Real Origins of the Great Depression: Monopoly Power, Unions and the American Business Cycle in the Interwar Period

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Abstract

Most treatments of the Great Depression have focused on its onset and its aftermath. In contrast, we look at a broader timespan, including the 1919-21 recession and the roaring 1920s boom, as well as the onset of the Great Depression until 1931, and attempt to explain these phenomena in a unified framework. The model combines monopolistic product market competition with search frictions and bargaining in the labor market, allowing for both individual and collective wage bargaining. We attribute the extraordinary macroeconomic and financial volatility of this period to two factors: Shifts in the wage bargaining regime and in the degree of monopoly power in the economy. We identify three shifts in the legal environment for labor unions, coinciding with business cycle and stock market turning points in 1914/19, 1921 and 1929. A shift from individual to collective bargaining presents as a recession, involving a decline in output, increases in unemployment and real wages, and a decrease in asset values. We also detail the process by which landmark court decisions in favor of trade unions in the late 1920s, ensuing legislative efforts, and political pressure on firms to adopt the welfare capitalism model of high wages combined to improve the ability of workers to bargaining collectively beginning in 1929.

Keywords: monopoly power, collective bargaining, individual bargaining, Great Depression

JEL Codes: E24, E32, J51, N12, N22

1 Introduction

The period between World War I and the New Deal was one of unprecedented macroeconomic instability. This short time span was punctuated by a severe recession and asset price crash in the early 1920s, the ensuing roaring 20s stock market boom and economic expansion, and the onset of the Great Depression in 1929. As Christina Romer put it: "There is simply no denying that all hell broke loose in the American economy between 1920 and 1940." Romer (1999) reports that volatility in her measures of GNP and output was more than twice as high as in the pre-war period, and about three times greater than in the post-war economy. She attributes this not only to the Great Depression, but also to "extreme movements in the early 1920s...".

Most treatments of this period focus only on the Great Depression of 1929-1933, or the slow recovery beginning in 1934. We take the view that the extreme business cycle and asset price movements of the entire interwar period should be examined together, with potentially similar driving forces in action throughout the entire time span. Accordingly, we set ourselves the more ambitious objective of accounting for not only the onset of the Great Depression, but also the severe recession of the early 1920s and the roaring 1920s expansion. We are able to achieve this objective by linking the extreme macroeconomic and asset market movements of the interwar period to two factors: monopoly power in goods markets and collective bargaining over wages.

1.1 History

We identify three major shifts in the ability of workers to bargain collectively, occurring in 1914, 1921 and 1929. Our main historical contribution is to document the process by which collective bargaining became re-legalized in the late 1920s. In particular, we show that the legal environment improved substantially during the summer and fall of 1929. We also present evidence suggesting that monopoly power increased during the 1920s due to the laissez-faire policies of the Coolidge administration.

Until 1914, the threat point of collectively bargaining workers was very weak. Under the Sherman Act, labor unions were 'illegal combinations in restraint of trade,' and as such, firms could easily obtain injunctions against striking workers. This implied that striking workers were unable to shut down firms, as their picket lines or blockades of firms would be - often violently - cleared by police or indeed the National Guard.[1] Clearly, workers who cannot credibly threaten to shut down firms are also unable to garner a share of profits (monopoly rents). Section 6 of the Clayton Act, enacted in October 1914, exempted labor unions from anti-trust law, legalizing tactics such as striking, picketing and blockading firms.[2] The effects of the Clayton Act on labor markets were, however, delayed

[1] For an overview of the role of labor injunctions see Brissenden (1933).

[2] The text of Section 6 of the Clayton Act famously states: "The labor of a human being is not a commodity or article of commerce. Nothing contained in the antitrust laws shall be construed to forbid the existence and operation of labor, agricultural, or horticultural organi-

until the end of World War I, due to the restrictions of the War Labor Board. Beginning in 1919, strike activity increases markedly. In 1919, more than 4 million workers were involved in a strike at some time during the year (see Table 1a). At the same time, the economy plunged into a severe recession in which output dropped to 87.6% of its trend value, unemployment rose to 16.7% and the Dow Jones dropped to around 60% of its trend value. In our model, we will link this deep recession and asset price crash to an increase in the share of workers bargaining collectively.

This renaissance of organized labor was brought to an abrupt end, however, by a series of Supreme Court rulings in late 1921 and 1922 that declared the pro-union provisions of the Clayton Act unconstitutional. In December 1921, the Supreme Court issued two judgments, on the *Tri-City Trades* case[3] and *Truax vs. Corrigan*[4], which drastically weakened the threat point of labor unions. In particular, these Supreme Court judgments specifically prohibited picketing or any other action which would shut down the firm. Interestingly, the hearing of these cases in the first week of October 1921 coincides quite well with the beginning of the stock market recovery. The economy also began to recover very quickly, with output returning to trend by 1923. This quick recovery is explained in our model by the switch from collective to individual bargaining, consistent with the collective bargaining threat point no longer being enforceable.

The 1920s was a period of very lax anti-trust enforcement due to the laissez-faire policies of the Coolidge administration. As a result, a range of measures of monopoly power increased. Keller (1973) reports that product market concentration increased, especially in manufacturing, between 1923 and 1929. In addition, he and other sources concur that the labor share of income decreased and the capital share increased, consistent with an increase in the share of monopoly rents in the economy.

We identify a third major shift in labor policy beginning in 1929. We discuss the role of two intertwined events in that year which paved the way for the New Deal's pro-union legislation. The first was a landmark court case on the right of railway unions to organize, the *Texas and New Orleans* case[5], which the union side won in the 2nd Court of Appeals in the summer of 1929. The union had previously won in District Court in 1927. Given that the Supreme Court would almost never overturn a consensual ruling of the two previous courts, this meant that by June 1929 it was clear to both sides that a reversal of the anti-union stance of the Supreme Court was imminent.

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zations, instituted for the purposes of mutual help, and not having capital stock or conducted for profit, or to forbid or restrain individual members of such organizations from lawfully carrying out the legitimate objects therof; nor shall such organizations, or the members thereof, be held or construed to be illegal combinations or conspiracies in restraint of trade, under the antitrust laws."

[3] *American Steel Foundries vs. Tri-City Central Trades Council et. al.*, 257 U.S. 184 No. 2, reargued October 4-5, 1921 and decided December 5, 1921.

[4] *Truax vs. Corrigan*, 257 U.S. 312 No.13, reargued October 5-6, 1921, decided December 19, 1921.

[5] *Texas and New Orleans Railway Co. vs. Brotherhood of Railway and Steamship Clerks*, 281 U.S. 548.

Intertwined with this was a legislative development. Already in January 1929, lawmakers in Congress had sought to impose new limits on the use of labor injunctions against striking workers[6]. In light of the Supreme Court's 1921 rulings, the constitutional basis for this seemed slim at first. The proposal gained new momentum in the summer of 1929, after it had become discernible that the Supreme Court's stance was likely to change. A group of U.S. Senators obtained the support of the American Federation of Labor (AFL) for their proposal to limit labor injunctions in a meeting held in August 1929 in Atlantic City, and importantly, this was announced during a large AFL congress held in Toronto in mid-October 1929.

As a result of these two developments, the credibility of workers' collective bargaining threatpoint increased markedly. Any labor injunction was liable to be successfully challenged in court. In independent work, Ohanian (2007) reports that President Hoover met with groups of influential industrialists to encourage them to maintain high wages. We see this as a further manifestation of the new legal environment for labor unions: Hoover would hardly have been able to persuade leading industrialists to maintain high wages if he were not able to wield the 'big stick' of legal backing for collective bargaining.

1.2 Theory

In the model, we focus attention on the two frictions identified by the business cycle accounting approach of Chari, Kehoe and McGrattan (2002, 2007) and Cole and Ohanian (2002b): monopoly power in goods markets and collective bargaining in labor markets. In the business cycle accounting approach, frictions are modelled by means of 'wedges', by which the model economy deviates from the standard frictionless neoclassical growth baseline. The efficiency wedge, modelled as a decrease in TFP, could be loosely interpreted as representing monopoly power in goods markets. The labor wedge, modelled as a tax which drives a wedge between the marginal product of labor and the marginal rate of substitution between leisure and consumption, is shown by CKM to be equivalent to a model with labor unions and sticky wages, similar to Bordo, Erceg and Evans (2000).

