Labor Force and Worker Bargaining Power

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Abstract

What is driving the decline in labor force participation in the United States over the past six decades? This paper investigates the role of worker bargaining power in this phenomenon. Motivated by a strong correlation in their trends, I leverage the staggered introduction of right-to-work laws across states to identify a causal link between lower worker bargaining power and a decline in labor force participation. Specifically, I construct a time series of worker bargaining power at the state level and find that lower worker bargaining power is associated with a decrease in labor force participation. To better understand the mechanisms at play, I develop a model with endogenous participation choices and show that worker bargaining power can account for a significant share of the decline in labor force participation rate, employment, and labor share in recent years. These findings suggest that policies aimed to strengthen worker bargaining power could help boost labor force participation in the United States.

JEL: E02, E24, J11, J21, J5

Keywords: *worker bargaining power, labor force, right-to-work laws*

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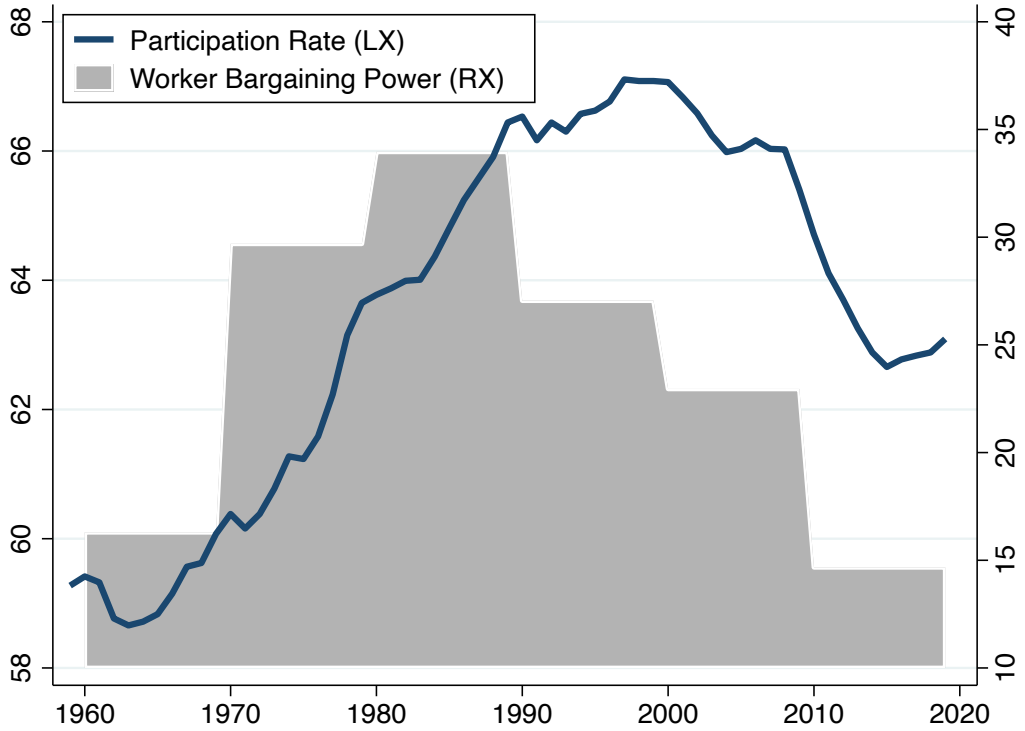
1 Introduction

The United States has experienced a significant change in the labor force participation rate over the last decades (Juhn and Potter, 2006; Perez-Arce and Prados, 2021). The solid blue line in Figure 1 shows its hump-shaped trend with a sharp increase from the 1960s and a decline in the new millennium. This trend has far-reaching consequences for the firm dynamics in the economy as lower labor force growth leads to lower firm entry, thus more market concentration, which can ultimately result in lower labor share and economic growth (Hopenhayn et al., 2022). Shedding light on the drivers of these changes is thus essential to understand the evolution of the economy over the last sixty years and for policymakers to promote sustainable economic growth.

In this paper, I propose and investigate a novel driver that may help to explain the hump-shaped trend in labor force participation: *worker bargaining power*. As shown by the gray area in Figure 1, the worker bargaining power trend closely mirrors the participation rate, suggesting a strong relationship between the two. Building on this observation, I establish a causal link between the two series by leveraging the staggered introduction of legislation across U.S. states. My findings indicate that lower worker bargaining power pushes workers out of the labor force, providing a potential explanation for the decline in labor force participation. To further explore this relationship, I develop a model with an endogenous labor force in which bargaining power directly affects participation decisions. A calibrated version of the model suggests that nearly 90% of the total changes in the labor force since the 1980s can be attributed to worker bargaining power. In what follows, I discuss these contributions in detail.

