Through this sequence of facts, we may infer that since wage premiums directly decrease companies' operating profits by increasing the overall value of wages, they consequently lead to a lower profitability, measured as the net income.

Unemployment insurance can be a mechanism that offsets the impact of unemployment risk on wages and therefore on net income as well. This is because, in the presence of UI, the wage premium that employees require per unit of layoff risk is lower, therefore unemployment becomes less expensive. Topel (1984), finds that even if, for a typical worker, wages rise between 0.006% and 1% for each percentage point increase in unemployment, this wage differential disappears if UI completely replaces lost earnings while unemployed. Agrawal and Matsa (2013), when considering the presence of UI, estimate that for a BBB-rated firm the wage premium would only be of about 57 basis points and for a BB-rated company of about 112 basis points. These values are significantly lower than the ones previously mentioned,

which do not account for UI benefits. The positive effect this can have on the net income may, nevertheless, be attenuated because companies are the ones who raise the funds for UI benefits, as it will be further explained in a following section.

Moreover, UI benefits can also have a negative impact on companies' profitability through the alteration in the incentives for income smoothing. It is well known that reported net profits of companies may be influenced by the choice of the accounting principles used for its measurement. According to Copeland (1968), one of the most common manipulating goals associated with corporate managers is the ability to report smooth income. Through a combination of field interviews and a survey instrument, Graham (2005) research indicated that CFOs believe earnings to be a key metric considered by outsiders. Volatile earnings are perceived as riskier than smooth earnings, thus companies prefer to report smooth income in order to appear more financially stable and consistent. The results obtained from the previously mentioned survey concluded that an astonishing 78% of the executives questioned would abdicate economic value for smooth earnings. In Ng, Ranasinghe, Shi and Yang, 2019, empirical study however, it was determined that, once again, through a reduction of unemployment concerns, UI contributes to the decrease of the incentive to engage in income smoothing. This effect is stronger when employees face higher unemployment risk and for companies that have a great proportion of low-wage employees, for whom UI benefits would be particularly useful and necessary. Through this effect therefore, it can be concluded that UI benefits may also lead to more reports of lower (higher) net incomes (losses).

This same principle can be applied for the consumption of unemployed workers, since Gruber (1997) found solid evidence that UI has a considerable impact in terms of providing nontrivial consumption smoothing benefits to employees. In the mentioned study, it was estimated that without the existence of UI, the consumption of the unemployed workers would fall by 22%, over three times the average fall with the presence of this system. Presumably,

companies can benefit in terms of profitability from this consumption smoothing, because of the impact that the unemployed workers' purchasing power may have on their net sales. If fired workers are able to have a higher consumption level due to the presence of UI, then it can be implied that this will lead to a smaller negative impact on the amount of net sales.

Practically all the theory analyzed in this section, namely the effect of UI benefits on wage premiums and consumption smoothing, indicates that the profitability of companies is positively impacted by the existence of UI benefits. However, the UI program can also contribute to a decrease of the practice of income smoothing, which implies that there could be an increase of the reporting of lower (higher) net incomes (losses). Furthermore, it is fundamental to add that the funds raised for UI benefits are financed by companies, through taxable wage bases and state payroll tax rates. The payroll tax rates depend on the unemployment history of each company, thus as the amount of layoffs of a company increases so does the state payroll tax rate the employer is charged with. This means that UI benefits can also represent a cost companies have to bear.

Institutional background

The federal-state unemployment insurance system of the United States was established in 1935 with the purpose of providing financial support for eligible unemployed workers whilst securing macroeconomic stability by enhancing consumption and income smoothing effects. The system's basic functioning is common across all states since it is overseen by the US Department of Labor, however, as long as the Federal Law is being followed, each state has the autonomy to administrate its own UI program and define particular state requirements. These include eligibility requirements, the amount of benefits earned and the benefits' duration.

According to the general, nationwide eligibility criteria for unemployment insurance, only those who have involuntarily lost a job, are actively seeking work and have earned at least a certain amount of money during a base period before becoming unemployed, are eligible for

UI benefits. Nevertheless, variations in state requirements lead to different applications of these general criteria across states, especially when it comes to the base period selection and treatment of part-time workers. The generosity and duration of UI benefits also varies across states. For example, certain states such as Connecticut, Illinois and New Hampshire have a uniform benefit duration, whilst others vary according to the unemployment rate such as Utah, that offers just 10 weeks of benefits when the rate is low, up to 26 when it is high. Regardless of this, in most states, benefits are assured for up to 26 weeks with approximately 50% of workers' previous wages being replaced. All states specify a maximum weekly benefit amount.

State requirements or conditions and changes in unemployment insurance benefits differ across states and over time due to a number of different factors. Examples of economic conditions that lead to these disparities are the level of local unemployment rates and its' evolution, the degree of industrial urbanization in each state, the average wage level, the gross state product (GSP) and the overall cost of living. As to non-economic conditions, the most common are political factors such as reelection incentives and party preferences, but other factors such as natural disasters or criminal rates also justify these differences in UI benefits. Both these economic and non-economic factors have been observed in historical changes in UI benefits in US states. For example, between 2011 and 2016, Florida saw its state unemployment benefits drop year after year. This was derived by the improvement it witnessed in its local unemployment rate over this period of time, which led to a constant reduction in the maximum benefit duration the state could provide under the eligibility criteria for the Federal extended benefits. From a different perspective, California saw its maximum unemployment weekly benefits increase in 2002 by approximately 43%, at a time when year-end gubernatorial elections were taking place, with the alleged goal of bolstering political support for the governor's reelection (Agrawal & Matsa, 2013). One final example is the case of Arkansas in 2009, which increased its' UI benefits by approximately 38%, the first increase in 11 years.

This increase was funded through the American Recovery and Reinvestment Act (ARRA) to support the state in times of recession but also favor the state's unemployment insurance program reform over the long term (Metzger, Huddleston and Blankenship, 2009).

In accordance with this regime, the UI system is mostly funded by states although the federal government is responsible for covering administrative costs and may provide financial support to states in the form of loans during times of need. In any case, the UI system is funded by taxes (state and federal ones) that employers pay on behalf of their employees. Thus, it is possible that changes in the generosity of unemployment insurance have a significant influence on the tax burden on companies and, consequently, on their profitability, a relation which we will examine further in this paper.

Data and empirical framework

Prior literature studies the association between unemployment insurance benefits and the profitability of companies under different scopes and perspectives. Nevertheless, it remains unclear as to whether there is a causal relationship between both, especially because of the complexity of this relation due to the two countervailing effects of UI benefits on firms' performance.

Raw data suggests that there is a slightly positive correlation between unemployment subsidies and firms' profitability, as shown by Figure 1. The graph plots the average net income per US state and year against the maximum unemployment insurance benefit in each state and year, over the same time period (1980-2019). This positive relation is consistent with the conclusions presented in certain literature, such as that from Wang and Zheng (2018), that suggest that the benefits of UI (higher labor output due to higher productivity and lower compensation premiums due to lower unemployment risk) offset the costs on firms. However, a positive correlation between these two variables does not necessarily imply causation between them since there are several other variables or factors that over time can also have a positive

influence on a firm's profitability such as the price level or state laws. On top of that, the correlation considers untreated raw data, therefore, it may include outliers or observations that are not suitable for comparison. This said, this paper uses panel regression analysis to precisely study the connection between unemployment insurance benefits and firms' profitability at the firm-year level, based on data on UI benefit laws from the US states, macroeconomic conditions and firm balance sheet characteristics, all of which have their summary statistics in Table 1.