In contrast to this stylized approach, we model the frictions in the goods and labor markets *explicitly*. Our model departs from the standard neoclassical model in two ways: First, labor markets are non-Walrasian, displaying Mortenson-Pissarides search frictions which underpin either individual or collective wage bargaining. Second, goods markets are monopolistically competitive, making use of the Dixit-Stiglitz framework. Firms aim to maximize profits, including monopoly rents, taking into account the impact of their choices on wage bargaining outcomes.[7]

[6] Recall that the labor injunction was key to destroying the credibility of the collective bargaining threat point. Conversely, limiting labor injunctions implied improving the credibility of the collective bargaining threat point.

[7] A very similar model has been used in Ebell and Haefke (2007) to study the diverging labor market experiences of continental Europe and the United States.

The key insight of our model is that *interactions* between the two frictions which drive the theoretical and quantitative results. In addition, the explicit modelling of goods and labor market frictions will allow us to account not only for the behavior of output and wages, but also for two key elements of the interwar business cycle not addressed by the business cycle accounting approach: stock market values and unemployment.

To understand how the two frictions operate and interact, begin by noting that the key difference between individual and collective bargaining is their *threat points*. Under individual bargaining, the worker's threat point is to leave the firm, depriving it of her marginal (revenue) product and imposing search costs to find a new worker. Collectively bargaining workers can, acting together, shut down the firm, depriving it of its profits. This implies that collectively bargaining workers are able to appropriate a share of firm's profits. Hence, when a firm switches from individual to collective bargaining, the firm's value decreases, because the profits (monopoly rents) which accrue to its owners have decreased.[8]

The behavior of stock market values when monopoly power increases is also determined by the bargaining setup. Firm values rise more strongly with monopoly power under individual bargaining than under collective bargaining, since under individual bargaining all increases in monopoly rents accrue to the firm's owners.

By first principles, an increase in monopoly power should also lead to a decline in output, as firms restrict output to maximize monopoly rents. The first key insight is that the *magnitude* of the decline in output - and rise in unemployment - will depend on the type of bargaining. Under individual bargaining, the decline in output and employment turns out to be very small, as does the rise in unemployment. The reason is an overhiring externality, first identified by Stole and Zwiebel (1996). Since surplus is a function of declining marginal revenue product (MRP), firms have an incentive to depress bargained wages by hiring additional workers. As a result, the wedge between the wage and the worker's marginal product of labor is reduced by a factor that is increasing both in worker's bargaining power and in the measure of monopoly power, bringing the employment level closer to its frictionless level.

Under collective bargaining, however, the decline in output - and the increase in unemployment - turn out to be much greater in magnitude. The reason lies again in the interaction between wage bargaining and monopoly power. Collectively bargaining workers get a share of monopoly rents, so that their incentives to restrict output to maximize rents are well-aligned with those of firms. As monopoly power increases, output declines more strongly than under individual bargaining, as do vacancies, leading to a larger drop in labor market tightness and a larger increase in unemployment.

Our model gives us a rich set of implications of shifts in bargaining regime and monopoly power. Uniquely, we are able to account for the fact that the

[8] That collectively bargaining workers are able to appropriate a share of monopoly rents has found broad empirical support from Van Reenen (1996) and many others.

1920s expansion involved output growth at about trend, while stock market values increased (much) more than proportionately. A standard neoclassical model without explicit frictions cannot account for such behavior, since asset prices and output are both driven by TFP, making them move roughly proportionately to one another. In our setting, an increase in monopoly power increases monopoly rents and firm values sharply, but under individual bargaining, output and unemployment remain approximately at trend. That an increase in profits could be behind the high stock market valuations of the late 1920s is also supported by evidence presented in McGrattan and Prescott (2004) that corporate profits as a share of GNP were high by historical standards in the late 1920s. In addition, the increase in monopoly power under individual bargaining induces a decrease in wages in our model. This is consistent with the fall in the empirical labor share reported in Keller (1973) and the countercyclical behavior of wages during the interwar period documented by Hanes (1996).

At the same time, our model is able to account for a large part of the two asset market crashes, with troughs in 1921 and 1933. In our model, the crashes are attributed to increases in the share of workers bargaining collectively, as the legal environment for unions changed. As far as we are aware, our model's ability to generate both stock market booms and busts of large magnitudes is unique among models that rely neither on irrationality nor on risk aversion (agents in our model are risk neutral).

In addition, we are able to account for the puzzling increase in real wages during the Great Depression.[9] The model is able to reconcile high wages despite high unemployment, because any offers by unemployed workers standing outside the factory gates to work for lower wages are time inconsistent. The moment these workers are hired, they become insiders, and find it optimal to exercise their collective bargaining threat point in order to increase their wages.

Our work is most closely related to Cole and Ohanian (2004) and Ohanian (2007). Cole and Ohanian (2004) attribute the slow recovery from the Great Depression to New Deal policies involving monopoly power and collective bargaining, while Ohanian (2007) attributes the onset of the Great Depression to Hoover's high wage policies. Our historical evidence on the improved legal environment for collective bargaining lends credence to Hoover's attempts to prop up wages. Also related are a series of papers using the Business Cycle Accounting approach of Chari, Kehoe and McGrattan (2007), which attribute the Great Depression to labor and/or efficiency wedges. These include Chari, Kehoe and McGrattan (2002) and Cole and Ohanian (2002b) for the United States, Cole and Ohanian (2002a) for the United Kingdom, Hornstein (2002) for Germany and Beaudry and Portiers (2002) for France.

Some authors have also previously related the run-up in stock prices during the 1920s to high levels of profits, in particular McGrattan and Prescott (2004) and Bittlingmayer (1992). Bittlingmayer (1992) also attempts to link the crash of 1929 to threats of tighter antitrust enforcement. Although tighter antitrust

[9] Cole and Ohanian (2004) provides a very similar explanation for high real wages during the slow recovery from the Great Depression. In Bordo, Erceg and Evans (2000), high real wages during the Great Depression are due to nominal wage rigidities.

enforcement could have led to lower profit expectations and contributed to a fall in asset values, it should also have led to an *expansion* in output, not a severe contraction.

Finally, our work is also loosely related to the literature attributing the Great Depression to nominal wage rigidities, most notably Bordo, Erceg and Evans (2000), Bernanke and Carey (1996) or Christiano, Motto and Rostagno (2003). The crucial assumption in this literature is that nominal wages were highly unresponsive to labor demand changes. Prima facie it is not obvious how this could have been optimal for firms, especially in light of the masses of unemployed workers. Our contribution in this context is to specify a mechanism by which any offers by workers standing outside the factory gate to work for lower wages would be time inconsistent. As soon as those same workers would be hired, they would have the same incentives as any other insiders to exploit their threat point to shut down the firm and press for higher wages. Hanes (2000) provides empirical evidence in support of our mechanism. He regresses the number of months it took for firms to lower wages after the 1929 peak on a variety of sectoral characteristics. He estimates a large and positive coefficient on the concentration index, a measure of monopoly power. This suggests that firms with greater monopoly power offered higher real wages during the deflation at the onset of the Great Depression, consistent with our model.

The remainder of the paper is structured as follows: Section 2 presents the model, while section 3 gives the historical evidence on the shifts in the legal environment for collective bargaining and in monopoly power. In section 4, we simulate the model for 3 scenarios on changes in the share of workers bargaining collectively. Section 5 concludes.

2 Model

In order to address the interplay between monopoly power and organized labor theoretically, two model elements are crucial. First, the goods market must allow for monopolistic competition. Second, there must be wage bargaining, allowing for two bargaining regimes: collective bargaining (organized labor) and individual bargaining. We also assume that the labor market is subject to Mortensen-Pissarides search frictions, in order to generate equilibrium unemployment. These model elements are integrated into as parsimonious a model setup as possible, in which agents are risk neutral, labor supply is inelastic and there is no capital. For technical reasons, we assume that any change in bargaining regime is unexpected.