Although the two series in Figure 1 have a robust correlation, that is not sufficient per se to set a cause-and-effect relationship; thus, I use the introduction of laws aimed to limit unions' power as an instrument for a decline in worker bargaining power. These laws – the right-to-work laws – regulate the position that unions have contractually at the state level, prohibiting mandatory membership or financial participation for employees. Each state can introduce them autonomously following the Taft-Hartley Act in 1947. The Act was voted by a newly elected Republican majority in the aftermath of World War II and the great strike wave of 1946 to strongly reduce unions' power and limit any form of collective action. It prohibited most contractual instruments favoring labor unions originating from the Wagner Act the decade before to help protect workers' rights and promote economic stability. Moreover, it allows each state to adopt right-to-work laws, whose introduction further reduces participation and financial means at the disposal of unions. States that tend to have Republican-controlled legislatures or governors affiliated with the Republican Party have gradually approved them since 1947. The purpose of these laws and their adoption makes them a suitable instrument for worker bargaining power and allows me to tackle the endogeneity issue in the analysis of the participation rate. By

Figure 1: Labor Force Participation and Worker Bargaining Power



Notes: This figure shows the evolution of the participation rate on the right axis and worker bargaining power on the left axis in the United States from 1960 to 2019. The U.S. Bureau of Labor Statistics provides the participation rate defined as "the number of people in the labor force as a percentage of the civilian noninstitutional population". The figure shows annual averages. Mengano (2023) provides the series of worker bargaining power that represents the share of surplus that workers are able to capture, computed at decade frequencies.

comparing in a staggered fashion states that have adopted and those that have not, I provide the first direct evidence of the effect of right-to-work laws on worker bargaining power. My findings show that introducing these laws is associated with a significant reduction of more than six percentage points in worker bargaining power, in line with the purpose they were initially designed for. Moreover, analyzing the reduced form effect on the participation rate, my findings confirm that the adoption of the law discourages workers from participating or even pushes them out of the labor force.

With the aim of investigating worker bargaining power as a driver of the changes in the participation rate depicted in Figure 1, I construct a time series of worker bargaining power at the state level using the novel method developed in Mengano (2023). The structural method estimates the equilibrium equation deriving from the wage negotiation between employers and employees in two steps. First, it uses contemporaneous methods to estimate each firm's marginal product of labor, which is a key determinant of the surplus generated in a job. Second, it estimates the wage equation on granular data using an instrumental strategy and recovers worker bargaining

power as the coefficient obtained by regressing wages on the marginal product, controlling for firm and worker outside options. As a result, it allows to construct a measure of worker bargaining power for the U.S. using only balance sheet information. For the purpose of this paper, however, I am interested in a regional indicator as the instrument is at the state level. The majority of firms operate across states, and it is not possible to disaggregate their information geographically. Hence, I use a shift-share approach. I start by estimating industry-specific measures of worker bargaining power for 2-digit sectors. Then, I use pre-determined industry employment shares at the state level as weights for the industry trends to create an indicator of state-specific worker bargaining power. Armed with these regional indicators, I analyze their relation with the labor force participation rate using the staggered introduction of these laws as instruments. This strategy sheds light on a positive causal effect, meaning that a one percentage point decrease in worker bargaining power reduces the participation rate by 0.28 percentage points. Identifying this causal link allows me to study the effect of the changes in worker bargaining power in a general equilibrium framework.

I rationalize the empirical findings in a framework with endogenous participation choices and use it to quantify the effect of the erosion of worker bargaining power since the 1980s. The model includes random search frictions in the labor markets, with firms posting vacancies to hire unemployed workers searching for them. Workers choose to participate in the labor force by comparing the expected value of being in the labor force with the value of being outside. If participating, workers are either employed or searching for jobs. Hence, the expected value of participating is a combination of the wages they would get paid and the outside option of being unemployed mediated by the probability of finding a job. The utility of not participating in the labor force is a worker-specific unobservable value drawn from an unknown distribution, which can be interpreted as leisure or home production. In equilibrium, the marginal worker is indifferent between participating and not participating, hence giving rise to a participation threshold in the value of being out of the labor force. In the quantitative exercise, I calibrate the model to discipline the parameters governing it to match the economy in the 1980s. Then I construct a theoretical counterfactual by switching worker bargaining power to its value in the 2010s – its lowest level – to study how the economy reacts. This analysis shows that the erosion of worker bargaining power alone accounts for 87% of the decline in labor force participation rate, 60% of the increase in employment, and 56% of the decrease in labor share in recent years.

Related Literature. Several structural factors have been proposed to explain the changes in the labor force participation rate. Autor et al. (2013) finds that the increased import competition from China had a disruptive effect on the U.S. labor markets and contributed to reducing the participation rate. Acemoglu and Restrepo (2020), using a similar econometric approach, find that technology – proxied by the adoption of industrial robots – generates a negative net

employment effect displacing more jobs than it creates. Labor supply factors include the rise in Social Security Disability Insurance (Wachter et al., 2011; Maestas et al., 2013; French and Song, 2014; Gelber et al., 2017), changing social norms (Aguiar et al., 2021), and declining immigration (Blau and Mackie, 2017).[1] I shed light on a yet unexplored driver in this paper: worker bargaining power. In doing so, I leverage the novel method proposed by Mengano (2023) with institutional changes in the U.S. and develop a simple framework to rationalize this finding. A theoretical counterfactual shows that this factor alone accounts for more than three-quarters of the pattern in the labor force participation rate.

In addition, a number of recent papers study the effect of the introduction of the right-to-work legislation interpreting it as a change in the working conditions for workers. In a similar analysis, Drautzburg et al. (2021) finds that distributional risk between capital and labor is an important source of aggregate fluctuation. Using the introduction of right-to-work legislation as a political distributional risk, they find it leads to an increase in capital share. Their model embeds shocks to bargaining power and is consistent with this paper. While they focus on short to medium-run fluctuations, I study long-run trends and contribute by including an endogenous labor supply in the framework to rationalize findings from a credible identification mechanism. Additional papers studying the effect of right-to-work laws in an empirical framework are Bloom et al. (2019) that find it increases the use of "incentives practices", Shierholz and Gould (2011) that shows that workers in states with right-to-work laws earn on average $1500 less, and Holmes (1998) that shows it is associated with a large presence of manufacturing activities. I contribute to this strand of the literature by combining the quasi-experimental variation stemming from the introduction of the laws with the structural approach developed in Mengano (2023) to provide the first direct evidence of the effect of right-to-work laws on worker bargaining power.