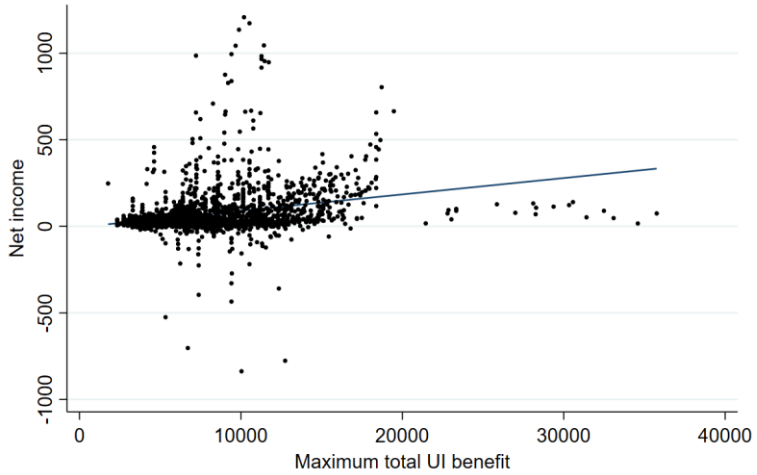

Figure 1. Cross correlation between the maximum total UI benefits and the average net income of all firms per US state between 1980 and 2019. The data of the unemployment insurance benefits are from annual reports of the US Department of Labor's "Significant Provisions of State UI Laws" and the data on firm level net income from Compustat. The regression line shown is weighted based on the number of state-year observations.

Table 1

Summary statistics.

The sample is composed of over 230,000 company-year observations from all the 50 states, from 1980 to 2019. The data of the unemployment insurance benefits are from annual reports of the US Department of Labor's "Significant Provisions of State UI Laws", the microeconomic data is from Compustat (these variables are winsorized at 1% tails), the gross domestic product (GDP) growth rates are from the US Bureau of Economic Analysis and the state unemployment rates (UR) are from the US Bureau of Labor Statistics. The sample includes all companies and there is no missing observation for every variable analyzed.

	Number of observations	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
Panel A: Unemployment Insurance Variable						
Log max total benefit	237,228	8.951	0.472	8.647	8.918	9.284
Panel B: Dependent Variables						
Net Income (Loss)	237,228	44.915	219.577	-2.272	1.190	15.284
Panel C: Control Variables						
Log Total Assets	111,058	4.832	2.199	3.290	4.686	6.291
Current Ratio	111,058	3.548	7.952	1.517	2.273	3.668
Total Debt/Total Assets	111,058	0.502	1.377	0.273	0.457	0.632
Unemployment Rate	237,228	6.060	1.946	4.7	5.7	7.2
GDP Growth	237,228	4.620	3.594	2.1	4.2	7.0

Data on state UI benefits is from the US Department of Labor's annual publications of "Significant provisions of state unemployment insurance laws" between 1980 and 2019. The state unemployment insurance benefits at grabs for an eligible claimant considered for analysis was computed by the product of the maximum weekly benefit amount and the maximum number of benefit weeks that can be received by all eligible claimants. This is naturally an approximation for this variable, since there are other determinants for this level, ranging from dependent's allowances to exceptional circumstances in certain states, such as high unemployment, continuation of approved training, or workforce dislocations. The variable "log max total benefit" is the natural log of this product and it is the variable used for our analysis.

It is important to note that significant variation exists across states at a certain point in time and over time as well. For example, in 2015 the maximum total UI benefits in Florida was 3.9 thousand US dollars, whereas in the same year, Massachusetts had a maximum total UI benefits of over 30 thousand US dollars. This variation across states can be seen in Figure 2, where five different random states were selected, each one represented by a different line, to show how the unemployment benefits level differs from state to state for each given year. From a different perspective, Figure 3 depicts the graphical evolution over time of state UI benefits in general, through a histogram that shows how the average unemployment benefits levels vary over decades and over the whole time period, considering all 50 US states. We can conclude from the graphs by decades that, in general, the maximum total UI benefits have continuously increased over time throughout all states, with the last decade being the only exception, however, the modal and average percentage change was decreasing over decades. Additionally, the histogram for the whole time period shows that, overall, states typically increase their UI generosity by 25%-50% over a decade.

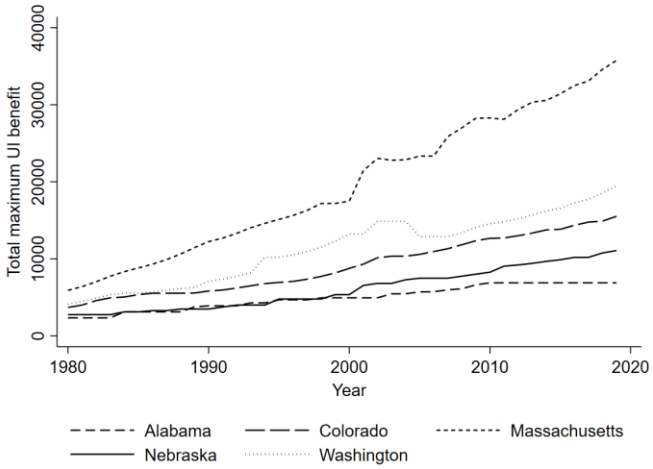

Figure 2. Evolution of the maximum total UI benefits by year between 1980 and 2019 for 5 random US states. The maximum total UI benefits data is the product of the maximum weekly benefits amount and the maximum subsidy duration, taken from annual reports of the US Department of Labor's "Significant Provisions of State UI Laws".

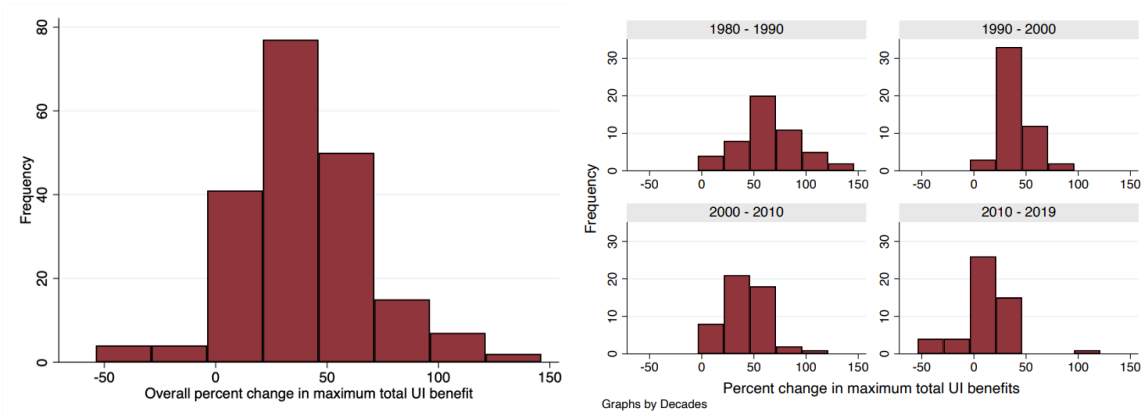

Figure 3. Distribution of changes in the maximum total UI benefits per decade between 1980 and 2019 of all 50 US states. The figure on the left depicts the overall decade percent change across the whole time period per state whereas the figures on the right show the distribution of changes in each of the decades. The maximum total UI benefits data is the product of the maximum weekly benefit amount and the maximum subsidy duration, taken from annual reports of the US Department of Labor's "Significant Provisions of State UI Laws".