2.1 Households

2.1.1 Labor Search

Wage bargaining is underpinned by Mortensen-Pissarides search frictions in the labor market, which create rents. The labor market is segmented. Workers

choose to search either among individually or collectively bargaining firms, indexed by $k \in \{C, I\}$. In each segment of the labor market, unemployed workers U_k and vacancies V_k are transformed into job matches by a constant returns to scale matching function $m(U_k, V_k) = sU_k^{\eta} V_k^{1-\eta}$, where η is the elasticity of the matching function and s is a scaling factor. Job matches are separated at the exogenous rate χ. Defining labor market tightness as $\theta_k \equiv \frac{V_k}{U_k}$, the firm meets unemployed workers at the job-filling rate $q_k \equiv \frac{m(U_k,V_k)}{V_k} = s\theta_k^{1-\eta}$, while unemployed workers meet vacancies at the job-finding rate $f \equiv \frac{m(U_k,V_k)}{U_k} = s\theta_k^{1-\eta}$.

In the steady-state, the flows of workers into and out of unemployment must be equal, leading to a Beveridge curve relating equilibrium unemployment to tightness:

$$U_k = \frac{\chi}{\chi + f_k} \tag{1}$$

2.1.2 Values of employment and unemployment

There is a continuum of identical risk-neutral workers on the unit interval. Workers may be employed at firms with either individual or right-to-manage collective bargaining, indexed by $k \in \{C, I\}$. The value of employment V_k^E satisfies the Bellman equation:

$$V_k^E = w_k + \frac{1}{1+r}\left[\chi V_k^{U\prime} + (1-\chi) V_k^{E\prime}\right] \tag{2}$$

where χ is the total separation rate.

Search is directed, in the sense that unemployed workers choose to search either among firms engaged in collective or individual bargaining. The value of searching among firms of type k is:

$$V_k^U = b + \frac{1}{1+r}\left\{f(\theta_k) V_k^E + [1 - f(\theta_k)] V_k^U\right\}$$

In equilibrium, workers will be indifferent between searching in the two markets, so that $V_I^U = V_C^U = V^U$.

2.1.3 Households' optimization with monopolistic competition

Agents have standard Dixit-Stiglitz preferences over a continuum of differentiated goods. In order to focus on the dynamics of the labor market, there is no saving or capital. Goods demand is derived from the household's static optimization problem.

$$\max\left(\int c_{i,n}^{\frac{\sigma-1}{\sigma}} di\right) \tag{3}$$

subject to the budget constraint $I_j = \int c_{i,n} \frac{p_i}{P} di$ where I_j denotes the real income of household j and $c_{i,j}$ is household j's consumption of good i. Aggregate demand for good i results as:

$$Y_i^D \equiv \int c_{i,j} dj = \left(\frac{p_i}{P}\right)^{-\sigma} I \tag{4}$$

where $I \equiv \int I_j dj$ is aggregate real income and $P = \left(\int p_i^{1-\sigma}\right)^{\frac{1}{1-\sigma}}$ is the price index. Equation (4) is the standard monopolistic competition demand function with elasticity of substitution among differentiated goods given by $-\sigma$.[10]

2.2 Firms

There is a continuum of monopolistically competitive firms on the unit interval. Each firm faces demand elasticity $-\sigma$, in line with the Dixit-Stiglitz assumptions above. We adopt a multiple-worker firm framework, because monopolistic competition makes it imperative to abandon the one-worker firm assumption. To see this, recall that assuming one-worker firms is harmless under perfect competition and constant returns to scale [cf. Cahuc and Wasmer (2001)], since the number and size of firms is indeterminate. Under monopolistic competition, however, firm size and hence output are determined optimally in equilibrium, as a function of the elasticity of demand. Continuing to assume one-worker firms would be tantamount to imposing a restriction on the model which is generically inconsistent with optimal firm behavior.

To see this point more clearly, recall that from first principles, firms' optimal reaction to an increase in monopoly power is to restrict output. The only way to vary output with a given technology is to vary the amount of labor employed either on the extensive or the intensive margin.[11] We assume that firms adjust employment by varying the number of workers [extensive margin] rather than the number of hours per worker.

We consider two wage bargaining settings, individual bargaining and right-to-manage collective bargaining, again indexed by $k \in \{C, I\}$. Both have in common that bargaining is over wages only, so that the firm is free to optimize over employment and vacancies. Firms maximize the discounted value of future profits. Due to search frictions in the labor market, h_k, the number of workers currently employed at a firm with bargaining institution k, is a state variable. The firm's decision variable is the number of vacancies. Type k firms open as many vacancies v_k as necessary to hire in expectation the desired number of workers next period, while taking into account that the real cost to opening a vacancy is κ. The firm's problem becomes

$$V_k^J(h_k) = \max_{h_k', v_k} \left\{ \frac{p(y_k)}{P} y_k - w_k h_k - \kappa v_k + \frac{1}{1+r} V_k^J(h_k') \right\} \tag{5}$$

[10] Note that this setup is isomorphic to one in which agents have linear preferences over a single composite good C, which is produced from intermediate goods using the Dixit-Stiglitz aggregator. In this case, $-\sigma$ is the elasticity of substitution across intermediate goods in the production function of the final goods firm, and Y_i^D is the demand of the final goods firm for intermediate good i.

[11] In a model with capital, firms could also vary output by varying only the amount of capital employed. In order to maintain an optimal capital-labor ratio, however, firms would generally adjust by varying labor as well.

subject to

$$\text{demand function} \quad : \quad \frac{p(y_k)}{P} = \left(\frac{y_k}{I}\right)^{-\frac{1}{\sigma}} \tag{6}$$

$$\text{production function} \quad : \quad y_k = Ah_k \tag{7}$$

$$\text{transition function} \quad : \quad h'_k = (1-\chi)\, h_k + q(\theta)\, v_k \tag{8}$$

$$\text{wage curve} \quad : \quad w_k = w_k(h_k) \tag{9}$$

where the wage curve represents the outcome of the wage bargaining process. The first order condition is

$$\frac{\kappa}{q(\theta_k)} = \frac{1}{1+r}\frac{\partial V_k^J(h'_k)}{\partial h'_k} \tag{10}$$

By (10), the marginal value of an additional worker must equal the discounted cost of searching for him/her. The firm's envelope condition is

$$\frac{\partial V_k^J(h_k)}{\partial h_k} = \frac{\sigma-1}{\sigma}A\frac{p(y_k)}{P} - w_k - h_k\frac{\partial w_k}{\partial h_k} + \frac{1-\chi}{1+r}\frac{\partial V_k^J(h'_k)}{\partial h'_k} \tag{11}$$

Substituting (10) into (11) yields an Euler equation for the firm's optimal labor choice:

$$\frac{\kappa}{q(\theta_k)} = \frac{1}{1+r}\left[\frac{\sigma-1}{\sigma}A\frac{p(y'_k)}{P} - w'_k - h'_k\frac{\partial w'_k}{\partial h'_k} + (1-\chi)\frac{\kappa}{q(\theta'_k)}\right] \tag{12}$$

where primes indicate next period variables. At the optimum, the cost of hiring a worker $\frac{\kappa}{q(\theta_k)}$ ($\frac{1}{q(\theta_k)}$ vacancies must be posted at cost κ each) is equal to the discounted benefits to the firm of hiring that worker. These benefits are the worker's marginal revenue product (MRP) net of wages and the impact of expanded employment on the bargained wage of all workers $h'_k\frac{\partial w'_k}{\partial h'_k}$, plus an option value term $(1-\chi)\frac{\Phi_V}{q(\theta'_k)}$.

2.3 Wage Bargaining

In this subsection we describe both the individual and the right-to-manage collective wage bargaining.