Finally, Hopenhayn et al. (2022) and Peters and Walsh (2021) study the effect of changes in the labor force on firm dynamics. Hopenhayn et al. (2022) assesses the importance of firm demographics for aggregate trends in the U.S. and then finds that a nondecreasing labor force growth is necessary for having a positive firm entry. It shows that the lower labor force growth observed in the U.S. has significantly affected the age distribution of the firm population, thus playing a major role in the recent aggregate trends in exit rates, average firm size, and concentration. In contemporary work, Peters and Walsh (2021) builds a growth model to analyze the aggregate productivity effect of demographic changes. They find that declining population growth leads to less innovation and less creative destruction. I contribute to these works by uncovering a crucial driver of labor force growth.

[1] Abraham and Kearney (2020) and Perez-Arce and Prados (2021) provide excellent reviews of the literature.

Road-Map. The rest of the paper proceeds as follows. In Section 2, I describe the data used and the institutional framework. In Section 3, I establish a causal link between worker bargaining power and labor force participation rate. I augment a random-search frictions model with an endogenous participation choice in Section 4 and show the importance of worker bargaining power in the recent evolution of the participation rate in Section 5. Finally, Section 6 concludes.

2 Institutional Background and Data

In this Section, I describe the institutional background, the staggered introduction of the right-to-work law in the United States, and the data used in the empirical analysis.

2.1 Labor Laws in the 20th Century

The end of the 19th and the beginning of the 20th century saw a ferocious fight against the formation of unions and collective actions. The Supreme Court prevented any attempt to organize unified labor movements leveraging the Sherman Antitrust Act, a law intended to promote free competition and prevent anti-competitive agreements. The Wall Street Crash and the Great Depression caused significant political changes in the United States, culminating with the election of Franklin D. Roosevelt. His economic recovery plan, the New Deal, based on relief, recovery, and reform, led the United States Congress to approve the National Labor Relations Act (NLRA) of 1935. Also known as the Wagner Act, it was passed during significant economic turmoil and high unemployment and was intended to help protect workers' rights and promote economic stability. Specifically, it aimed to correct the "inequality of bargaining power" between employers and employees by establishing the right of workers to organize and collectively bargain with their employers. Moreover, the Act also created the National Labor Relations Board (NLRB), which is responsible for enforcing labor laws and investigating unfair labor practices.

2.2 Right-to-Work Legislation

The tumultuous economic scenario in the aftermath of World War II leads to the largest wave of strikes in American history. With the inflation rate spiking, entire industries reconverted, and millions of soldiers to relocate, protesters demanded better pay and working conditions. As a result, elections in 1946 gave a Republic majority in Congress with strongly conservative newly elected members. After that, the United States Congress approved the Labor Management

Relations Act of 1947, also known as the Taft-Hartley Act, despite President Truman's veto. The Taft-Hartley Act amended the NLRA, restricting the activities and power of labor unions. Specifically, the Act heavily regulated, often prohibiting strikes and other forms of collective actions, and it forbade closed shops. Closed shops were contractual agreements requiring an employer to hire only labor union members and preventing any worker who would stop being a labor member union from being employed. Finally, the Taft-Hartley Act allowed each state to approve right-to-work laws. These are state laws that prohibit agreements between labor unions and employers that require workers to join (union shops) or financially support (agency shops) the union as a condition of employment. Essentially, these laws allow workers to opt out of joining a union and paying union dues, even if the union represents the workers in collective bargaining negotiations. Since the introduction of the Taft-Hartey Act, 28 states have passed right-to-work laws.[2] Figure 2 shows the year each state adopted the law. In the empirical framework in Section 3, I use the introduction of the right-to-work law at the state level as an instrument for a decline in bargaining power.

2.3 Worker Bargaining Power and State-Level Data

Worker bargaining power is an essential element of labor markets, and it represents the share of the surplus generated performing a job that workers capture. While economists used to think of salary negotiations between employers and employees as processes where each party had the same bargaining power (Petrongolo and Pissarides, 2001), recent evidence uncovered a significant power imbalance, with firms having a lot of bargaining power relative to workers (Card et al., 2018). In this paper, I use recent evidence on the evolution of worker bargaining power from Mengano (2023). The latter develops a novel method to estimate worker bargaining power using a model with search and matching frictions and heterogeneous firms. It brings the equilibrium wage equation to the data by estimating a firm-level indicator of the marginal productivity of labor and studies its transmission to wages in a repeated cross-sectional analysis controlling for firm and worker outside options. The data used are firm-level financial information from S&P's Compustat covering the universe of publicly listed firms in the U.S. manufacturing industry from 1960 to 2019. Table A.1 shows summary statistics for the sample used.

I use data on labor force participation, population, and employment by industry at the state level in the analysis in Section 3. Labor force and population statistics are provided as annual averages by the Local Area Unemployment Statistics (LAUS) program of the Bureau of Labor Statistics (BLS). Finally, I construct industry employment shares using information from the County Business Patterns (CBP), which is available since 1986.

[2]Source: National Conference of State Legislatures, https://www.ncsl.org/labor-and-employment/right-to-work-resources.