Using the statistical software for data manipulation Stata, we combined the data of the states' unemployment insurance benefits with data for the net income of US firms, from Compustat, and a set of controls. The controls include the financial variables commonly included in profitability regressions (Nguyen and Nguyen, 2020), namely the natural logarithm of total assets as a measure of firm size, the current ratio as a measure of liquidity and the ratio of total debt to total assets as a measure of leverage. The data for all these variables was also taken from Compustat and was winsorized at 1% tails to exclude potential outliers. Local

macroeconomic conditions are also accounted for in these controls through the inclusion of GDP growth rates, from the US Bureau of Economic Analysis, and state unemployment rates (UR), from the US Bureau of Labor Statistics, as variables. Ultimately, the total sample includes all firms, with the exception of firms from utilities and financials industries due to their highly different capital structure, with non-missing observations, resulting in more than 230,000 firm-year observations over the 1980-2019 period.

For our analysis, we regress net income, as our measure for firms' profitability, using the following regression:

$$Net\ Income\ (Loss)_{ijt} = \alpha_1 LN(Max\ Total\ UI\ Benefit)_{jt} + \beta X_{ijt} + \nu_i + \omega_t + \varphi_j + \varepsilon_{ijt}. \quad (1)$$

In this regression the net income of a firm *i* in state *j* at year *t* is modeled as a function of the natural log of the maximum total UI benefit in the same year, a set of controls as previously detailed, X_{ijt}, firm fixed effects, ν_i, year fixed effects, ω_t, and state fixed effects, φ_j. It is important to note that the maximum total UI benefits considered in the regression are timed at *t* and not *t*-1 since the data refers to January of each year, thus the effect on the net income happens in the same year, although months apart. Firm fixed effects are included to remove the effect that each firm's average investment has on the net income (loss) of firms, which might be affected by unobserved firm-specific variables, whereas year and state fixed effects aim to remove the source of variation caused by aggregate macroeconomic conditions and state-specific variables that affect all firms such as economic crises. Thus, these fixed effects ensure that the estimate for α_1 reflects, with a higher level of accuracy, actual changes in benefit generosity and profitability over time. Finally, according to Bertrand, Duflo and Mullainathan (2004), adjusting standard errors for clustering at the state level accounts for potential time-varying correlations in unobserved factors that affect different firms within the same state. Thus, this clustering method was used in all regressions.

Findings

The estimates obtained with the regression analysis conducted all led to the same result, which is that the impact of UI benefits in the profitability of companies is not statistically significant. Quoting Altman and Bland (1995), "absence of evidence is not evidence of absence", which means that the results presented in Table 2, should be carefully interpreted, not immediately seen as proof that a relation between the variables in question does not exist, but rather that more analyses should be done to reach a more certain conclusion. There can be many reasons as to why the regressions performed are not statistically significant, such as that the right model might not have been used to estimate this relation, the assumptions made may not be the most adequate, the effect may be too small, or the variation in the sample simply too large. Nevertheless, insights on the regressions performed can be valuable to understand its eventual defects. To assess the effects of the controls applied, in each column an additional one is added. In Column 1, only fixed effects are accounted for, and the estimate obtained was that for each 100 log point increase in the maximum total amount of UI benefits, net income increases by 6.3 million US dollars. Similar findings were attained when added, in Column 2, state economic indicators (UR and GDP growth rate) to further control for macroeconomic conditions.

Following prior research (Agrawal and Matsa, 2013), in Columns 3 and 4 we exclude firms in wholesale, retail, and transport, since a great percentage of these industries' workforce is likely to be geographically dispersed. Employees are subjected to the UI regime imposed by the state in which they work, and since we are only taking into consideration the UI law of the state in which each company is headquartered, this dispersion could reduce the value of our estimations. Excluding these companies almost doubles the value of the $\ln UI_t$ coefficient. In Column 4, we add firm financial controls, and the regression details that a 100 log point increase

in UI benefits leads to an increase (decrease) of 13.5 million US dollars of the net income (loss), despite still not being statistically significant.

Table 2

Unemployment insurance benefits and companies' profitability.

This table comprises the results obtained from firm-panel regressions of net income (loss), on the natural log of the maximum total UI benefit under each states' UI system. In all regressions, controls for state, firm and year fixed effects were added. The last three regressions include state economic indicators (UR and GDP growth rate), with the last one including, moreover, firm financial controls (current ratio, natural logarithm of total assets and ratio of total debt to total assets). Where specified, industries in which a great percentage of employees is likely to be geographically dispersed is excluded. Firm financial controls are winsorized at 1% tails. Standard errors were adjusted for clustering at the state level. OLS corresponds to ordinary least squares.

	(1)	(2)	(3)	(4)
Panel A: Net Income				
Natural log max total benefit, t	6.260	8.543	14.512	13.462
Robust standard error	6.815	6.774	9.555	11.673
p-value	0.363	0.213	0.135	0.254
Number of observations	235,976	235,976	202,557	110,188
R2	0.627	0.627	0.620	0.656
Sample				
Excluded dispersed industries	No	No	Yes	Yes
Control variables				
State economic indicators	No	Yes	Yes	Yes
Firm financial controls	No	No	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Estimation method	OLS	OLS	OLS	OLS

Industries and companies' differentiation

In order to better comprehend the statistically insignificance of the estimates of Table 2 and to understand if there could be any statistically significant result, in this subsection industries and companies are studied according to some defining dimensions related to the variables under scrutiny. Firstly, we start by evaluating how the relation between UI benefits and profitability differs between industries that have higher and lower layoffs and discharges levels. According to the existing theory, UI benefits can decrease the wage premium employees require per unit of layoff risk, which implies that the UI system is capable of offsetting the impact of unemployment risk on wages and consequently on profitability. However, in

industries that present high layoff levels, the existence of UI benefits may not be enough to significantly decrease the wage premium that employees demand, as the probability of being fired is much more likely. Moreover, since employers are the ones that pay for UI benefits, even the greatest positive effect that UI can have on profitability, could be surpassed by the burden of the payments of said benefits. Thus, it is somewhat unclear what will be the results we are going to reach, because it can be equally possible that UI benefits are more than enough to significantly decrease wage premiums and, this way, overcome the negative impact of the respective payments.

According to the US Bureau of Labor Statistics, in 2019, the industries that presented the highest annual layoffs and discharges levels were professional and business services (5,045 thousand layoffs and discharges) and leisure and hospitality (3,570 thousand layoffs and discharges). On the other hand, the industries where it was reported in 2019 the lowest annual layoffs and discharges levels were real estate and rental and leasing (317 thousand layoffs and discharges), educational services (404 thousand layoffs and discharges) and information (464 thousand layoffs and discharges). It is relevant to notice that even though the industries of transportation, utilities, finance and insurance presented layoffs and discharges levels that could have been included in this analysis, they deliberately were not for the reasons already explained. Thus, two regressions are going to be run with the sample restricted to companies of those industries respectively. The results displayed in Table 3 (Column 1 and 2), are both statistically insignificant, with the p-values being extremely high (0.974 and 0.943), therefore, through the analysis of different layoffs and discharges levels, the null hypothesis, that there is no relation between the variables in question, cannot be rejected.

Then we examine what effects UI benefits can have in companies that only state profits in contrast to firms that solely report losses. As workers demand a wage premium to compensate for the unemployment risk they face, we expect that, since companies with net losses are more

easily perceived as riskier, the compensating wage differentials are far greater in these firms. The effect of UI benefits in these companies is uncertain, it can either have a significant impact in terms of reducing wage premiums, decreasing losses, or it may not have a great effect on wages, leading to an increase of the losses due to the costs that UI benefits represent. Regarding companies with a positive net income, it is more likely that the existence of UI benefits leads to a decrease of compensating wage differentials which is more than capable of offsetting and even of surpassing the negative effect of the costs that UI benefits represent, as the companies are perceived as less risky.