2.3.1 Individual Bargaining

The key assumption of the Stole and Zwiebel (1996) individual bargaining framework used here is that firms engage in sequential pairwise negotiations with workers, so that each worker is treated as the marginal worker. Hence, the firm's outside option is not remaining idle, but rather producing with one worker less. Since we have assumed a continuum of agents, the firm's surplus

from the employment relationship is given by the marginal value of a worker to the firm $\frac{\partial V^{J_I}(h_I)}{\partial h_I}$.The individual worker's bargaining problem is:

$$\max_{w_I} \beta \ln V_I^W + (1-\beta) \ln \frac{\partial V_I^J(h_I)}{\partial h_I} \tag{13}$$

where β is the worker's bargaining power and V_I^W is worker's surplus. Worker's surplus is defined as $V_I^W \equiv V_I^E - V_I^U$ and can be obtained at steady-state from (2) as

$$V_I^W = \frac{(1+r)\, w_I - r V_I^U}{r+\chi} \tag{14}$$

Firm's surplus can be obtained from the envelope condition (11) at steady state:

$$\frac{\partial V_I^J(h_I)}{\partial h_I} = \frac{1+r}{r+\chi}\left(\frac{\sigma-1}{\sigma} A \frac{p(y_I)}{P} - w_I - h_I \frac{\partial w_I}{\partial h_I}\right) \tag{15}$$

The first order condition of (13) takes the form of a first-order linear differential equation in the wage

$$w_I(h_I) = (1-\beta)\frac{r V_I^U}{1+r} + \beta\left[\frac{\sigma-1}{\sigma} A \frac{p(y_I)}{P} - h_I \frac{\partial w_I}{\partial h_I}\right] \tag{16}$$

The differential equation (16) has a standard solution, which is derived in the appendix.

$$w_I(h_I) = (1-\beta)\frac{r V_I^U}{1+r} + \beta \frac{\sigma}{\sigma-\beta}\frac{\sigma-1}{\sigma}\frac{p(y_I)}{P} A \tag{17}$$

Equation (17) is the wage curve.[12] The wage curve illustrates the strategic interaction between monopoly power and individual wage bargaining. The wage curve is downward-sloping in h_I so that when an additional worker is hired, the firm's wage bill decreases by $h_I \frac{\partial w_I}{\partial h_I}$. From (16), one can see that each worker gets a share β of the wage savings to the firm from hiring him or her $h_I \frac{\partial w_I}{\partial h_I}$, plus a share β of her marginal revenue produce $\frac{\sigma-1}{\sigma} A \frac{p(y_i)}{P}$. Comparing (16) and (17), one can see that the term $\frac{\sigma}{\sigma-\beta} \geq 1$ represents the impact of wage savings.

Labor demand We can now obtain a closed form for the firm's optimal labor choice under individual bargaining by substituting the slope of (17) $h_I' \frac{\partial w_I}{\partial h_I'} = -\frac{\beta}{\sigma}\frac{\sigma-1}{\sigma-\beta} A \frac{p(y_I')}{P}$ into the firm's Euler equation (12) to obtain:

$$\frac{\kappa}{q(\theta_I)} = \frac{1}{1+r}\left[\frac{\sigma-1}{\sigma-\beta} A \frac{p(y_I')}{P} - w(h_I') + (1-\chi)\frac{\kappa}{q(\theta_I')}\right] \tag{18}$$

Equation (18) can be interpreted as a job creation or as a labor demand expression which relates the firm's wage $w_I(h_I)$ to its employment level h_I. The firm's

[12] It is straightforward to confirm that this steady-state bargaining solution is identical to that obtained in the fully dynamic individual problem in Ebell and Haefke (2009).

labor demand involves overhiring. As defined by Stole and Zwiebel (1996), firms engage in overhiring if they hire workers beyond the point at which employment costs (wages plus hiring costs) are covered by marginal revenue product. This can be seen by taking labor demand (18) at the steady state:

$$\underbrace{\frac{\sigma}{\sigma-\beta}}_{\text{overhiring term}} \underbrace{\frac{\sigma-1}{\sigma}A\frac{p(y_I)}{P}}_{\text{MRP}} = \underbrace{w(h_I) + \frac{\kappa}{q(\theta_I)}(r+\chi)}_{\text{employment costs}} \tag{19}$$

The overhiring term $\frac{\sigma}{\sigma-\beta} > 1$ gives the magnitude of the overhiring externality, as it describes the factor by which employment costs exceed MRP. The reason that firms are willing to hire such 'loss-making' workers is the fact that adding an additional worker lowers MRP and thereby reduces wages for *all* workers. Hence, hiring an additional worker imposes an externality on all other workers, which firms can exploit to depress wages. This again is a manifestation of the strategic interaction between monopoly power and individual wage bargaining.

Firm-level equilibrium The firm-level equilibrium employment h_I and bargained wage $w_I(h_I)$ pair are obtained at the intersection of labor demand (19) and the wage curve (17). The resulting bargained real wage is:

$$w_I = \frac{r}{1+r}V_I^U + \frac{\beta}{1-\beta}(r+\chi)\frac{\kappa}{q(\theta_I)} \tag{20}$$

while firm-level equilibrium employment is described for given aggregate variables (σ, θ_I) implicitly by

$$A\frac{p(y_I)}{P} = \frac{\sigma-\beta}{\sigma-1}\left[\frac{r}{1+r}V_I^U + \frac{1}{1-\beta}(r+\chi)\frac{\kappa}{q(\theta_I)}\right] \tag{21}$$

Finally, we can also compute the individually bargaining firm's optimal employment explicitly by combining (21) with the demand curve facing the firm (6):

$$h_I = A^{\sigma-1}I\left\{\frac{\sigma-\beta}{\sigma-1}\left[\frac{r}{1+r}V_I^U + \frac{1}{1-\beta}(r+\chi)\frac{\kappa}{q(\theta_I)}\right]\right\}^{-\sigma} \tag{22}$$

2.3.2 Right-to-Manage Collective Bargaining

Under collective bargaining, all workers employed by a given firm form a coalition. Members of the coalition agree to negotiate wages together with the firm. In the event of disagreement, the firm is dissolved, so that the firm's surplus is equal to its value. Formally, the Nash collective bargaining problem is:

$$\max_{w_C} \beta \ln\left(h_C V_C^W\right) + (1-\beta)\ln V_C^J(h_C) \tag{23}$$

From (5), the steady-state value of a collective bargaining firm with h_C workers is given by

$$\frac{r}{1+r}V_C^J(h_C) = \frac{p(y_C)}{P}y_C - w_C h_C - \chi\frac{\kappa}{q(\theta_C)}h_C \tag{24}$$

where we have used that steady state vacancies are $v_C = \frac{\chi h_C}{q(\theta_C)}$. The firm's value is simply the discounted stream of profits. The collective bargaining workers surplus is obtained by multiplying the number of workers at the firm h_C by the steady-state worker's surplus $V_C^W = \frac{(1+r)w_C - rV_C^U}{r+\chi}$. Taking the first order condition of (23) yields the wage curve under collective bargaining.

$$w_C - \frac{rV_C^U}{1+r} = \frac{\beta}{1-\beta}\left(A\frac{p\left(y_C\right)}{P} - w_C - \chi\frac{\kappa}{q\left(\theta_C\right)}\right) \tag{25}$$

Under right-to-manage collective bargaining, each worker's surplus is a share $\frac{\beta}{1-\beta}$ of profits per worker.

Labor demand We can now obtain a closed form for the collective bargaining firm's optimal labor choice by substituting the slope of (25) $h'_C \frac{\partial w_C}{\partial h'_C} = -\frac{\beta}{\sigma} A \frac{p\left(y'_C\right)}{p}$ into the firm's Euler equation (12) to obtain:

$$\frac{\kappa}{q\left(\theta_C\right)} = \frac{1}{1+r}\left[\frac{\sigma-(1-\beta)}{\sigma}A\frac{p\left(y'_C\right)}{p} - w'_C + (1-\chi)\frac{\kappa}{q\left(\theta'_C\right)}\right] \tag{26}$$

In the steady state, labor demand (26) reduces to:

$$w_C = \frac{\sigma-(1-\beta)}{\sigma}A\frac{p\left(y_C\right)}{p} - (r+\chi)\frac{\kappa}{q\left(\theta_C\right)} \tag{27}$$

Firm-level equilibrium Under right-to-manage collective bargaining, the steady state firm level equilibrium wage and employment are obtained at the intersection of steady labor demand (27) and the wage curve (25). The resulting bargained wage for given aggregate variables (σ, θ_C) is:

$$w_C = \left(1+\frac{\beta}{\sigma-1}\right)\frac{rV_C^U}{1+r} + \frac{\beta}{\sigma-1}\frac{\kappa}{q\left(\theta_C\right)}\left(\frac{r}{1-\beta}\sigma+\chi\right) \tag{28}$$

while the firm's employment level is described implicitly by:

$$A\frac{p\left(y_C\right)}{P} = \frac{\sigma}{\sigma-1}\left[\frac{rV_C^U}{1+r} + \frac{\kappa}{q\left(\theta_C\right)}\left(\frac{r}{1-\beta}+\chi\right)\right] \tag{29}$$