Figure 2: Right-to-Work Adoption by State

Notes: The Taft-Hartley Act allows states to introduce the right-to-work law to outlaw union shops and agency shops. This map illustrates the staggered introduction of the right-to-work legislation. States in dark gray adopted the law, whereas light gray indicates that it was not adopted. Labels indicate the year of adoption. Data provided by the National Conference of State Legislatures.

3 Empirical Framework: Establishing a Causal Link

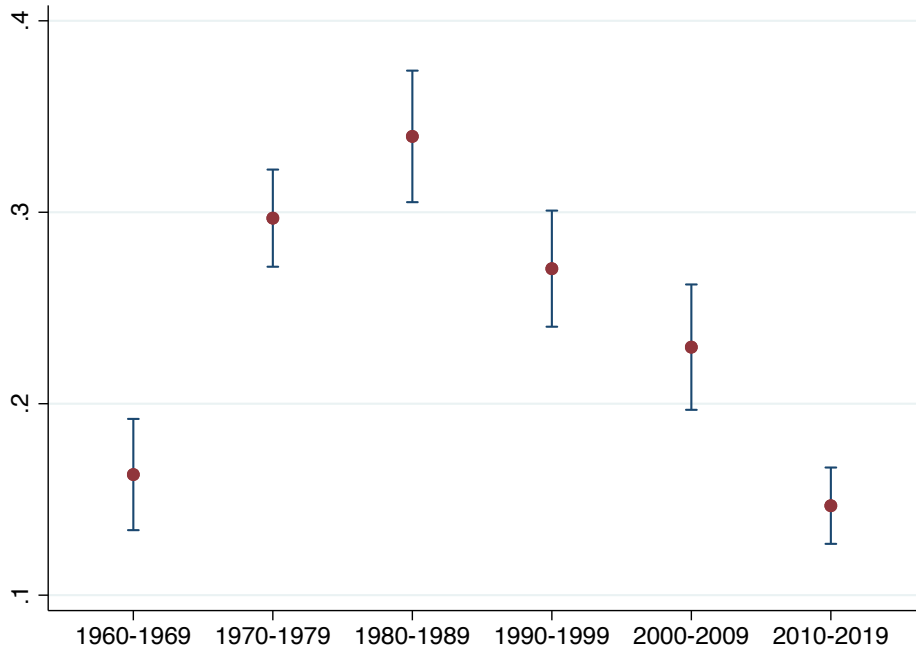
Table 1: Correlations

	(1)	(2)
Bargaining Power	0.15	0.17
	(0.05)	(0.02)
Decade FE	No	Yes
Obs	60	60

Notes: These are OLS coefficients estimated regressing national labor force participation rate on worker bargaining power (Figure 1). The second column includes decade fixed effects.

Figure 1 and Table 1 show the strong correlation between worker bargaining power and labor force participation rate. The evolution of the two series is strikingly similar over the last six decades, and in the next Section, I show that much of the changes in the participation rate are due to changes in worker bargaining power in a general equilibrium analysis. Before that, however, one might be concerned that the participation rate affects worker bargaining power

Figure 3: The Evolution of Worker Bargaining Power



Notes: Worker bargaining power represents the share of surplus generated performing a job that a worker is able to capture in an individual negotiation. The source of the time series is Mengano (2023), and the underlying data are from Compustat.

or that the two series are simultaneously determined. Therefore, I investigate and establish a causal link between bargaining power and participation choices in this Section.

I leverage the staggered introduction of the right-to-work legislation in U.S.states (Figure 2) to study the link between worker bargaining power and labor force participation rate (Drautzburg et al., 2021). As explained in the previous Section, the Taft-Harley Act was approved in 1947 to reduce the power of labor unions, and it specifically allowed each state to approve right-to-work laws to reduce unions' power further individually.

Reduced Form

I start by estimating the reduced form effect of introducing the right-to-work law on labor force participation. Specifically, I adopt the following empirical setting

$$\text{LFP}_{st} = \beta_0 + \beta_1 \mathbb{1}[\text{LAW}]_{st} + \boldsymbol{\beta}_2 \mathbf{X}_{st} + \varepsilon_{st} \tag{1}$$

with LFP_{st} being the labor force participation in state s at time t and $\mathbb{1}[\text{LAW}]_{st}$ an indicator function taking value one from the period in which state s introduces the legislation onward.

Table 2: Participation Rate and Right-to-Work Laws

	(1)
Law	-1.71
	(0.62)
Controls	Yes
Obs	1428

Notes: Law is an indicator function taking value one when the state adopts right-to-work law and zero elsewhere. Controls include state and year fixed effects, state-level manufacturing industry employment shares, and population. Standard errors clustered by states are in parentheses.

$\mathbf{X}_{st}$ is a matrix of controls including state and year fixed effects, the employment shares of the manufacturing industry in state s at time $t-1$ and the population in state s at time $t-1$. I cluster standard errors at the state level. Following the recent developments in the literature on two-way fixed effect regressions with staggered treatment (de Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Sun and Abraham, 2021), I used the estimator proposed by de Chaisemartin and d'Haultfoeuille (2020) to adjust for dynamic and heterogeneous treatment effects.

Table 2 shows the result of the reduced form analysis: the introduction of the right-to-work legislation leads to a decrease in the labor force participation rate. Specifically, the approval of the right-to-work law decreases the labor force participation rate in that state by 1.71 percentage points. Using the introduction of the right-to-work law as a proxy for a decline in worker bargaining power, this result can be interpreted as a reduction in the labor force participation rate following an erosion of worker bargaining power.