When considering companies with losses, the results presented in Column 4 are statistically insignificant. However, when taking into account companies that only reported profits, in Column 3, the results are statistically significant and indicate that there is indeed an economically meaningful relation between UI benefits and companies' profitability. More specifically, a 100 log point increase in the maximum total UI benefits leads to an increase of 41.09 million US dollars of the net income. This is in accordance with the theory of the decrease of the wage premium demanded by employees, but the magnitude of the increase is somewhat surprising, which leads us to conclude that UI benefits can have a positive impact in other variables other than wages.

Third, we investigate whether the level of firms' financial leverage influences the results on the relation between UI benefits and firms' profitability. Higher levels of financial leverage lead to more interest payments by firms, which subsequently decreases net income. Therefore, according to this logic, it would be expected that analyzing firms with low levels of financial leverage would give us more reliable results since interest payments would have a lower or null influence on the net income of firms. As such, we restrict our sample to firms with a higher leverage (above median total debt to total assets) and then to firms with a lower level of leverage (below median total debt to total assets) and run two separate regressions, whose results are

reported in Table 3 (regressions 5 and 6 respectively). The results show that, when considering only firms with a low level of leverage, the relation between UI benefits and firm's profitability is in fact statistically significant and economically meaningful. In particular, that a 100 log point increase in the maximum total UI benefit leads to an increase in firms' profitability of approximately 34 million US dollars in net income.

Table 3

Impact of unemployment insurance benefits on firm's profitability by different dimensions.

This table comprises the results obtained from firm-panel regressions of net income, on the natural log of the maximum total UI benefit under each state's UI system and a set of controls as previously defined. For all regressions, these controls were included, controls for state, firm and year fixed effects were added and industries in which a great percentage of employees is likely to be geographically dispersed are excluded. Firm financial controls are winsorized at 1% tails. **, designates statistical significance at the 5% level. Standard errors were adjusted for clustering at the state level. OLS corresponds to ordinary least squares.

	High layoff and discharges levels (1)	Low layoff and discharges levels (2)	Net income profits (3)	Net income losses (4)	High leverage ratio (5)	Low leverage ratio (6)	Large firm size (7)	Small firm size (8)
Panel A: Net Income								
Natural log max total benefit, t	0.574	1.396	41.091**	2.429	19.896	34.094**	40.823**	-0.234
Robust standard error	17.546	19.438	17.497	4.838	17.631	15.265	19.160	0.761
p-value	0.974	0.943	0.023	0.618	0.265	0.03	0.038	0.760
Number of observations	19,867	15,964	66,761	41,424	53,992	54,244	54,798	54,415
R2	0.675	0.707	0.765	0.651	0.701	0.635	0.673	0.504
Sample								
Excluded dispersed industries	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables								
State economic indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm financial controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS

Finally, this paper also explores if firm size, as measured by the natural logarithm of total assets, has a significant influence on the relation between unemployment subsidies and net income. In other words, if considering larger or smaller sized firms only, instead of both, leads to a different, more significant conclusion. In fact, results in Table 3 show a statistically significant and economically meaningful positive relation between UI benefits and net income when considering larger-sized firms, whereas for smaller-sized firms results are not significant and the estimate for α_1 is even negative. Larger firms typically present higher levels of profits since they are more established and mature firms with greater access to funding and more repeat

business. As a result, the unemployment risk for workers in these firms is expected to be lower, enabling lower wage premiums and, consequently, higher profitability.

Additional studies

To further complement the previous analysis, we believe it would be empirically relevant to perform some additional studies. First, we want to comprehend how does the relation between UI benefits and companies' profitability develop over the four decades that have been under scrutiny. To that purpose, we performed four regressions, with each including firm-year observations of a specific singular decade, as it can be seen in Table 4. For the 1980s, 1990s and 2010s decades, the results are statistically insignificant, but for the decade that begins in 2000 and ends in 2009, the findings indicate that there is a statistically significant and economically meaningful relation between UI benefits and firms' profitability. Particularly, a 100 log point increase in the maximum UI benefits leads to an increase of companies' profitability of 35.3 million US dollars in net income.

The decade in question is characterized by three main occurrences, the 2001 Recession, an economic expansion between 2001 and 2007, and the Great Recession of 2008. Through prior regressions it became established that the relation between UI benefits and profitability tends to be a positive one. As such, initially we found plausible that the economic expansion observed in that period could have simply enhanced and strengthened the relation. However, this expansion is considered as one of the weakest ever since World War II (Aron-Dine, Stone and Kogan, 2008). Moreover, the 1990s decade was also characterized by a period of strong economic performance, but the results obtained for this set of years are still statistically insignificant. Therefore, the reason for the statistical significance of the results of Column 3 has to come from the two recessions of the decade. As already mentioned, one of the main goals of the UI system is to serve as a stabilizer of the economy, which is crucial in times of an economic downturn. In the recession of 2008, there had to be an overall significant increase of UI benefits

(in a later part of this paper this will be more thoroughly discussed), which was done, for instance, through the Emergency Unemployment Compensation Act and the Federal-State Extended Benefits Program. Through simulations yielded, Vroman (2010), concluded that the regular UI benefits program had indeed a stabilizing effect, closing approximately one-tenth of the real GDP decrease caused by the Great Recession. Furthermore, Vroman (2010), concluded that the extended benefits had a fundamental stabilizing role as well. This leads us to conclude that this positive stabilizing effect, which affected the US economy as a whole, had to surpass the eventual negative impact of additional costs with UI benefits on companies' net income.

To further explore our framework and results, we also investigate whether the selection of the measure for profitability used has a significant influence on the results achieved. To do this, we perform two additional regressions (regressions 5 and 6 in Table 4) using EBIT and EBITDA respectively as dependent variables, instead of net income. All remaining variables and conditions are kept the same. Results reported in Table 4 show that both regressions are also not statistically significant, thus showing that a different choice for the measure of profitability would not change our conclusion and suggesting that the reason for the statistical insignificance in the relation between unemployment subsidies and firms' profitability has nothing to do with the selection of the dependent variable.

To finish, we examine the influence that inflation may have on our results. A firm's net income is affected by changes in price levels, therefore it is possible that inflation may be distorting results. Thus, regression 7 considers inflation adjusted values for the net income variable, using the CPI index from 1980 to 2019 obtained from the US Bureau of Labor Statistics. Results are still not statistically significant at the 10% level or less, as it can be seen in Table 4, meaning that no relation between unemployment benefits and net income can be concluded, however the p-value for this regression (0.116) is lower when compared against the original one without adjustment to inflation reported in Table 2, regression 4 (0.254).

Table 4
Impact of unemployment insurance benefits on firm's profitability under additional specifications.
This table comprises the results obtained from firm-panel regressions of net income, on the natural log of the maximum total UI benefit under each state's UI system and a set of controls as previously defined. For all regressions, these controls were included, controls for state, firm and year fixed effects were added and industries in which a great percentage of employees is likely to be geographically dispersed are excluded. Firm financial controls are winsorized at 1% tails. ***, designates statistical significance at the 1% level. Standard errors were adjusted for clustering at the state level. OLS corresponds to ordinary least squares.

