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Firm Size and Change in Employment over the Economic Cycle

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Abstract: The objective of this research is to understand whether, during economic downturns (and upturns) in the United States, employment in small businesses is disproportionately more affected than that in large firms. During the coronavirus disease 2019 pandemic, small firms struggled to recover from their losses and therefore had to cut back on their number of employees despite efforts from federal and state governments to provide emergency relief to small businesses. For a firm size that employs almost half of the private sector employees, the results of this research are critical in identifying solutions to alleviate the burden on businesses disproportionately affected during recessions.

This paper examines the relationship between the change in employment in small versus large firms as compared to the annual real gross domestic product (GDP) growth rate over the 1979 to 2021 time period. Results show that the percentage change in employment for small firms does indeed show a stronger linear relationship with the real GDP growth rate than the corresponding relationship for large firms. Expanding fiscal support measures to help keep small firms afloat during downturns would indirectly influence their employment and reduce the decline in employment. Additionally, the Small Business Administration should prioritize loans primarily based on financial need to combat this disparity and spread resources in a way that benefits more small businesses.

Author keywords: Firm size; Unemployment; Economic Cycle

Introduction

Small businesses are one of the most influential drivers of growth in the economy.[1] Despite their name, small businesses employ 46.4% of private sector employees and have been the main contributors to job creation for the past few years.[2] However, small and local businesses have often been portrayed as more vulnerable than large firms to the fluctuations in the economic cycle. If the employment of small firms is indeed particularly volatile, then this makes a large proportion of the workers in the economy quite vulnerable during recessions. On the other hand, if results indicate that it is actually the employment of large businesses that is cyclically volatile, then efforts should be made to lessen the impact recessions have on the employment of large firms.

This paper examines the percentage change in employment in small and large firms from 1979 to 2021 and the annual real gross domestic product (GDP) growth rate. Percentage change in employment was used to measure employment growth, as this variable would specifically track year-to-year differences in the percentage of employees lost or gained, providing a direct insight into the proportion of employees leaving or entering a particular firm size. Sahin et al.[3] also used the percentage change in employment as their variable of interest in a similar study. Measuring the percentage change in employment allows for proportional comparison between firm sizes. Results show that the percentage change in employment for small firms does indeed show a stronger linear relationship with the real GDP growth rate than the percentage change in employment for large firms.

Placing this research in the broader literature, there generally seems to be more studies supporting the idea that employment in large firms varies with the economic cycle more than in small firms.[4–6] However, during the coronavirus disease 2019 (COVID-19) pandemic, small firms were affected much more significantly than large firms.[7] This is not reflected in the existing literature, as most of it is pre-pandemic; these studies lack more recent data. Additionally, this paper and other literature vary in terms of the type of metric used to assess employment. For example, while this study utilized annual percentage change in employment for both firm sizes, other studies used annual net job creation. Finally, different studies define "small" and "large" firms in different ways. While a small business is defined as one having fewer than 500 employees and a large firm as one having 500 or more employees, which aligns with the Small Business Administration (SBA) definition, other studies may refer to small businesses as having fewer than 50 employees and large firms as having more than 1,000 employees. This disparity could certainly lead to different results and conclusions.

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This paper is organized as follows: The Literature Review section covers a deeper analysis of past research on employment across firm sizes during economic cycles. The Description section presents the datasets used, the variables analyzed, and the methodology of the data analysis. Afterward, two ordinary least-squares regression lines (OLSRLs) are introduced: one for the percentage change in employment for small firms and one for the percentage change in employment for large firms. The OLSRLs, which show similar correlations, are compared based on the coefficients of the explanatory variables of interest, as well as any other statistically significant variables. The Discussion section explores potential solutions to combat the dip in employment of small businesses during recessions. Finally, the Conclusion section takes note of the purpose and significance of the results.

Literature Review

Recovery in employment after a recession is slower now than it was in the past. Recessions prior to 1990 generally saw a steady recovery in employment soon after the recessions ended.[8] Furthermore, recent recessions until the Great Recession show a continued decline in employment even during economic recoveries. Additionally, the continued decline in employment could be correlated with a rise in the number of firms of a particular size class, such as the recent and rapid rise in the number of small businesses in the United States since the 1990s.[2] Though a link between the two has not been proven, it is certainly possible and therefore important to consider while reviewing older literature.