Instrument and Shift-Share Approach

To provide further support in favor of the hypothesis and to confirm the mechanism, I use the introduction of the right-to-work legislation as an instrument for bargaining power. As explained in Section 2, the law is part of the Taft-Harley Act and aims to reduce worker power. However, the time series for worker bargaining power (Figure 3) is only available at the country level, whereas the legislation was introduced at the state level. For this reason, I construct state-level indicators of worker bargaining power in two steps.

First, I use the method developed in Mengano (2023) to estimate a time series of worker bargaining power at the 2-digit sector level. As described in the original paper, the method consists in first deriving an equilibrium wage equation of the form

$$w_{fit} = \tau_{it}\text{MPN}_{fit} + \Omega_{fit} \tag{2}$$

where w_{fst} is the equilibrium wage that firm f in industry i at time t pays, MPN is its marginal productivity of labor, and Ω_{fit} includes worker outside option as well as labor market conditions.[3] Then I estimate MPN $= \frac{\partial Y}{\partial L}\frac{L}{Y}$ at the firm level using the control function method originally proposed in Olley and Pakes (1996). I assume that each firm produces output Y with a value-added Cobb-Douglas production function, and I estimate output elasticities at the 2-digit sector level on a 7-year rolling basis. Finally, I estimate Equation 2 instrumenting current marginal productivity with its lagged realization at the firm level and including 4-digit sector-specific fixed effect interacted with periods to control for Ω_{fit}.[4]

Second, I adopt a shift-share approach to construct state-level indicators of worker bargaining power following a recent strand of the literature (Autor et al., 2013; Acemoglu and Restrepo, 2020). I use the predetermined employment shares of the 2-digit sectors to combine industry-level time series at the state level. Specifically, I construct state-level worker bargaining power as:

$$\tau_{st} = \sum_{i \in \mathcal{I}} l_{si}\tau_{it} \tag{3}$$

where l_{si} indicates the predetermined employment share in state s and industry i.[5] τ_{it} represents the 2-digit level worker bargaining power and τ_{st} is the resulting state-level indicator of worker bargaining power.

Armed with state-level indicators, I estimate the effect of changes in worker bargaining power on the labor force participation rate using the introduction of the right-to-work law as an instrument. I use the following empirical specification

$$\text{LFP}_{st} = \alpha_0 + \alpha_1\tau_{st} + \boldsymbol{\alpha}_2\mathbf{X}_{st} + \eta_{st} \tag{4}$$

with LFP_{st} being the labor force participation in state s at time t and τ_{st} the indicator of worker bargaining power in state s at time t defined in Equation 3. $\mathbf{X}_{st}$ is a matrix of controls including state and year fixed effects, the employment shares of the manufacturing industry in state s at time $t-1$ and the population in state s at time $t-1$. I cluster standard errors at the state level.

Table 3 shows the estimation results. The first column includes the OLS estimated coefficient of the regression of labor force participation rate on worker bargaining power. The regression predicts a positive relationship with an increase of 0.17 percentage points for each unit increase

[3] I derive this equation in the context of the model used in this paper in Section 4 and explain each term in detail.

[4] The detailed description of the method can be found in the original paper (Mengano, 2023).

[5] I use the employment share in each state in 1986 as the baseline, which is the first year available on the CBP Datasets online.

Table 3: Participation Rate and Bargaining Power

	(1) OLS	(2) IV	(3) 1st
Tau	0.17	0.28	
	(0.02)	(0.04)	
Law			-6.28
			(1.10)
Controls	Yes	Yes	Yes
Obs	1428	1428	1428
F-Stat	82	185	33

Notes: Tau is an indicator of worker bargaining power at the state level constructed using the method developed in Mengano (2023) and a shift-share approach. Law is an indicator function taking value 1 when the state adopts right-to-work law and 0 elsewhere. Controls include state and year fixed effects, state-level manufacturing industry employment share, and population. The first column shows the OLS coefficient from equation 4. The second column shows the coefficient of the same equation instrumenting worker bargaining power with the introduction of the right-to-work law. The third column shows the first stage of the IV regression. Standard errors clustered by states are in parentheses.

in worker bargaining power. The second column shows the estimation output using the introduction of the right-to-work law as an instrument. It confirms a positive link between worker bargaining power and the participation rate. Specifically, for an increase of one percentage point in worker bargaining power, the labor force participation rate increases by 0.28 percentage points. This result confirms that worker bargaining power is a crucial determinant of the labor force and sheds light on the mechanism behind its evolution over the last decades. That is in line with the message in Figure 1, establishes a causal relation, and serves as a justification for the analysis in the next Section. The third column shows the result from the first stage, namely a significant decrease in worker bargaining power following the introduction of the right-to-work law. This is the first direct evidence of the effect of such legislation on worker bargaining power and confirms that the law served its purpose de facto worsening workers' negotiating position.

4 A DMP Model with Participation Choice

I build a model with random search friction in the labor market and an endogenous participation choice to rationalize the findings in section 3 and to study the implications for the total economy. In this model, there is a continuum of risk-neutral firms and workers. Firms need labor to operate, thus posting vacancies to hire workers to start producing in the following period. On the other hand, workers are either employed, unemployed, or out of the labor force. Participation decisions are made based on expected wages. Once a match is formed between a vacancy and a worker, employers and employees negotiate wages according to the Nash bargaining protocol. A matching technology governs the probability of finding a job, and jobs are destroyed at an exogenous rate. Time is discrete.