	Decade of 1980-1989 (1)	Decade of 1990-1999 (2)	Decade of 2000-2009 (3)	Decade of 2010-2019 (4)	EBIT as dependent variable (5)	EBITDA as dependent variable (6)	Adjusted for inflation (7)
Panel A: Net Income							
Natural log max total benefit, t	12.483	30.075	35.348***	-1.967	16.430	15.535	7.880
Robust standard error	10.648	26.396	10.693	7.761	20.051	24.762	4.930
p-value	0.247	0.260	0.002	0.801	0.417	0.533	0.116
Number of observations	25,203	34,056	28,320	21,253	110,156	109,911	110,188
R2	0.818	0.740	0.764	0.850	0.785	0.811	0.691
Sample							
Excluded dispersed industries	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables							
State economic indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm financial controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation method	OLS	OLS	OLS	OLS	OLS	OLS	OLS

The impact of labor productivity – Individual Part

Introduction

The effect that unemployment insurance has on labor productivity plays a fundamental role in the relation between unemployment insurance and firms' profitability. The extent to which variables such as increased unemployment rates, tax burden or even wage levels will negatively influence a firm's performance will depend on the way worker productivity changes whenever there are UI benefit extensions. This part of the paper hence studies the impact of unemployment subsidies on firms' labor productivity, as I believe this is a fundamental channel in the relation between unemployment subsidies and firms' profitability. The analysis is done in a way that adds value to the line of research that already exists on costs and benefits of unemployment insurance.

Most existing analyses focus on quantitative economic models that capture the behavior of labor markets using general equilibrium framework. According to Acemoglu and Shimer

(2000), unemployment benefits increase average labor productivity in a search economy. However, their analysis focuses on the behavior of homogeneous risk-averse and low skilled workers only, whereas this paper considers a wider range of individuals. On a different perspective, Kumar (2002) shows that the positive effect of unemployment benefits on productivity and output is not dependent on workers being risk-averse and that even with risk-neutral workers output is maximized at a positive level of unemployment benefits. Nevertheless, his results consider homogeneous firms with monopsony power in the labor market, in contrast to my analysis that considers ex-ante heterogeneous firms. Zhang (1996) also concludes on the existence of a positive relation between the two variables under analysis, but in his model the distribution of labor productivities is exogenous and not affected by unemployment subsidies. In my model, labor productivity is an endogenous variable.

On top of these studies, there are several others that investigate the effect of unemployment benefits on productivity. In this paper, contrarily to all the literature on this topic I am aware of, I use panel regression analysis to examine this connection based on a wider sample on data of ex-ante heterogeneous firms and workers across different industries and states in the US. I show that increases in unemployment insurance benefits are associated with higher firm labor productivity and that this relation is statistically significant, economically meaningful and robust to inflation. Empirical identification of this relation is challenging for two reasons. The first challenge is the precise measurement of labor productivity at the firm level. Therefore, I explore the effect that different measures for labor productivity have on the results, to show the importance that the selection of an adequate proxy has. The second challenge is related to the unpredictable time lag it takes for UI changes to influence labor productivity, which I also explore. Finally, this part of the paper exists to complement the analysis on UI benefits and firms' profitability, therefore, I also study whether capital productivity is impacted by UI changes. The absence of a statistically significant relation

between these two variables reinforces the predominant role that labor productivity has in positively influencing a firm's profitability when unemployment insurance benefits change. In this way, this paper presents additional contributions to the existent literature on this topic.

Theoretical framework

Evidence shows that unemployment insurance systems are closely related to unemployment rates. As Gollier (1991) suggests, higher UI benefits lead to higher unemployment rates for two main reasons. First, because it increases reservation wages, thus creating a stronger disincentive to work since more people find it more appealing to sustain themselves on UI benefits without working rather than investing time and effort for work for a not so higher salary. This has to do with the trade-off between leisure and work. Second, higher UI benefits will attract more people into the labor force and consequently increase the number of people eligible for unemployment subsidies that before were not. In theory, this would reduce the level of output in an economy and of companies, hence its profitability, however the extent to which labor productivity is affected by changes in UI benefits may either offset these negative effects or not. The results from Acemoglu and Shimer (2000), for example, show that a decrease in US unemployment insurance levels would not only decrease the level of output but also the overall welfare, even though it could result in less unemployment.

Several theoretical papers relate the positive effects of UI benefits on labor productivity to job search effort and talent-job match quality and stability gains (namely, but not limited to Caliente et al., 2013; Centeno, 2002; Marimon and Zilibotti, 1999; Rujiwattanapong, 2022). Considering a hypothetical scenario of an economy without any unemployment insurance benefits, people will, in general, look out for any job at a fast pace, regardless of their tastes, skills or aspirations, since their main goal is to get a salary. Additionally, in order to avoid the risk of unemployment in the future, many will also opt for lower productivity jobs that are easier to obtain (Acemoglu and Shimer, 2000). All in all, there will be a bigger job mismatch and

lower productivity per worker. Therefore, although more generous UI systems increase the average duration of unemployment, this increases job search efforts which could favor higher labor productivity. In fact, Meyer (1989) for example, shows that a 10% increase in unemployment insurance raises unemployment duration by approximately 10% on average. As a result, workers can endure a longer period of unemployment and invest more search effort to attain more specific jobs with higher wages and increased job satisfaction, despite the greater risk. The overall effect on productivity is uncertain since on one hand a longer job-search duration favors a better match quality, but at the same time longer unemployment durations lower output levels for a longer period of time. Thus, it will mostly depend on how much time is needed for a worker to find a more productive job. This paper will not answer this question, but it will study whether the time lag between UI changes and labor productivity changes influence the significance of this relation.

The improved job match is not only derived from longer job search efforts and durations. UI benefit extensions increase workers outside options, making them more selective towards job offers. This encourages companies to create better, more productive jobs in order to attract the best talent and remain competitive in the labor market against other firms. This inevitably increases labor productivity since lower quality worker-firm matches are either destroyed or not formed, especially during recession periods as suggested by Rujiwattanapong (2022). This author explores the relation between unemployment subsidies and labor productivity by showing that the first influences the procyclicality of the second. He uses a model that shows that systematic changes in the American UI system explains over 40 percent of the drop in the correlation between labor productivity and output during recessions, further reinforcing a positive effect of unemployment subsidies on labor productivity. Nonetheless, there are also theories that suggest a negative correlation between both variables. Gollier (1991) finds that at the optimum equilibrium between productive efficiencies and risk sharing among

workers, unemployed and firms, higher unemployment benefits lead to lower labor productivity. On another perspective, increases in UI benefits reduce unemployment risk, therefore certain workers may be less worried about becoming unemployed and, as such, less worried about performing at the most productive level, thus reducing labor productivity. In the empirical analysis that follows I explore this trade-off and present my findings, to investigate whether it can be concluded that there is a positive influence of UI changes on firms' profitability due to labor productivity changes.

Data and empirical framework

US country-level data suggests that unemployment subsidies have a positive macroeconomic impact on labor productivity. Figure 5 shows the state-level correlation between the maximum total UI benefit and labor productivity between 2007 and 2019. The productivity numbers are annual index values, with 2012 as the base year, from the US Bureau of Labor Statistics, Office of Productivity and Technology. The graph shows a positive correlation between both variables suggesting that increases in unemployment subsidies lead to higher labor productivities, consistent with most of the reviewed literature. However, this statistical relation at a macroeconomic level considers labor productivity as an exogenous variable, contrarily to my model, where the relation between both variables is examined at firm-year level and with labor productivity as dependent variable.