An explicit expression for firm employment can be found by combining (**??**) with the demand curve facing the firm (6):

$$h_C = A^{\sigma-1} I\left\{\frac{\sigma}{\sigma-1}\left[\frac{rV_C^U}{1+r} + \frac{\kappa}{q\left(\theta_C\right)}\left(\frac{r}{1-\beta}+\chi\right)\right]\right\}^{-\sigma}$$

2.3.3 Reservation Value of Unemployment

Now it remains to determine the reservation values of unemployment in the IB and CB labor markets. To do this, we use (2), along with the equilibrium wages (20) and (28) to obtain:

$$\frac{rV_I^U}{1+r} = b + \frac{\beta}{1-\beta}\kappa\theta_I \tag{30}$$

$$\frac{rV_C^U}{1+r} = \frac{r+\chi}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}}b + \frac{f(\theta_C)\frac{\beta}{\sigma-1}}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}}\frac{\kappa}{q(\theta_C)}\left(\frac{r}{1-\beta}\sigma+\chi\right) \tag{31}$$

Since workers may choose to search in either sector, the value to searching in the two sectors must be equalized in equilibrium, so that $V_I^U = V_C^U = V^U$. This implies that labor market tightness in the two sectors are related as:

$$\frac{\beta}{1-\beta}\kappa\theta_I = \frac{f(\theta_C)\frac{\beta}{\sigma-1}}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}}\left[b+\frac{\kappa}{q(\theta_C)}\left(\frac{r}{1-\beta}\sigma+\chi\right)\right] \tag{32}$$

This no arbitrage condition implies that tightnesses in the two sectors are positively related. When tightness in one sector falls, tightness in the other sector must also fall. Via the Beveridge curve, this implies that unemployment in the two sectors are also positively related.

2.4 Equilibrium

The market clearing condition completes the characterization of the equilibrium:

$$I = (1-\mu)\frac{p(y_I)}{P}y_I + \mu\frac{p(y_C)}{P}y_C$$

Substituting in from (21), (22), (**??**) and (**??**) yields an equilibrium condition:

$$\begin{aligned} A^{1-\sigma} &= (1-\mu)\left\{\frac{\sigma-\beta}{\sigma-1}\left[\frac{rV_I^U}{1+r}+\frac{1}{1-\beta}(r+\chi)\frac{\kappa}{q(\theta_I)}\right]\right\}^{1-\sigma} \\ &\quad +\mu\left\{\frac{\sigma}{\sigma-1}\left[\frac{rV_C^U}{1+r}+\left(\frac{1}{1-\beta}r+\chi\right)\frac{\kappa}{q(\theta_C)}\right]\right\}^{1-\sigma} \end{aligned} \tag{33}$$

where reservation utilities $\frac{rV_k^U}{1+r}$ are given by (30) and (31).

For given parameters $(\mu, \sigma, \beta, r, \chi, \kappa)$, (33) and (32) jointly characterize the equilibrium labor market tightnesses θ_I and θ_C. When all firms in the economy bargain individually ($\mu = 0$), the equilibrium conditions reduce to a single equation in θ_I:

$$A = \frac{\sigma-\beta}{\sigma-1}\left[b+\frac{\beta}{1-\beta}\kappa\theta_I+\frac{1}{1-\beta}(r+\chi)\frac{\kappa}{q(\theta_I)}\right] \tag{34}$$

When all firms in the economy bargain collectively ($\mu = 1$), labor market tightness θ_C is characterized by:

$$A = \frac{\sigma}{\sigma - 1} \frac{r + \chi}{r + \chi - f(\theta_C) \frac{\beta}{\sigma - 1}} \left[b + \frac{r}{r + \chi} \frac{\beta}{1 - \beta} \kappa \theta_C + \frac{\kappa}{q(\theta_C)} \left(\chi + \frac{r}{1 - \beta} \right) \right] \tag{35}$$

Once one has obtained equilibrium labor market tightnesses θ_I and θ_C, it is straightforward to find the remaining equilibrium variables. In particular, equilibrium unemployment can be found from the Beveridge curve (1).[13]

2.5 Asset Prices

Agents are risk-neutral, so that the value of a firm is simply the infinite discounted sum of expected future dividends

$$q_t = \sum_{\tau=1}^{\infty} \left(\frac{1}{1 + r} \right)^{\tau} d_{k,t+\tau}$$

where $d_{k,t} = \frac{p(y_k)}{P} y_k - w_k h_k - \kappa v_k$ are the firm's date t dividends under bargaining regime k. When agents expect the bargaining regime to be permanent, and in the absence of other shocks, the value of a type k firm is simply

$$q_k = \frac{1}{r} d_k \tag{36}$$

where d_k are the firm's steady state dividends. Clearly, the firm's valuation is proportional to the period profits associated with each bargaining regime. If period profits are higher under individual bargaining – as will be the case – then asset prices will be proportionately higher as well.

3 Labor market and antitrust policies in the 1920s

The Sherman Act of 1890 threatened "contracts, combinations (...) or conspiracies in restraint of trade" with severe sanctions, and treated workers' unions and producers' cartels or trusts in symmetric fashion[14]. However, both public and case law evolved significantly over time, at times undercutting, at times reinforcing the Sherman Act. We believe that between the immediate pre-World War I years and the New Deal, two distinct regime changes in the legal stance toward trade unions can be identified that greatly affected the wage bargaining setup. In contrast, antitrust enforcement underwent a more gradual change,

[13] When $0 < \mu < 1$, so that both bargaining institutions exist in equilibrium, then unemployment is calculated as the following weighted average:

$$u(\theta_C, \theta_I, \mu) = \mu \frac{\chi}{\chi + f(\theta_C)} + (1 - \mu) \frac{\chi}{\chi + f(\theta_I)}$$

[14] July 2, 1890, c. 647, 26 Stat. 209.

with a variety of indicators pointing to an increase in monopoly power during the 1920s. In the present section, we will discuss the main issues and carve out the stylized facts.

3.1 Labor

Armed with the provisions of the Sherman Act, courts prior to World War I curbed strikes frequently through the use of court orders to prevent workers from picketing or blockading firms. This type of court order became known as a labor injunction. As a consequence of labor injunctions, the ability of workers to credibly threaten to shut down firms and obtain a share of profits was severely limited. Due to the futility of collective bargaining, union membership was less than 10% in 1910.[15]

This changed after the Clayton Antitrust Act of 1914 exempted organized labor from the Sherman Act's presumption of conspiracy in restraint of trade[16]. With a delay of one year, trade union membership began to soar. Mitigated by wartime efforts to avoid disruptions in production and transport, an upsurge in labor disputes followed, as illustrated in Table 1a.

The impact of labor's improved threat point is difficult to quantify. Between 1916 and 1920, union membership as a percentage of the labor force grew from less than 10 % to over 16 %. Total strike duration dipped briefly in 1917 and 1918 and then soared, as did the number of involved workers. In 1919, more than 4 millions workers were involved in a strike at some time during the year, exceeding the number of union members. From this we infer that union coverage must have been at least 20%, and potential quite a bit higher.[17] In Tables 1a and 1b we also provide a tentative estimate of the total number of workdays lost to strikes, which confirms the picture of substantial trade union activity immediately after the end of World War I.[18] Organized labor struck in Seattle in 1919, beginning with a shipyard strike that extended into a general strike. Particularly important was the attempted reorganization of labor in U.S. coal and steel industry and a prolonged steel workers' strike in 1919 and 1920, which at one time involved over 300 thousand workers and shut down a considerable percentage of America's steel making capacity. A major coal strike in late 1919 resulted in a pay increase of 27 % after an arbitration process that followed the end of the strike.[19] Unions had flexed their muscles and demonstrated that given

[15] See Friedman (1999).

[16] October 15, 1914, c. 323, 38 Stat. 730

[17] Note that in present day France and Spain, union membership rates are also below 20% despite near universal union coverage.

[18] Sources for the period between 1905 and 1916 seem to be shaky. They also do not provide data on the total number of days lost to strikes until 1926, when the methodology was changed, see Edwards (1981). For 1927 and 1928, the available sources report the number of lost days and the older estimate of total strike days alongside each other. We used the ratio between the two series in 1928 to backward extrapolate total workdays lost, employing the data on workers involved and total strike days in Table 1. This amounts to assuming that the proportion between the number of workers involved and the number of strike days in all years is as in 1928.