4.1 Firm

Firms produce a homogeneous good with a linear technology and share the same productivity. Each firm produces z units of final goods with a worker. Firms post vacancies to hire on the labor market at a fixed cost $\kappa > 0$ for every period the vacancy is open. Using the prime notation to denote future variables, the values of an open vacancy and an unfilled one can be represented as:

$$V = \max\left\{0, \beta\mathbb{E}[q(\theta)J' + (1 - q(\theta))V'] - \kappa\right\} \tag{5}$$

$$J = z - w + \beta\mathbb{E}\left[sV' + (1 - s)J'\right] \tag{6}$$

The value of an open vacancy, V, is the difference between the expectation of filling the vacancy and the cost of opening it and is bounded to be nonnegative. $q(\theta)$ represents the probability that a vacancy finds an applicant, and β is the discount factor. On the other hand, the value of a filled vacancy, J, is the sum of current profits – the difference between the quantity of final output produced and the wage paid – and the continuation value. s denotes the exogenous probability that a job gets destroyed.

From equation 5, it is straightforward to see that firms continue posting vacancies as long as there are positive profits to capture. Hence, in equilibrium, this leads to the zero-profit condition in which the marginal cost is equal to the marginal value of a new vacancy:

$$\kappa = \beta q(\theta)\mathbb{E}\left[J'\right] \tag{7}$$

4.2 Workers

Workers choose to participate in the labor force; if they participate, they can be either employed (E) or unemployed (U). They are out of the labor force (O) if they do not participate. The respective Bellman values are:

$$\begin{aligned} W &= w + \beta\mathbb{E}\left[(1 - s)W' + s\max\{U', O'\}\right] \\ U &= b + \beta\mathbb{E}\left[p(\theta)W' + (1 - p(\theta))\max\{U', O'\}\right] \\ O &= a + \beta\mathbb{E}\left[\max\{U', O'\}\right] \end{aligned}$$

The value of being employed, M, is the sum of the current wage and the continuation value subject to the probability of the job being destroyed. Similarly, the value of being unemployed,

U, is the sum of the unemployment benefits, b, and the continuation value where the unemployed internalizes the probability of finding a job, $p(\theta)$. If unemployed workers do not find a job, they choose between staying in the labor force or exiting. Finally, O is the value of being out of the labor force, and the current payoff is the worker-specific utility of being out of the labor force, a. Each worker is endowed with a constant a that they draw from a time-invariant distribution $G(a)$.

Aggregate unemployment, u, evolves according to the following law of motion:

$$u' = (1 - p(\theta))u + se \tag{8}$$

with e being aggregate employment.

4.3 Matching Function

A matching function, $M(v, u)$, governs the labor market dynamics and determines the number of new matches given the current vacancies and unemployed. This function is increasing in both arguments and exhibits constant returns to scale. A key indicator that describes the labor market conditions is the tightness ratio, i.e., the ratio of vacancies over unemployment, $\theta = \frac{v}{u}$. That helps us define the probabilities at which vacancies meet workers, the job filling probability, $q(\theta) = \frac{M(v,u)}{v} = M\left(1, \frac{1}{\theta}\right)$, and workers find vacancies, the job finding probability, $p(\theta) = M\left(\frac{v}{u}, 1\right) = M(\theta, 1) = \theta q(\theta)$. The job-finding and job-filling probabilities, as well as the tightness ratio, are taken as given by agents.

4.4 Wages

Once a firm and an unemployed worker meet, a match is formed, and they negotiate the wage according to the Nash bargaining protocol. This envisages that the surplus generated by a match is divided among the parties according to their relative bargaining power. More specifically, wages are determined as follows:

$$w = \arg\max_{w} \underbrace{(W - U)^{\tau}}_{\text{Worker Surplus}} \times \underbrace{J^{1-\tau}}_{\text{Firm Surplus}} \tag{9}$$

with the two terms representing the worker' and firm's surplus from the match. τ is the worker bargaining power and (1-τ) is the firm bargaining power.

Substituting in the Bellman values and the non-profit condition from equation 7, in equilibrium, wages can be expressed as:

$$w = \tau z + (1 - \tau)b + \tau\theta\kappa \tag{10}$$

This formulation is the traditional wage equation in this class of models highlighting that wages are the weighted sum of three different components, 1) firm productivity, z; 2) worker outside option, b; and 3) labor market conditions, $\theta\kappa$. Moreover, the weights are τ and $(1 - \tau)$, the bargaining power of workers and firms, respectively. This equation is the counterpart in the model of Equation 2 used to estimate worker bargaining power. In this model, all firms share the same productivity so $MPN = z$ and the controls, Ω, include worker outside option, b, and labor market conditions, $\theta\kappa$.

4.5 Steady State Equilibrium

An steady state equilibrium is a collection of wages, w, tightness ratio, θ, unemployment rate, u, and out of the labor force rate, o, such that the following conditions are satisfied:

1. the zero profit condition (equation 7);
2. the wage equation (equation 10);
3. the law of motion of unemployment (equation 8);
4. the labor market clears: $1 = e + u + o$.