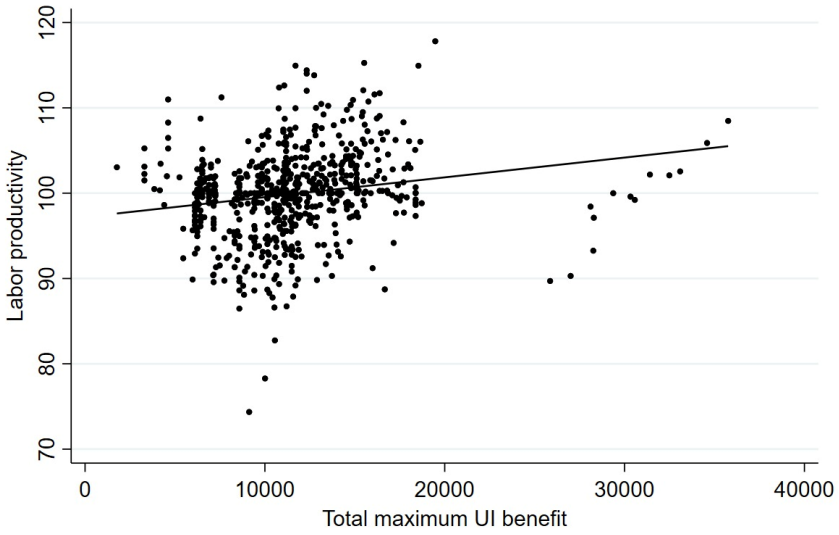

Figure 5. Cross correlation between the maximum total UI benefit and the aggregate labor productivity per US state between 2007 and 2019. The data of the unemployment insurance benefits are from annual reports of the US Department of Labor's "Significant Provisions of State UI Laws" and the data on aggregate labor productivity from the Office of Productivity and Technology of the US Bureau of Labor Statistics. The regression line shown is weighted based on the number of state-year observations.

I use panel regression analysis to study this connection by estimating the following regression where the level of net sales as a fraction of the firms' number of employees is modeled as a function of the natural log of the maximum total UI benefit (as defined in this paper) in the same period, a set of controls, X_{ijt}, firm fixed effects, ν_i, year fixed effects, ω_t and state fixed effects, φ_j:

$$\frac{Sales_{ijt}}{Employees_{ijt}} = \alpha_1 LN(Max\ Total\ UI\ Benefit)_{jt} + \beta X_{ijt} + \nu_i + \omega_t + \varphi_j + \varepsilon_{ijt}. \quad (5)$$

The whole sample used for this regression includes all US firms, except those from the financials and utilities industries, with non-missing observations for the included variables, which amounts to over 190,000 firm-years over the 1980-2019 period. Annual data on the net sales (in millions of USD) and the number of employees (in thousands) of firms is taken from Compustat. Both variables were winsorized at 1% tails to reduce the number of outliers. This ratio of sales to employees is the measure of labor productivity used for my study, as it is considered to be an accurate measure of such and the best one considering the available data

and overall framework of analysis. The average sample labor productivity, unadjusted for inflation, is 276.588, as it can be seen in Table 8. The control variables considered in this analysis are the main drivers of labor productivity. These include the natural logarithm of total assets as a measure of firm size and the invested capital as a measure of capital investment. The number of employees, as a measure of firms' labor force size, was only used as a control variable for Panel B regressions, since in Panel A regressions it is being used for the dependent variable. All of them were also taken from Compustat and winsorized at 1% tails. Variables such as Research & Development Expenses are also important controls for labor productivity but showed insufficient data to be included. Finally, similarly to the profitability-UI benefits regressions, GDP growth rates and state unemployment rates were also accounted for in these controls. The inclusion of firm fixed effects, state fixed effects, year fixed effects and standard error clustering at the state level was also done for the same reasons as before. Summary statistics for all these variables are presented in Table 8.

Table 8

Summary statistics.

The sample is composed by over 190,000 company-year observations from all the 50 states, from 1980 to 2019. The data of the unemployment insurance benefits are from annual reports of the US Department of Labor's "Significant Provisions of State UI Laws", the microeconomic data is from Compustat (these variables are winsorized at 1% tails), the gross domestic product (GDP) growth rates are from the US Bureau of Economic Analysis, the state unemployment rates (UR) are from the US Bureau of Labor Statistics. The sample includes all companies with no missing observation for each variable analyzed by itself.

	Number of observations	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
Panel A: Unemployment Insurance Variable						
Log max total benefit	191,006	8.928	0.467	8.605	8.889	9.267
Panel B: Dependent Variables						
Net sales/employees	191,006	276.588	1176.65	79.667	145.794	259.713
Net sales/labor expenses	23,679	4.586	2.917	2.995	3.986	5.310
Panel C: Control Variables						
GDP Growth	191,006	4.793	3.697	2.2	4.3	7.2
Unemployment Rate	191,006	6.079	1.939	4.7	5.7	7.2
Log Total Assets	190,799	4.705	2.472	2.933	4.669	6.462
Invested Capital	190,799	832.008	2634.222	10.69	67.212	382.786
Employees	21,111	11.395	29.538	0.288	1.471	6.932

Findings

1. Unemployment insurance generosity and labor productivity

In this paper, Figure 5 suggests a positive relation between unemployment insurance and labor productivity using average US-state level data. The regression analysis performed in this section confirms that the same relation exists using microeconomic firm-level data and that this relation is economically meaningful and statistically significant. The results are presented in Table 9, where several regressions, with different characteristics, were performed for a more complete analysis and understanding.

Table 9

Unemployment insurance benefits and companies' labor productivity.

This table comprises the results obtained from firm-panel regressions of labor productivity measures (net sales revenue divided by number of employees in Panel A and net sales revenue divided by labor expenses in Panel B), on the natural log of the maximum total UI benefit under each state's UI system. In all regressions, controls for state, firm and year fixed effects were added. The last four regressions include state economic indicators (UR and GDP growth rate), with the third and fifth including, moreover, firm financial controls (invested capital amount, natural logarithm of total assets and, for Panel B regressions, number of employees). Where specified, industries in which a great percentage of employees is likely to be geographically dispersed are excluded. Firm financial controls are winsorized at 1% tails. **, *** designate statistical significance at the 5% and 1% level respectively. Standard errors were adjusted for clustering at the state level. OLS corresponds to ordinary least squares.

	(1)	(2)	(3)	(4)	(5)
Panel A: Sales/Employees					
Natural log max total benefit, t	46.583**	50.145**	43.877**	74.784***	69.899***
Robust standard error	18.188	19.412	20.504	20.750	20.235
p-value	0.014	0.013	0.027	0.001	0.001
Number of observations	189,440	189,440	189,242	160,757	160,580
R2	0.536	0.536	0.537	0.430	0.432
Panel B: Sales/Labor Expenses					
Natural log max total benefit, t	-0.298	-0.253	-0.154	-0.020	0.095
Robust standard error	0.184	0.185	0.146	0.183	0.137
p-value	0.111	0.179	0.294	0.915	0.494
Number of observations	23,412	23,412	20,840	19,609	17,157
R2	0.835	0.836	0.840	0.831	0.841
Sample					
Excluded dispersed industries	No	No	No	Yes	Yes
Control variables					
State economic indicators	No	Yes	Yes	Yes	Yes
Firm financial controls	No	No	Yes	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Estimation method	OLS	OLS	OLS	OLS	OLS

Panel A refers to the regressions performed with the main measure of labor productivity I am using to study this relation. Results show that a 100 log point increase in the maximum total UI benefit leads to an increase in labor productivity of approximately 46 million US dollars of net sales revenue per employee, with statistical significance at the 5% level (Column 1). When accounting for local economic conditions as control variables in this regression, results remain statistically significant at the 5% level and the estimate for α_1 actually increases by approximately 10%, denoting a greater influence of unemployment insurance on labor productivity (Column 2). Column 3 results account for firm-specific control variables too, as previously described, and statistical significance is kept at the same level.