Some papers provide evidence supporting the sensitivity of small firms to economic fluctuations. The recessions in the early 1990s and 1980s saw the net job creation rates of small firms suffer more than those of large firms.[5] Additionally, during the COVID-19 pandemic, fiscal support measures putting small firms at a disadvantage were prominent, and policies to aid small businesses were insufficient. While large businesses had multiple avenues to seek relief, small businesses could only be aided by the Paycheck Protection Program and Health Care Enhancement Act (PPP). Additionally, the priority of handing out PPP loans was given to more established businesses, so the most in-need small businesses struggled.[9] Furthermore, data from the recession of 2007–2009 indicate that small firms were hit harder than large firms because of reduced customer demand (especially in small firms), and therefore a decline in fixed investment by small firms.[3] The research presented in this paper focuses more on the relationship between recessions and employment than others. It is worth mentioning that GDP growth was found to have a stronger correlation with the employment growth at smaller firms than at larger ones.[5]

However, not everyone agrees with the idea that small firms are more cyclically sensitive than large firms. It is still an ongoing debate. Other evidence points to large firms as being more sensitive to economic fluctuations.[3–5] Regarding net employment growth rates, large firms suffered more than small firms during the recessions of 1982 and 2001. Even in the Great Recession, the growth rate of employment at initially large firms declined by 1.65% more.[5] Additionally, in the recession of 2001, the percentage change in employment of large firms was more greatly affected than that of small firms.[3] In terms of net job creation rate, large businesses proportionately shed more jobs over recessions and create more jobs during expansions.[4] There appears to be a pattern that relatively poor job creation of large firms happens for years after the trough. Large firms are typically more productive and offer higher-paying jobs, so they can successfully poach workers from smaller competitors. Job-to-job reallocation redistributes workers from low- to high-paying jobs.[10] This research often links lower-paying firms to small firms and higher-paying firms to large firms, which may not always be an accurate representation of large and small firms. During downturns, large firms want to get rid of the excess of workers they obtained from poaching.[5] This indicates that large firms will proportionally shrink more than small firms during economic contractions. For example, Moscarini and Postel-Vinay claim that small, credit-constrained firms would quickly rebound during recessions due to the central bank's reactions in monetary policy.[5] As the economy recovers and unemployment falls, monetary policy tightens and curbs the growth of small firms, which are outperformed by larger, financially less constrained competitors, again causing the larger firms to proportionately gain more employees.

Historically, research from 1994 indicates that in the prior six recessions, only the 1970 and the 1980 recessions saw a clear collapse in the growth rate of sales at small firms in comparison to large firms.[6] While there is a clear collapse of the growth rate of sales of small firms relative to large firms in the recessions of 1970 and 1980, the opposite occurs in the recession of 1961, and the recessions of 1974, 1982, and 1991 appear fairly neutral. The poor performance of small businesses during both recessions lasted for just a year, while in all recoveries, large firms remained sluggish for years.

Building upon data from the pandemic, new research disputes some ideas presented in older studies.[9] Previous studies have linked higher wages to larger firms, but this correlation has weakened in recent decades. The authors found that during the COVID-19 pandemic, there was greater excess unemployment among workers in small enterprises than in larger firms. However, in industries with higher flexibility for working remotely, the pattern reversed, and small businesses retained their workers at slightly higher rates than larger firms. It is important to note that this reversed pattern is only seen for micro-businesses with fewer than 10 employees, which are likely family businesses or ones with close ties.

Small businesses were more likely to be in the nonessential services sector, so they were particularly affected during the pandemic. Workers in small- and medium-sized enterprises are more likely to have lower education levels and live in rural areas, contributing to the firm size wage premium, although since 1980, the firm size wage premium has declined substantially, especially for low-skilled workers.[9] Still, there is significant variability in the wages of workers in small firms.