The three terms in the labor market cleaning conditions are employment, e, unemployment, u, and the share of the population out of the labor force, o. The latter is the result of the choice of workers to participate in the labor market. Such a choice is taken after drawing a, i.e., the worker-specific value of being out of the labor force. Workers will enter the market as long as the utility of participating is larger than the utility of being out of the labor market. This means that there exists a cutoff such that in equilibrium, the value of being unemployed and the value of being out of the labor force are the same for the marginal worker:

$$a^* : U^{SS} = O^{SS} \tag{11}$$

Such a cutoff can be expressed as:

$$a^* = (1 - \beta)\Gamma(\theta^{SS}) \left[b + \frac{\beta p(\theta^{SS})}{1 - \beta(1 - s)} w^{SS} \right] \tag{12}$$

with $\Gamma(\theta^{SS}) = \left[\frac{1-\beta(1-s)-\beta^2 p(\theta)s-\beta(1-p(\theta))[1-\beta(1-s)]}{1-\beta(1-s)} \right]^{-1}$.

Table 4: External Calibration

Parameter	*Value*	*Source*
Productivity (z)	1	*normalization*
Discount factor (β)	0.997	*4% annual interest rate*
Bargaining power (τ)	0.34	*estimated value in the 80s*
Outside option (b)	0.4	*Shimer (2005)*
Separation rate (s)	0.036	*2001q1 - 2019q4, JOLTS*
Matching elasticity (α)	0.22	*Lange and Papageorgiou (2020)*
Vacancy cost (κ)	1	*normalization*

Notes: These are the externally calibrated parameters and their sources. See text for more details.

5 Quantitative Analysis

I now use the model described in Section 4 to provide a quantitative assessment of the effect of changes in worker bargaining power on the economy. The aim is primarily to understand the effect of such changes on the evolution of the labor force participation rate (Figure 1) after establishing the causal link in Section 3. To do so, I calibrate the model in steady state to the period with the highest bargaining power, the 80s, and then switch it to the lowest value, the 2010s, and analyze the new steady state. Keeping everything else constant, the comparison of steady-state equilibria allows us to investigate and precisely pin down the aggregate effects on the economy of changes in worker bargaining power.

Table 4 shows the parameters I calibrate externally. The time period in the model is set to be monthly, and I choose the discount factor, β, to have a 4% annual interest rate. The value of the bargaining power in the 80s is described in Section 3 and taken from Mengano (2023). The outside option is 0.4 as in Shimer (2005) while the separation rate is the monthly average on the available data in JOLTS. Finally, I take the matching elasticity from Lange and Papageorgiou (2020) and set the vacancy cost to 1.

This leaves the efficiency of the matching function, A^z, and the distribution of the utility value of being out of the labor force, $G(a)$, free. The latter, especially, is unobservable, and I set it to be an exponential distribution with a free rate parameter. The rationale for using this distribution is twofold. First, it takes only positive values, which is consistent with the rest of the model, given that each agent earns a positive current utility and continuation value if unemployed or employed. Second, disciplining the exponential distribution requires a single parameter – the rate parameter –, and I can calibrate it internally. Indeed, I calibrate the efficiency of the marching function to match the unemployment rate and the rate parameter to match the labor force in the 80s. Table 5 shows the moments matched and the corresponding values. I provide robustness using alternative distributional assumptions in Appendix B.

Table 5: Internal Calibration

Moment	Data	Model	Parameter	Value
Unemployment	7.3%	7.3%	Matching Efficiency	19%
Labor Force	64.8%	64.8%	Rate Parameter	1.15

Notes: The matching efficiency regulates the number of matches that are formed in each period for a given number of vacancies and unemployed workers. The rate parameter defines the shape of the distribution of the utility of being out of the labor force. Both parameters are internally calibrated and the table shows the moments matched and the resulting values.

Table 6 below shows the comparison of two steady states. The first one is constructed by calibrating the economy to the 80s, and the second is a theoretical counterfactual constructed by exogenously changing the value of worker bargaining power to the one estimated for the 2010s. This exercise aims to show the importance of bargaining power for the evolution of the economy. The patterns depicted align with the empirical trends in the labor force, unemployment, and labor share. Specifically, the counterfactual predicts i) a decrease in the labor force from 64.8 in the 1980s to 63.5 in the 2010s, ii) a decline in unemployment from 7.3 in the 1980s to 6.7 in the 2010s, and iii) a 5% reduction in the labor force. As shown in the last column of Table 6, the amount of changes predicted just by erosion of worker bargaining power vis-à-vis the observed changes is 87%, 60%, and 56%, respectively. Hence, while the empirical analysis in Section 3 finds that worker bargaining power is a crucial determinant of the labor force participation rate, the quantitative analysis in this Section shows that changes in worker bargaining power account almost entirely for its evolution over the last 40 years.

Table 6: Steady State Comparison

	Model			Data			Effects of
	80s	10s	Δ	80s	10s	Δ	Δs in WBP
Labor Force	64.8	63.5	-1.3	64.8	63.3	-1.5	87%
Unemployment	7.3	6.7	-0.6	7.3	6.3	-1.0	60%
Labor Share	1	0.95	-0.05	1	0.91	-0.09	56%
WBP	0.34	0.15	-0.19				
Cutoff	0.91	0.87	-0.04				

Notes: This table shows the steady state values of the economy in the 80s and the 2010s. The first column displays labor force, cutoff, unemployment, and labor share from the calibrated model to the economy in the 80s. The second column is the value from the theoretical counterfactual constructed by changing the value of worker bargaining power (WBP) to the estimated one in the 2010s. The third column shows the predicted changes. Columns four, five, and six show the empirical counterparts. The last column quantifies how much of the observed changes in the labor force, unemployment, and labor share are accounted for just by changes in worker bargaining power.