In columns 4 and 5, equations 2 and 3 respectively are reestimated excluding industries that are likely to have a significant workforce geographical dispersion for the same reasons, previously mentioned in this paper, as to their exclusion when studying the relation between unemployment insurance and firms' profitability. When excluding these industries (retail, transport and wholesale) results show a higher level of statistical significance confirming the expectation that doing so would improve the value of the results. For both regressions, results are statistically significant at the 1% level and the estimates for α_1 are bigger, suggesting that a 100 log point increase in the maximum total UI benefit leads to an increase in labor productivity of approximately 70 million US dollars of net sales revenue per employee.

Whilst the p-values of all regressions denote statistical significance, the magnitude of all coefficients denote economical meaningfulness in the relation between unemployment insurance benefits and labor productivity. In fact, if we look at the estimated coefficients for the remaining variables accounted for in the regressions (presented in Table A3 of the Appendix) we can see that a 100 log point increase in the maximum total UI benefit has a much bigger effect on labor productivity when compared to the effect that the remaining control variables have.

Panel B refers to the regressions performed exactly with the same independent variables per column but using net sales/labor expenses as the dependent variable, an alternative (worst) proxy for labor productivity. This analysis was made to investigate the importance of the selection of the measures for the variables under study and the influence that this selection has on the results. Labor productivity is conceptually defined as real economic output (GDP) per labor hour. Thus, at the firm level, net sales/number of employees is considered to be the best proxy considering the available data since there is a strong, direct relation between net sales and output, and hours worked and number of employees, despite small imperfections in this measure which I will investigate ahead in this paper. On the other hand, net sales/labor expenses is, in theory, a worst proxy for labor productivity since the relation between labor expenses and hours worked is not as linear and direct. This happens because apart from the cost of regular and overtime labor working hours (salaries), the variable for labor expenses also includes payroll taxes and other expenses such as social security and Medicare, which have a poor association with labor hours, making the overall variable misappropriate. The results reported in table 9 for panel B support this. All the estimates are not economically meaningful, not only because their magnitudes are close to 0 but also because regression 5 suggests a positive relation whereas all others a negative one, suggesting inconsistency. Additionally, results are not statistically significant at a reasonable level and, on top of that, p-values increase to really big levels as more control variables are accounted for, something which should not happen, at least so substantially. It is, however, important to notice that the number of observations for Panel B regressions are much lower than those for Panel A, which inevitably limits its accuracy. Nevertheless, the sample size is big enough for this analysis to show that the choice of a suitable proxy is essential for reliable results.

Across all specifications in Table 9 for Panel A, I find significant associations between changes in unemployment insurance and firms' labor productivity. Thus, these empirical

findings are consistent with most literature on the topic that state that increases in UI benefits improve labor productivity.

2. Importance of labor intensity, time and price level

My empirical analysis suggests that increases in UI benefits lead to increases in firms' labor productivity and that this relation is economically meaningful and statistically significant. Nevertheless, there are further analyses which can be done to improve the reliability of my results and further explore how this relation is under different contexts. In this section I will be looking at the effect of three particular dimensions using panel regression analysis under the same data and empirical framework. All the regressions exclude dispersed industries and include all the control variables.

I first examine firms according to their labor intensity ratio. Labor intensity is measured as the ratio of number of employees to property, plant and equipment (PPE) (data taken from Compustat). Taking into consideration that labor productivity in this paper is being measured as the ratio of net sales to number of employees, it is expected that more labor-intensive firms present more reliable results on the relation between UI benefits and labor productivity. If, for example, net sales increase as a result of improved capital productivity only, this will reflect an increase in labor productivity suggesting that workers have become more productive with a rise in UI benefits, when they have not. Thus, it is important to take into consideration a firm's labor intensity when evaluating the effect of UI benefits on labor productivity. To do so I restrict my sample to firms more labor intensive (above median labor intensity) and then to firms less labor intensive (below median labor intensity) and run two separate regressions, whose results are reported in Table 10 (regressions 1 and 2 respectively).

For both regressions the relation between UI benefits and labor productivity remains statistically significant and economically meaningful, thus the overall conclusion is the same as before. However, when considering more labor-intensive firms only, results show that a 100

log point increase in the maximum total UI benefit leads to an increase in labor productivity of approximately 45 million US dollars in net sales per employee. Comparing this estimate with the one in regression 2 (70.50) and regression 5 in Table 9 (69.90), suggests that accounting for more capital-intensive firms overestimates the effect that UI benefits have on labor productivity; however, I did not test whether these estimates are statistically significant from each other. Nevertheless, the conclusion that increases in UI benefits lead to increases in firms' labor productivity remains.

Second, I evaluate the extent to which the effect of UI benefit changes on labor productivity is immediate or may suffer a time lag. As reviewed in this paper, several existing literatures show that UI benefit changes have a positive influence on labor productivity due to improvements in job match quality by enabling unemployed workers to invest more time and effort on job search. This suggests that there may exist a time lag between the moment when unemployment insurance benefits change and the moment where labor productivity is affected by that change. To study this hypothesis, I run regressions 3, 4 and 5 considering different time periods for the unemployment insurance independent variable (t-1, t-2 and t-3 respectively). Results suggest that changes in UI benefits can indeed take 1 to 2 years to be reflected in changes in firms' labor productivity, since estimates for α_1 in both regressions 3 and 4 are statistically significant (at 5% and 10% respectively) and reflect a positive, economically meaningful relation.

Finally, I examine the influence that price changes have on my analysis. Changes in the price level will always influence data. In particular, one of the main determinants of the net sales revenue of a firm is the price. Therefore, it is possible that the positive relation between UI benefits and firms' labor productivity only reflects the common effects from price changes. To investigate whether this is the case, all the observations of firms' net sales revenue in the data set are adjusted for inflation using the CPI index from 1980 to 2019 obtained from the US

Bureau of Labor Statistics. Results show that the findings are robust to adjusting for inflation. Although the estimate for α_1 when considering inflation-adjusted figures for the dependent variable is smaller (32.61) than when they are not (69.90), it still is statistically significant at the 1% level, supporting the conclusion that there is indeed a positive relation between UI benefits and firms' labor productivity.

Table 10

Impact of unemployment insurance benefits on companies' labor productivity by labor intensity, time and price. This table comprises the results obtained from firm-panel regressions of net sales divided by number of employees (labor productivity), on the natural log of the maximum total UI benefit under each state's UI system and a set of controls as previously defined. For all regressions, these controls were included, controls for state, firm and year fixed effects were added and industries in which a great percentage of employees is likely to be geographically dispersed are excluded. Firm financial controls are winsorized at 1% tails. *, **, *** designate statistical significance at the 10%, 5% and 1% level respectively. Standard errors were adjusted for clustering at the state level. OLS corresponds to ordinary least squares.