Recent years have seen increased product and labor market concentration in the economy due to scale-based

technological changes and barriers to the entry of new competitors, leading to the rise of a few superstar firms. The measure of new COVID-19 cases per 1,000 residents was also used to show that small firms faced a surge in unemployment compared to large firms.[9] For every additional case per 1,000 residents, unemployment increased by more than 2.2% for firms with fewer than 10 workers, 2% for firms with 10–99 residents, 1.6% for firms with 100–999 workers, and 1.2% for firms with more than 999 employees. The authors highlighted that the pandemic augmented existing inequalities between small and large firms, as there was a further increase in product and labor market concentration as more small businesses failed and cut back their workforces.

Description

Data

For this research, data were sourced from the U.S. Census Bureau's Business Dynamic Statistics (BDS), Federal Reserve Economic Data (FRED), and the United Nations Department of Economic and Social Affairs Population Division. The data source for the statistics used to calculate the annual percentage change in employment for large and small firms was the BDS. The BDS is a set of datasets that provide measures of business dynamics (such as job creation and destruction, establishment births and deaths, and firm startups and shutdowns) for the economy overall and aggregated by establishment and firm characteristics. The datasets are based on administrative and survey-collected data. The BDS contains data at the establishment level, although the data analyzed in this research were at the parent firm level. The dataset utilized, "Sector by Firm Age by Initial Firm Size," contains annual statistics on the number of employees by firm size (1–19 employees, 20–499 employees, and 500 or more employees). In the context of this paper, small firms are defined as firms with 1 to 500 employees, while large firms are defined as firms with 500 or more employees. This definition of "small" and "large" aligns with the SBA's definitions. As per the BDS, firm size is the average number of employees in the current and prior years.

Additionally, raw data on real GDP as well as the annual unemployment rate were derived from FRED, which is an online database of time series regarding different economic variables based on U.S. data. It is compiled from data provided by the U.S. Census Bureau as well as the Bureau of Labor Statistics, and is managed by the Federal Reserve Bank of St. Louis.

Finally, the crude rate of net migration in the United States, defined as the ratio of net migration during the year to the average population in that year and expressed per 1000 persons, is derived from the UN's Crude Rate of Net Migration data. This data is obtained from the United Nations Department of Economic and Social Affairs Population Division. The datasets used to calculate the crude rate of net migration include the U.S.'s Total Net-Migration and the U.S.'s Total Population by Sex.

Variables

The explanatory variables in this analysis include the real GDP annual growth rate, real GDP annual growth rate with a lag of 1 year, U.S. net migration growth rate, unemployment rate, and the percentage change in employment by firm size (the data for small firm sizes were used for the analysis of small firms, and the data for large firm sizes were used for the analysis of large firms) with a lag of 1 year. These variables were considered to be potentially correlated with the percentage change in employment for both small and large firms, as the crude rate of net migration affects the labor force and the unemployment rate would likely align with changes in employment for the two firm sizes. The response variable is the percentage change in employment by firm size (either small or large). Table 1 presents summary statistics for the variables used in the analysis.

Methodology

The annual percentage change in employment between 1979 and 2021 was calculated as shown in Eq. (1).

$$\%\ change\ in\ number\ of\ employees = 100 * (number\ of\ employees\ in\ the\ current\ year - number\ of\ employees\ in\ the\ prior\ year)/(number\ of\ employees\ in\ the\ prior\ year). \quad (1)$$

To plot against the annual percentage change in employment for large and small firms, the growth rate of real GDP was calculated as shown in Eq. (2).

$$growth\ rate\ of\ real\ GDP = 100 * (real\ GDP\ of\ the\ current\ year - real\ GDP\ of\ the\ prior\ year)/(real\ GDP\ of\ the\ prior\ year). \quad (2)$$

Table 1. Summary statistics

Summary statistics					
Response variables	Q1	Median	Q3	Mean	Std. Dev.
Percentage change in employment for small firms	−0.284	1.285	2.354	0.948	2.486
Percentage change in employment for large firms	0.969	2.100	3.322	1.656	2.235
Real GDP annual growth rate	1.915	2.768	3.829	2.622	1.985
Crude rate net migration	2.651	4.495	4.942	4.021	1.276

This data was calculated beginning in 1979 as well. More explanatory variables were added to the equation as controls due to possible correlations they may have with the response variable. The crude rate of net migration in the United States was calculated using 1000 ∗ (total net migration in the United States for a given year/total population of the United States for that given year) from 1979 to 2021. The annual unemployment rate from FRED was kept as is. Additionally, a lag(1) variable of the annual percentage change in employment was added as an explanatory variable because the previous year's percentage change in employment may relate to the next year's. Furthermore, a lag(1) variable of the annual growth rate of real GDP was added as well. Due to the lag of 1 year, all the data are measured from 1980 to 2021.