[19] See, e.g. Dulles and Dubovsky (1984).

the limitation of on labor injunctions under the Clayton Act, they could cause major disruption to economic activity. Summing up, we see the years following the passage of the Clayton Act as the first labor market regime, characterized by the ability of labor unions to bargain collectively effectively.

However, the regime created by the Clayton Act was brought to end in 1921, and a severe backlash against unions ensued. In early 1921, the Supreme Court ruled on a case in which striking workers had attempted to organize the boycott of a firm by its suppliers and customers. The court determined that this interfered with interstate commerce and violated the Sherman Act, arguing that nothing in the Clayton Act protected unions from injunctions which might be brought against them for conspiracy in restraint of trade[20]. This early ruling, however, did not touch on the Clayton Act's protections for the right of unions to organize picket lines, so that union activity remained high during 1921. Going further, in a case of picketing that was argued in October and decided in December of the 1921, the Supreme Court ruled that the Clayton Act introduced no new principles and was merely declaratory of existing practice[21]. This ruling had the crushing effect of reducing union activity to mere information and persuasion, and even this not anywhere near factory gates. The ruling explicitly determined that picketing was unlawful and subject to injunction, just as in the days before the Clayton Act[22]. In a decision handed down a few days later, the Supreme Court declared an Arizona state law unconstitutional that had allowed peaceful picketing, arguing that picketing involved considerable losses of business and therefore violated a property right under the 14th Amendment[23].

As a result of these landmark decisions, the use of injunctions resumed immediately and recovered to pre-1914 levels, see Brissenden (1933), rendering the provisions of the Clayton Act almost immaterial. Consequently, trade unions were severely weakened for most of the decade, and union membership declined by one third

As Table 1b shows, trade union activity declined markedly during the 1920s by all indicators, and become an almost marginal phenomenon toward the end of the decade. In 1928, trade union density, the number of workers involved

[20] *Duplex Printing Press Co. v. Deering* , 254 U.S. 443 (Jan. 3, 1921). The decisive passage referring to Section VI of the Clayton Act says: "But there is nothing in the section to exempt such an organization or its members from accountability where it or they depart from its normal and legitimate objects and engage in an actual combination or conspiracy in restraint of trade. And by no fair or permissible construction can it be taken as authorizing any activity otherwise unlawful, or enabling a normally lawful organization to become a cloak for an illegal combination or conspiracy in restraint of trade as defined by the anti-trust laws." [254 U.S. 443, 469].

[21] *American Steel Foundries v. Tri-City Central Trades Council*, 257 U.S. 184 (December 5, 1921) The passage reads: "It is clear that Congress wished to forbid the use by the federal courts of their equity arm to prevent peaceable persuasion by employees, discharged or expectant, in promotion of their side of the dispute, and to secure them against judicial restraint in obtaining or communicating information in any place where they might lawfully be. This introduces no new principle into the equity jurisprudence of those courts. It is merely declaratory of what was the best practice always. Congress thought it wise to stabilize this rule of action and render it uniform." [257 U.S. 184, 203].

[22] [257 U.S. 184, 205].

[23] *Truax v. Corrigan*, 257 U.S. 312 (December 19, 1921).

in labor disputes, and the loss of days due to strikes all were far lower than at the beginning of the decade, and indeed lower than before World War I. In line with conventional wisdom on interwar labor history, we see this return to the low pre-war levels of trade union activity as a major regime change in the U.S. labor market constitution. The Supreme Court decisions of 1921 repealed the pertinent clauses of the Clayton Act, reversed the growth of trade unionism and marginalized collective wage bargaining in large swaths of the U.S. economy for almost a decade. We emphasize again, however, that it is not union membership per se which lends credibility to workers' collective threat point. For the purposes of our model, union members whose collective threat point is not credible cannot bargain collectively.

In the late 1920s, however, the tide began to change once more. In what initially seemed like an isolated development, the Railway Labor Act of 1926 contained pro-union legislation, which made collective bargaining at a company level mandatory and provided for state arbitration. Railroad companies soon attempted to circumvent the provisions of the Railroad Labor Act by setting up their own company unions and staffing them with representatives of their liking.

Such was the case with the Texas and New Orleans Railroad. A trade union active in this firm, the Brotherhood of Railway and Steamship Clerks, had taken a wage dispute to the U.S. Board of Mediation. As a reaction, the management shut out the union and replaced it with one of its own design. This case was taken to court in 1927, and won by the trade union against the appeals of the railway company, most importantly in the 2nd Circuit Court of Appeals on June 10, 1929[24]. When the case was brought to the Supreme Court in 1930, it famously upheld the rulings of the District Court and the Circuit Court of Appeals, citing as a well-established rule the principle that the Supreme Court would not overturn a lower court ruling if the two previous courts had agreed, unless clear error was shown [281 U.S. 548, 558; May 26, 1930].

Two aspects of this case are crucial. First, this case marked a major sea change in American industrial relations, as it overturned a whole string of previous Supreme Court rulings that had upheld employers' rights against trade unions[25]. Second, any legally sophisticated observer would have been aware that the Supreme Court was highly unlikely to overturn the 2nd Circuit's June 1929 decision. Overturning this ruling would have implied a major break with legal traditions, a step that the Supreme Court was unwilling to take.

The effects of this turnaround in the attitude of the courts towards trade unions cannot be overestimated. Numerous previous attempts by state and federal legislators to regulate labor markets had been thwarted by court rulings that upheld the First and Fourth Amendment and repeatedly ruled the

[24] *Brotherhood of Railway and Steamship Clerks vs. Texas and N.O. Railroad Co.*, 33 F (2) 13.

[25] Indeed, the railroad company had argued that the respective passages of the Railroad Act either conferred only an abstract, non-enforceable right or were altogether unconstitutional, citing arguments similar to those that the Supreme Court had used in Tri-City v. Deering in 1921 against the limitation of injunctions in the Clayton Act.

pertinent legislation unconstitutional, or minimized its legal enforceability (see Brissenden, 1933). With the *Texas and New Orleans* case, trade union power and collective bargaining in the railroad industry were now firmly established. In addition, a precedent was set for further court rulings on industrial labor relations, and the road for more union-friendly legislation was free. As a contemporary observer, Edward Berman, wrote in the *American Economic Review* in 1930:

> "The Supreme Court's decision in the Texas and N.O. Railroad case is without doubt one of the most important rendered in a labor case in many years. Considered as a whole, it may be regarded as a great victory for organized labor. ... It puts the Supreme Court on record in favor of legislation designed to promote collective bargaining. It promises that the court will, in the future, be more friendly to state and federal legislation designed to protect workers from the coercive activities of anti-union employers. "

The impact of the June 1929 Circuit Court ruling was particularly important due to its impact on the movement for anti-injunction legislation. In particular, this is true of the Shipstead anti-injunction bill, a proposal for legislation that had been introduced first in 1929, was reintroduced in 1931 as the Shipstead-Norris bill, eventually passed and enacted as the Norris-LaGuardia Act of 1932. This bill reinstated limitations against the use of injunctions in labor disputes as originally intended in the Clayton Act.

The Shipstead bill's first incarnation, introduced to Congress in January 1929, was quickly tabled by the Senate Judiciary Committee because it was considered certain to be ruled unconstitutional[26]. In August 1929, however, shortly after the Circuit Court of Appeals had upheld the District Court's original decision in the Texas & N.O. case, a subcommittee of the Senate Judiciary Committee, composed of Senators Walsh, Norris and Blaine, presented a new piece of anti-injunction legislation for approval by the Executive Council of the American Federation of Labor (AFL)[27]. This new anti-injunction legislation was approved by the delegates to the AFL's annual convention on October 18, 1929, clearing the way for its introduction to Congress. This new push for anti-injunction legislation was widely reported in the press during the week of October 14-19th, the week before Black Thursday, and on October 27th, the day before Black Monday[28]. A version of this bill ultimately passed as the

[26] Cf. the account in the August 14, 1929 edition of the New York Times, headlined "Labor Men Revise Injunction Bill."