6 Conclusions

This paper proposes a novel driver for the evolution of the labor force participation rate over the last sixty years in the United States, worker bargaining power. The latter has followed a similar pattern, suggesting a strong relationship between the two trends. Leveraging the introduction of legislation aimed to limit unions' power, I find that it reduced the labor force. I use a novel method to construct regional indicators of worker bargaining power, which represents the ability of workers to capture the job surplus they generate in their compensation. I provide the first evidence of the direct negative impact of the introduction of right-to-work laws on worker bargaining power, which leads to a decline of more than six percentage points. Then, I use the law as an instrument and identify the causal link between worker bargaining power and labor force participation rate. Although several structural factors have been proposed to explain the hump-shaped evolution of the labor force, including trade, technology, and changes in institutions and norms, this paper provides empirical evidence on a new driver. Finally, I rationalize the finding in a model with endogenous labor supply. In a quantitative exercise, I show that this factor alone is responsible for most of the changes in the labor force.

Recent research identifies the labor force as a driving force of firm dynamics, market concentration, and growth (Hopenhayn et al., 2022; Peters and Walsh, 2021). In this paper, the model is purposely kept simple to focus on the precise mechanism. In future research, it would be interesting to provide a unified framework to understand how changes in worker bargaining power also affect firm dynamics through the labor force and to characterize the optimal policies to maximize total welfare.

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A Additional Tables and Figures

Table A.1: Summary Statistics: Manufacturing, 1960 - 2019

Variable	Mean
Revenues	3,849
Capital	1,259
Employees	21
Wages	35
Observations	13,794

Notes: Manufacturing firms in Compustat reporting information on their labor costs. Revenues and Capital are expressed in USD millions with base year 2012. Number of Employees and Wages in thousands of workers and USD with base year 2012, respectively. Wages are defined at the firm-level as labor cost divided by the number of employees.

B Quantitative Analysis with Alternative Distributions

In this appendix, I replicate the quantitative analysis in Section 5 with alternative distributions: Pareto and normal.

B.1 Pareto Distribution

I choose $G(a)$ to be a Pareto distribution with location parameter l and shape parameter γ. I set $l = 0.1$ and calibrate the shape parameter internally. Table B1 shows the results of the internal calibration

I replicate the analysis in Section 5 and Table B2 shows the steady state comparison.

B.2 Normal Distribution

I choose $G(a)$ to be a normal distribution with mean μ and variance σ. I set $\mu = 0$ and calibrate the variance internally. Table B3 shows the results of the internal calibration

Table B1: Internal Calibration with Pareto Distribution

Moment	Data	Model	Parameter	Value
Unemployment	7.3%	7.3%	Matching Efficiency	19%
Labor Force	64.8%	64.8%	Shape Parameter	0.48

Notes: The matching efficiency regulates the number of matches that are formed in each period for a given number of vacancies and unemployed workers. The rate parameters defines the shape of the distribution of the utility of being out of the labor force. Both parameters are internally calibrated and the table shows the moments matched and the resulting values.

Table B2: Steady State Comparison

	Model			Data			Effects of
	80s	10s	Δ	80s	10s	Δ	Δs in WBP
Labor Force	64.8	63.8	-1.0	64.8	63.3	-1.5	67%
Cutoff	0.91	0.86	-0.05				
Unemployment	7.3	6.6	-0.7	7.3	6.3	-1.0	70%
Labor Share	1	0.93	-0.07	1	0.91	-0.09	78%

Notes: This table shows the steady state values of the economy in the 80s and the 2010s. The first column displays labor force, cutoff, unemployment, and labor share from the calibrated model to the economy in the 80s. The second column is the value from the theoretical counterfactual constructed by changing the value of worker bargaining power (WBP) to the estimated one in the 2010s. The third column shows the predicted changes. Columns four, five, and six show the empirical counterparts. The last column quantifies how much of the observed changes in the labor force, unemployment, and labor share are accounted for just by changes in worker bargaining power.

Table B3: Internal Calibration with Normal Distribution

Moment	Data	Model	Parameter	Value
Unemployment	7.3%	7.3%	Matching Efficiency	19%
Labor Force	64.8%	64.8%	Variance	2.27

Notes: The matching efficiency regulates the number of matches that are formed in each period for a given number of vacancies and unemployed workers. The rate parameters defines the shape of the distribution of the utility of being out of the labor force. Both parameters are internally calibrated and the table shows the moments matched and the resulting values.

I replicate the analysis in Section 5 and Table B4 shows the steady state comparison.

Table B4: Steady State Comparison

	Model			Data			Effects of
	80s	10s	Δ	80s	10s	Δ	Δs in WBP
Labor Force	64.8	64.0	-8.0	64.8	63.3	-1.5	53%
Cutoff	0.91	0.86	-0.05				
Unemployment	7.3	6.6	-0.7	7.3	6.3	-1.0	70%
Labor Share	1	0.93	-0.07	1	0.91	-0.09	78%

Notes: This table shows the steady state values of the economy in the 80s and the 2010s. The first column displays labor force, cutoff, unemployment, and labor share from the calibrated model to the economy in the 80s. The second column is the value from the theoretical counterfactual constructed by changing the value of worker bargaining power (WBP) to the estimated one in the 2010s. The third column shows the predicted changes. Columns four, five, and six show the empirical counterparts. The last column quantifies how much of the observed changes in the labor force, unemployment, and labor share are accounted for just by changes in worker bargaining power.