The following regression model was considered to investigate the effect on percentage change in employment for the two firm sizes:

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 x_t + \beta_3 x_{t-1} + \beta_4 m_t + \beta_5 u_t + e_t, \quad (3)$$

where y_t is the annual percentage change in employment (for small or large firms) at time t; α is the model intercept; y_{t-1} is the annual percentage change in employment at $t - 1$, included to account for persistence in the variable of interest. The main coefficients of interest are β_2, which captures the sensitivity of the percentage change in employment to the annual growth rate of GDP at time t (x_t), and β_3, which accounts for the delayed effect. Finally, the model incorporates m_t, the crude rate of net migration at time t, and u_t, the annual unemployment rate at time t. Parameters β_4 and β_5 are regression coefficients corresponding to m_t and u_t, respectively. The term e_t is the error term. The regression parameters in Eq. (3) were estimated by performing an OLS regression in Microsoft Excel.

Results

Overall, the OLS estimate for the relationship between the real GDP annual growth rate at time t and the percentage change in employment at time t was 0.342 (Table 2) for large firms and 0.667 (Table 3) for small firms. The value of 0.667 is notably larger than 0.342, indicating that the percentage change in employment for small firms is much more strongly correlated with the real GDP annual growth rate than the percentage change in employment for large firms is. These results suggest a stronger sensitivity to the economic cycle for employment at small firms. The least squares estimate for the relationship between the lagged real GDP annual growth rate and the percentage change in employment further supports this conclusion, given that the coefficient is 1.110 for small firms (Table 3) and 0.828 (Table 2) for large firms. All these values are statistically different from 0.

Additionally, only for the data for small firms, the coefficient of the percentage change in employment for small firms with a lag of 1 year is statistically significant at −0.306 (Table 3). Since the coefficient of the percentage change in employment lag(1) is only significant for the OLSRL of small firms, it implies that the prior year's percentage change in employment correlates with the current year's percentage change in employment far more for small firms than for large firms. Since this is a negative slope, the percentage change in employment lag(1) and the percentage change in employment have an inverse relationship for the OLSRL of small firms. Perhaps there is a yearly cyclability in regard to the percentage change in employment for small firms, alternating between growth and decline each year.

All other coefficients of variables, including the percentage change in employment for large firms lag(1), the crude rate of net migration, and the unemployment rate, are not statistically significantly different from zero (Tables 2 and 3). It is possible that any observed association between these variables and the percentage change in employement for small and large firms occurred simply by chance. However, it is also possible that this study may be underpowered, and that more data pre-1979 would reveal coefficients for each variable that are statistically significant. The BDS's earliest data regarding the number of employees based on firm size were from 1978, so this study was limited to calculating the percentage change in the number of employees from 1979 to 2021 (when the data ended).

The two OLSRLs calculated for their respective firm sizes have reasonably strong positive R^2 values: 0.705 for the OLSRL of small firms (Table 5) and 0.741 for the OLSRL of large firms (Table 4). It is interesting to note that the standard error of the OLSRL of small firms, 1.441 (Table 5), is somewhat greater than the standard error of the OLSRL of large firms, 1.214 (Table 4).

Table 2. Regression coefficients for large firms

	Coeff.	*Std. err.*	*t stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	−3.076	1.970	−1.561	0.127	−7.072	0.920
Percentage change in employment for large firms lag(1)	0.167	0.126	1.331	0.192	−0.088	0.422
Real GDP annual growth rate	0.342	0.119	2.870	0.007	0.100	0.584
Real GDP annual growth rate lag(1)	0.828	0.120	6.889	0.000	0.584	1.071
Crude rate net migration	0.268	0.176	1.523	0.136	−0.089	0.624
Unemployment rate	0.052	0.175	0.295	0.770	−0.304	0.408