[27] Cf. the August 24, 1929 edition of the New York Times, headlined "Labor Men Revise Injunction Bill: Federation Council Believes It Now Has A Measure That Congress Will Accept."

[28] Articles appeared in the October 14th, October 15th, October 18th, October 19th and October 27th editions of the New York Times. On October 27th, the New York Times headlined a prominent article in its Sunday supplement (the precursor to today's Week in Review section): "LABOR'S MAGNA CHARTA DRAFTED FOR CONGRESS: Anti-Injunction Bill of the A.F. of L. Is Designed to Assure Workers the Right to Strike and Picket, and the Same Liberty as Farmers to Combine."

Norris-LaGuardia Act. Hence, by October 1929, it should have been clear to investors and firms that labor unions were likely to re-obtain the rights to strike and picket in the near future.

Summing up, there is evidence from prominent court rulings in the late 1920s of a major sea change in the attitude toward union formation and collective bargaining which foreshadowed the New Deal and rendered it legally feasible altogether. Indeed, recent research has gone so far as to argue for major continuity between Republican policy toward trade unions on the eve of the Great Depression and the New Deal, see O'Brien (1998). Given these legislative efforts and court rulings, rational investors at the end of the 1920s had good reason to believe that a regime shift back to greater union activity was underway, and that a persistent downward shift in profits, output, and employment would follow. We see this regime change as a decisive event forming expectations about future profits on the eve of the Great Depression. By implication and in line with recent historiography, pro-union legislation and the institutionalization of collective wage bargaining under the New Deal emerge as the new labor market regime whose parameters were defined beginning already in 1929, not just in 1933.

3.2 Welfare Capitalism and High Wage Policies

In the largely union-free environment of the late 1920s, leading firms renewed attempts to establish a system of industrial relations based on voluntary benefits and above-market wages. These schemes, commonly labeled as "welfare capitalism" and seen as a paternalistic substitute for public labor market intervention, did not start in the 1920s, nor did they end with the depression[29]. However, welfare capitalism gained influence during the late 1920s, and was arguably concentrated in industries with substantial monopoly power.

One rationale for welfare capitalism is that above-average wages were highly effective in keeping unions out of the factory. These programs quickly lost significance during the New Deal[30]. This suggests that firms indeed often maintained company benefits to keep trade unions out, and lost interest as soon as trade union representation became more widespread.

Indeed, a political link existed between trade union and antitrust policy before the NIRA. Against the stiff resistance of the Justice Department that sought stricter antitrust enforcement, Hoover as commerce secretary had gradually extended collective bargaining and trade union representation, most notably in the 1926 Railway Act of 1926 discussed above. After his election into the White House in 1928, and again around the stock market crash of October 1929, Hoover employed carrot-and-stick policies to induce industry to maintain high wages and adopt a union-friendly attitude in spite of the impending recession, using tighter antitrust enforcement as a threat[31]. The apparent hope

[29] See Cohen (1990), Jacoby (1997).
[30] See Gordon (1994), Jacoby (1997).
[31] Hoover's role in promoting high wage policies is emphasized by Ohanian (2007).

was that by maintaining the purchasing power of labor, the level of private consumption could be stabilized[32]. Indeed, major business leaders followed suit, and Ford pledged to increase its daily wage from six to seven dollars (Barber, 1985). From our perspective, Hoover's ability to persuade firms to voluntarily maintain high nominal wages (that is, to increase real wages) must have also been greatly strengthened by the improved threat point of labor documented in the previous subsection.

Bittlingmayer (1992) has argued Hoover's threat of tighter antitrust policy in October 1929 may have contributed to the stock market crash. We do not rule this out. However, as will become clear in the following section, the macroeconomic consequences of a change to stricter antitrust with individual bargaining would have been radically different from the ones we see in the data. Bittlingmayer (1992) himself concedes that there is little evidence of any subsequent action on tougher anti-trust policy during the Hoover administration, so that the high degrees of monopoly power persisted through the Great Depression, and further throughout the 1930s.

Tighter antitrust was used as a threat, but not meant as a commitment. Herbert Hoover's strategic pledge, supported by the turnaround in Supreme Court opinion, was to keep wages high, promote collective wage bargaining, and turn a blind eye to collusive practices and monopolization in industry. In this, he differed not one iota from the policy of his successor in office after 1932, Franklin Roosevelt[33].

3.3 Anti-Trust

While regulation of the labor market was subject to violent swings in legal opinion, competition policy for product markets was not. Indeed, the regulatory environment of the 1920s was one of laxity in antitrust enforcement, and highly conducive to abnormally high corporate profits. The antitrust and merger policies of the Coolidge administration consisted in pre-approving mergers, although the Sherman and Clayton acts did not provide for such a measure. Profit shares, measured by the share of capital in sectoral and national income, appear to have increased substantially throughout the decade, to the effect that profits outpaced the growth of wages (on the latter, see Lebergott (1964)). Keller (1973) reports that labor's share of income in electric utilities declined by about 8 percentage points between 1923 and 1929, while labor's share in manufacturing and railroads declined by about 6 percentage points over the same period, from 78 to 72%. This is consistent with an increase in monopoly profits over this period.

Although parts of this phenomenon can be explained by rapid growth of capital-intensive sectors, much of it is evidently due to increased monopoly profits. This is partly due to the fact that two of the three rapid-growing sectors in question, public utilities and railways, were heavily regulated during

[32] This policy experiment failed, and private consumption declined precipitously beginning in 1930, as evidenced by the data in Romer (1990).

[33] On the consensus among historians about this, see Himmelberg (1976) and O'Brien (1998).

the 1920s, and that regulators allowed maximum profits in these industries to increase over time. Keller (1973) collects the evidence, reviews the earlier literature and notes, inter alia, a 33% hike in railroad freight rates imposed by the Interstate Commerce Commission in 1922, which was not reversed when input cost for railroads fell sharply later in the decade. Similar evidence is documented for utilities. In the metal-making and metal processing industry (including electrical), which Keller (1973) identifies as the third fast-growing sector of the U.S. economy of the 1920s, concentration ratios were high at the beginning of the decade and rose further in steel making. The eight largest steel producers increased their market share from 58 percent in 1920 to 78 percent in 1930. Likewise, the three largest auto producers had a market share of 68 percent in 1920, and of 72 percent in 1930. Evidently, monopoly power in U.S. product markets was high and kept increasing markedly throughout the 1920s.

Just what the markups over cost were seems difficult to ascertain. Hanes (1996) tackles this issue indirectly by looking into the cyclical behavior of wages in manufacturing. Under monopolistic competition, markups would react procyclically, causing wages to be countercyclical. For carefully constructed, intertemporally comparable wage and price series, Hanes' (1996) finding is that wages were more countercyclical in the interwar period than during the postwar. By implication, markups over cost must have been higher and the degree of competition lower between the wars than in the postwar period. Then, postwar markups over cost would constitute a lower bound for those of the interwar period.

While estimating markups from industry data is difficult and results differ widely, the available evidence suggests that markups in US. manufacturing were considerable in the postwar period. Hall (1988) arrives at estimated markups in excess of 80%, while a more conservative estimate by Roeger (1995) puts markups at a still high 45-48%. Combining these findings with the results of Hanes (1996) on the cyclical behavior of wages, markups in the interwar period could well have been in the range of 50% over cost or higher.

Thus, we identify a regime of high and increasing monopoly power in the American economy during the 1920s. This leads to the obvious question of why antitrust enforcement was so low and what the possible connections with the trade union questions were.

4 Quantitative Results

4.1 Parameter Values

The period length is one quarter. There are ten parameters: the discount rate r, the exogenous job destruction rate χ, the technology parameter A, workers' bargaining power β, the matching elasticity η, the flow value of unemployment b, the matching scale parameter s, vacancy costs κ, the fraction of firms bargaining collectively μ and the demand elasticity facing firms $-\sigma$. For purposes of the calibration only, we set $\mu = 0$ and take the limit as $\sigma \to \infty$. That is, we

choose parameters for the model by looking at a benchmark economy in which competition in the goods market is perfect and all firms engage in individual bargaining with their workers.