	More labor intensive (1)	Less labor intensive (2)	Time lag of 1 year (3)	Time lag of 2 years (4)	Time lag of 3 years (5)	Adjusted for inflation (6)
Panel A: Sales/Employees						
Natural log max total benefit, t	44.631**	70.501***				32.607***
Natural log max total benefit, t-1			63.368**			
Natural log max total benefit, t-2				54.780*		
Natural log max total benefit, t-3					40.887	
Robust standard error	22.405	25.171	24.093	29.951	36.001	9.127
p-value	0.05	0.007	0.011	0.073	0.262	0.001
Number of observations	79,249	79,224	139,305	124,925	112,539	160,580
R2	0.646	0.488	0.418	0.420	0.501	0.445
Sample						
Excluded dispersed industries	Yes	Yes	Yes	Yes	Yes	Yes
Control variables						
State economic indicators	Yes	Yes	Yes	Yes	Yes	Yes
Firm financial controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Estimation method	OLS	OLS	OLS	OLS	OLS	OLS

3. Labor productivity and profitability of firms

The analysis of the relation between unemployment subsidies and labor productivity conducted in this paper exists to explore whether labor productivity is one of the positive forces on the effect that changes on unemployment subsidies may have on firms' profitability. As already seen, my empirical analysis shows that increases in UI benefits increase firms' labor productivity. Given the direct positive relation between productivity and profitability, this

shows us that one of the positive effects that changes in UI benefits has on firms' net income is through labor productivity changes (despite the existence of other opposing forces that counterbalance this positive effect, making the overall relation between UI changes and profitability statistically insignificant). However, capital productivity also has a direct positive relation with profitability therefore, it is relevant to conduct a falsification test on the relation between unemployment subsidies and capital productivity to confirm that there is no statistically significant relation between UI benefits and capital productivity. Otherwise, I could not conclude that labor productivity was the main driver of the positive effect of UI changes on net income (it could be capital productivity). Additionally, because labor productivity is being measured as net sales/number of employees, if a significant relation exists between UI benefits and capital productivity this could mean that the significant results from the relation between UI benefits and labor productivity may be solely due to increases in net sales, derived from increases in capital productivity, and not labor productivity as a whole.

Table 11

Falsification test: Unemployment insurance benefits and companies' capital productivity.

This table comprises the results obtained from firm-panel regressions of net sales divided by total PPE as a measure for capital productivity, on the natural log of the maximum total UI benefit under each state's UI system. In all regressions, controls for state, firm and year fixed effects were added. The last four regressions include state economic indicators (UR and GDP growth rate), with the third and fifth including, moreover, firm financial controls (invested capital amount, natural logarithm of total assets and number of employees). Where specified, industries in which a great percentage of employees is likely to be geographically dispersed are excluded. Firm financial controls are winsorized at 1% tails. Standard errors were adjusted for clustering at the state level. OLS corresponds to ordinary least squares.

	(1)	(2)	(3)	(4)	(5)
Natural log max total benefit, t	1.494	0.407	0.698	1.515	1.583
Robust standard error	1.778	1.759	1.798	1.963	2.176
p-value	0.405	0.818	0.7	0.444	0.470
Number of observations	206,563	206,563	187,836	175,198	159,315
R2	0.363	0.363	0.346	0.327	0.328
Sample					
Excluded dispersed industries	No	No	No	Yes	Yes
Control variables					
State economic indicators	No	Yes	Yes	Yes	Yes
Firm financial controls	No	No	Yes	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Estimation method	OLS	OLS	OLS	OLS	OLS

To conduct this test, I use panel regression analysis where the level of net sales as a fraction of the firms' total PPE is modeled on the natural log of the maximum total UI benefit, a set of controls as used, firm fixed effects, state fixed effects and year fixed effects. The data and empirical framework for this analysis is the same as the one considered for the regression analysis reported in Table 9, with the only difference being the dependent variable. Results for this falsification test, reported in Table 11, suggest that there is no relation between UI benefits and capital productivity, since all regressions are statistically insignificant. This allows me to conclude that labor productivity increases, derived by UI changes increases, is indeed one of the positive countervailing effects on firms' profitability.

Individual conclusion

This part of the paper focuses on the relation between UI benefits and firms' labor productivity since I believe this is one of the main channels in the relation between UI benefits and firms' profitability. The findings illustrate that there is a significant positive association between both variables, even when accounting for inflation-adjusted figures. Exploring the implications of additional dimensions such as firm size, labor policies and work incentives on this relation is an important area for future research.

Group conclusion

This paper examines the impact the unemployment insurance system has on a firm's financial performance, as measured by the level of profitability, and explores one of the main channels that affect this association. Our results suggest an inconclusive relation between unemployment insurance benefits and a firm's net income. However, when developing further analysis, we reach some conclusive results that show a significant positive relation between both variables for profitable companies, for firms with a low level of leverage and for larger-sized firms, which is in line with economic theory. Nevertheless, the overall insignificant

results, prior to additional analysis, may be justified by the existence of multiple effects with opposing forces, one of which is examined in this paper. When analyzing the role of labor productivity, our findings indicate a positive impact of unemployment insurance benefits on firms' labor productivity, even when exploring additional dimensions for higher level of reliability, which confirms our expectation that this variable has a key role on explaining the positive effect of UI changes on firms' performance.

In conclusion, this paper adds to a growing literature that analyzes the interaction between unemployment insurance and firms' performance and labor productivity (including Wang and Zheng, 2018; Kumar, 2002). Our paper reinforces the idea that labor market and industry characteristics are important features of analysis to draw more reliable and concrete conclusions. For future research we recommend the investigation of different channels in the relation between UI benefits and firms' profitability and the inclusion of additional variables, since certain omitted variables in our analysis exist and may affect the association between UI benefits and firms' performance or provide additional explanation for the findings.

Appendix

Table A1

This table lists the full regression outputs, including the coefficients on all control variables, obtained from the firm-panel regressions of net income (loss), on the natural log of the maximum total UI benefit under each states' UI system, as a complement to Table 2 of this paper.

	Coefficient		Robust standard error		P-value
Panel: Net Income					
Regression 1					
Natural log max total benefit, t	6.260		6.815		0.363
Regression 2					
Natural log max total benefit, t	8.543		6.774		0.213
Unemployment Rate	-0.753		0.985		0.448
GDP Growth	0.913***		0.281		0.002
Regression 3					
Natural log max total benefit, t	14.512		9.555		0.135
Unemployment Rate	-1.204		0.928		0.2
GDP Growth	0.830***		0.309		0.01
Regression 4					
Natural log max total benefit, t	13.462		11.673		0.254
Unemployment Rate	-0.223		0.905		0.806
GDP Growth	0.956**		0.398		0.020
Log Total Assets	24.992***		2.327		0
Current Ratio	-0.275		0.28		0.332
Total Debt/Total Assets	-4.547		6.418		0.482

Table A2

This table lists the full regression outputs, including the coefficients on all control variables, obtained from the firm-panel regressions of labor productivity as measured by net sales revenue divided by number of employees (Panel A), on the natural log of the maximum total UI benefit under each state's UI system, as a complement to Table 9 of this paper.

	Coefficient		Robust standard error		P-value
Panel A: Sales/Employees					
Regression 1					
Natural log max total benefit, t	46.583**		18.188		0.014
Regression 2					
Natural log max total benefit, t	50.145**		19.412		0.013
GDP Growth	1.215		1.102		0.276
Unemployment Rate	-0.400		5.464		0.942
Regression 3					
Natural log max total benefit, t	43.877**		20.504		0.027
GDP Growth	1.209		1.107		0.280
Unemployment Rate	0.961		5.088		0.851
Log Total Assets	29.841***		9.410		0.003
Invested Capital	0.004		0.005		0.364
Regression 4					
Natural log max total benefit, t	74.784***		20.750		0.001
GDP Growth	1.844		1.203		0.132
Unemployment Rate	-1.625		6.965		0.816
Regression 5					
Natural log max total benefit, t	69.899***		20.235		0.001
GDP Growth	1.866		1.193		0.124
Unemployment Rate	0.083		6.324		0.990
Log Total Assets	30.120***		9.271		0.002
Invested Capital	0.007		0.006		0.198

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