Table 3. Regression coefficients for small firms

	Coeff.	*Std. err.*	*t stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	−5.446	1.959	−2.780	0.009	−9.420	−1.473
Percentage change in employment for small firms lag(1)	−0.306	0.145	−2.102	0.043	−0.600	−0.011
Real GDP annual growth rate	0.667	0.126	5.286	0.000	0.411	0.923
Real GDP annual growth rate lag(1)	1.110	0.176	6.319	0.000	0.754	1.467
Crude rate net migration	0.019	0.208	0.092	0.928	−0.403	0.441
Unemployment rate	0.337	0.179	1.888	0.067	−0.025	0.700

Table 4. Regression statistics for large firms

Regression statistics	
Multiple R	0.861
R^2	0.741
Adjusted R^2	0.705
Standard error	1.214
Observations	42

Table 5. Regression statistics for small firms

Regression statistics	
Multiple R	0.840
R^2	0.705
Adjusted R^2	0.664
Standard error	1.441
Observations	42

Discussion

Results of this study indicate that small firms are more sensitive to the economic cycle. Many research papers have contributed to the discussion of the effects of size class on employment over the economic cycle, and different metrics have been used to measure employment. For example, Moscarini and Postel-Vinay[4] used the net job creation rate. They identified that gross job creation for large firms surges ahead of that of small firms at the peak of expansions. The paper recognizes this same pattern occurring within industries as opposed to across industries, although the data it uses extend only up to 2006. It has also been observed that the negative correlation between the net job creation rate of large employers and the level of unemployment at business cycle frequencies is stronger for larger employers than for smaller employers. Moscarini and Postel-Vinay[5] studied net employment growth rates, finding that large firms suffered more than small firms during the recessions of 1982 and 2001. In addition to different metrics being used, research papers also differ in their definitions of "small" and "large" businesses. For example, Sahin et al.[3] used the percentage change in employment between small (1–49 employees), medium (50–499 employees), and large (500+ employees) firms as a metric to measure employment and directly compare data from the Great Recession and the dot-com crash.

Based on the analysis presented in this paper, the percentage change in employment of small firms has a stronger relationship with the annual growth rate of GDP, as well as with the annual growth rate of GDP with a lag of 1 year. The slope for the annual growth rate of GDP lag(1) for small firms is slightly steeper than 1, indicating that this variable is a particularly good predictor of the percentage change in employment of small firms.

Protecting the employment security of almost half of the private sector's employees during economic downturns should be the SBA's priority. Using the coefficients from the OLSRL in this paper for the annual growth rate of GDP, as well as (more importantly) the annual growth rate of GDP lag(1), the SBA can predict when small businesses may see a decline in employment. Small firms often rely heavily on external bank loans and credit. SBA loans are known for having low interest rates, which is ideal for many small businesses, but it is tough to qualify for them. Oftentimes, more well-established businesses get priority when it comes to loans that the SBA hands out, so there are still many younger, more vulnerable businesses struggling to stay afloat. The SBA should prioritize loans primarily based on financial need to combat this disparity and spread resources in a way that benefits more.

Conclusions

This paper investigated the effects of the economic cycle on the percentage change in employment for small and large firms. Key sources of data included employee data from the U.S. Census Bureau's BDS and annual GDP data from the FRED. A regression model was used to investigate the effect on the percentage change in employment for the two firm sizes. The results of this research demonstrate that small firms are more sensitive to the economic cycle than large firms, which contrasts with the results of several studies in this area.

Being able to learn and apply the coefficient of the OLSRL for the annual growth rate of GDP lag(1) for small firms to predict the percentage change in employment for

the next year is particularly vital. While it may not be able to foresee completely unexpected events, such as the COVID-19 pandemic, it can certainly be of aid during economic contractions. Above all else, this paper should bring more attention to employees of small businesses and the effort to find ways to protect their jobs, whether this includes reforming how the SBA administers loans or providing small businesses with other avenues to obtain credit.

With different definitions of small and large firms throughout the long discourse on which firm size is more cyclically variable, this research used the SBA's definition of a small firm, which is fewer than 500 employees, while a large firm is 500 or more employees. The results of this research contribute to the discussion of employment variability over the economic cycle by firm size by attempting to standardize the definitions of large and small firms. As more research is conducted in this area, having standard definitions of large and small firms would provide a clearer picture of the dynamics between firm size and changes in employment.

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