Parameter values are summarized in Table 2. Without loss of generality, A is normalized to unity, and there are no shocks to productivity. The exogenous rate of job destruction is set at $\chi = 0.118$, so that 11.8 % of jobs are destroyed each quarter, corresponding to the average total separation rate between 1922 and 1930 reported in the Monthly Labor Review of July 1929 and February 1931. The quarterly discount rate r is chosen to generate a riskless interest rate of 4.0 % annually, leading to a choice of $r = 0.01$. The matching elasticity is set to $\eta = 0.50$, as is standard in the literature on search frictions and wage bargaining, and in the range of estimates reported in Petrongolo and Pissarides (2001). Also standard is the imposition of the Hosios condition that matching elasticity and workers' bargaining power are equal, $\beta = \eta$.

This leaves three free parameters, necessitating three targets. The flow value of unemployment b is set so that it replaces 30% of the real wage in the baseline. This low replacement rate target reflects the lack of unemployment insurance in the interwar period, so that the flow value of unemployment would have derived exclusively from home production (primarily in agriculture, which still had a labor share of around 20% at the time) and charitable assistance. By comparison, analyses of the late 20th-century US labor market typically assume that b takes values in the range of 40 to 60% of the real wage. The matching scale parameter s and vacancy costs κ are chosen to replicate a firm's matching rate of $q = 0.24$ (as in den Haan, et. al., 2000) and an unemployment rate of 5.0%, corresponding to a natural rate of unemployment in a laissez-faire economy. The resulting vacancy costs of $\kappa = 0.193$ yield a cost of about 0.82 units of output per hire. This corresponds to about 22% of a worker's annual wage, in line with the estimates reported in Hamermesh and Pfann (1996) for post-war data.

4.2 General Results

The parameterization described above allows us to characterize equilibrium at each competition-bargaining mix pair (σ, μ). Figure 1 shows the behavior of output, unemployment, asset values and wages as a function of our measure of product market competition σ. The solid blue lines represent an economy in which all firms bargain individually ($\mu = 0$), while the dashed red lines show the case where $\mu = 1$, so that all firms in the economy bargain collectively.

4.2.1 Individual Bargaining

First, focus on the individual bargaining economy, represented by the solid blue lines. Varying competition under individual bargaining has little impact on quantities - unemployment and output. The level of monopoly power does, however, have a strong effect on wages and profits. As monopoly power increases, profits increase sharply, while wages decline. Hence, an increase in monopoly power will lead to an asset price boom (as profits grow, so does the

value of firms), and a distributional shift from wages to profits, but have very little impact on unemployment and GDP. The reason is that the *strategic interaction between monopoly power and wage bargaining* causes firms to overhire workers, counteracting the first principles negative impact of monopoly power on output and labor demand.

The intuition for this 'overhiring effect' is that as monopoly power increases, marginal revenue product (MRP) also declines.[34] Since the decreasing MRP is a component of the bargained wage, firms can depress wages by hiring additional workers.[35] This hiring externality causes firms to produce more than the socially efficient level of output, countering the negative effect of monopoly power on output. Quantitatively, the combined effect of monopoly power and the IB hiring externality is to leave output (and thereby unemployment) broadly unchanged when monopoly power increases. The ability of firms to depress wages does, however, cause profits to be increasing and wages to be decreasing in monopoly power.

4.2.2 Collective Bargaining

Next, consider the collective bargaining economy. Varying competition under collective bargaining has a profound effect on quantities such as unemployment and output, but a relatively mild impact on wages and profits. Once again, this is due to a *strategic interaction between monopoly power in the goods market and collective wage bargaining.* Workers bargaining collectively can threaten to shut down the firm, depriving it of its profits. In this way, workers are able to capture a share of their firm's profits. This is of course all the more attractive, the greater are profits - that is, the greater is monopoly power and hence monopoly rents. The fact that workers obtain a share of monopoly rents accounts for the lower profits and firm values under collective than under individual bargaining, and for the more muted increase in firm values as monopoly power increases. Conversely, wages are higher under collective bargaining, and decrease more slowly than under individual bargaining as monopoly power rises. The strategic interaction rears its head again in the determination of equilibrium output and unemployment. Under CB, the incentives of firms and workers to maximize the monopoly rents they share are well-aligned[36]. As a result, they find it optimal to set wages relatively high and restrict output relative to the IB level in order

[34] The overhiring effect on individually bargaining firms was first identified by Stole and Zwiebel (2006). It has also been explored by Smith (1999) and Ebell and Haefke (2009).

[35] Recall from the discussion in Section 2.3.1 that individual bargaining is sequential, so that each worker is treated as the marginal worker. Hence the increase in the wage bill from paying an additional worker is tempered by the decline in the total wage bill due to the reduction in wages for all workers. Firms hire workers beyond the point at which employment costs are covered by MRP, as illustrated in equation (19).

[36] Specifically, the Nash bargaining problem sets the wage so as to maximize a convex combination of workers' and firm's surplus (profit) shares. Under efficient bargaining, total surplus is maximized - an earlier version of this paper reported quantitatively very similar results from an efficient bargraining setup.

to maximize monopoly rents.[37] The greater is monopoly power, the stronger the incentives to restrict output under CB, and hence the greater the gap between the IB and CB output levels. Unemployment increases as steady state output falls, because firms then find it optimal to open fewer vacancies, causing labor market tightness to decrease and equilibrium unemployment to rise.

4.2.3 Business Cycle Implications

In our model, business cycle fluctuations in output, unemployment, asset prices and wages have two sources: shifts in the share of workers bargaining collectively μ and changes in monopoly power, measured as demand elasticity σ. The key insights of this new paradigm for business cycle fluctuations are:

1. An increase in the share μ of firms bargaining collectively induces a recession, in the sense that output and profits decline while unemployment rises. Wages also rise in such a recession, which fits well with the evidence on wage increases during the Great Depression.

2. The greater is monopoly power, the more severe the recession (or depression) which is induced by a given increase in the share of firms bargaining collectively μ. Thus, the increase in μ would generate a smaller recession in the early 1920s than in the 1930s if monopoly power were lower in the earlier period, consistent with the evidence on increasing monopoly power throughout the Coolidge administration.

3. An increase in monopoly power under individual bargaining leads to a stock market boom, while output and unemployment remain roughly stable, and wages decrease. This is consistent with the behavior of the economy during the 1920s, when monopoly power increased due to the laissez-faire policies of the Coolidge administration.

4.3 The Interwar Period

4.3.1 Description of Scenarios

We now present three scenarios for the interwar period. Each scenario pins down plausible values for the economy's demand elasticity σ (which we interpret as reflecting the degree of monopoly power in the economy) and the share of firms bargaining collectively μ. The scenarios are summarized in Table 3. The values for σ are common to all three scenarios, while the assumed time series for μ varies across scenarios.

Interwar Monopoly Power We use asset market data from 1913-1929 to pin down σ. For all scenarios, we assume that demand elasticity over the period 1913-1921 was $\sigma_{1913-21} = 4.0$, which implies that the Dow Jones Industrials

[37] Recall that under IB, the hiring externality causes firms to maximize profits by producing inefficiently *high* levels of output.

dropped by 20% due to the switch from individual to collective bargaining, so that the model accounts for about 60% of the drop in asset prices between 1913 and 1921.[38] We then allow demand elasticity to fall beginning in 1925, in order to capture the increase in monopoly power due to the laissez faire anti-trust policies of the Coolidge Administration. We pin down the demand elasticity in 1929 by assuming that the combination of the decrease in μ to zero and the increase in monopoly power caused 60% of the increase in the Dow Jones Industrial Average between the 1921 trough and 1929 peak[39]. Choosing $\sigma_{1929} = 2.3$ meets this target, and implies that stock prices increased by 235% between the trough year of 1921 and the peak year of 1929. We then assume that σ remains at its 1929 level throughout the 1930s.[40]

Interwar Wage Bargaining Regimes For the share of firms μ bargaining collectively, we distinguish three scenarios: our preferred baseline scenario, and alternative maximal and minimal configurations.

Our choices for the share of firms bargaining collectively μ are guided by labor history. Under the Sherman Anti-Trust Act, labor unions were considered to be "illegal combinations in restraint of trade". Hence, we consider all firms to have been bargaining individually until 1914. The Clayton Act, implemented in October 1914, exempted labor unions from anti-trust prohibitions, effectively legalizing collective bargaining. However, wartime restrictions and voluntary pacts delayed the implementation of collective bargaining by unions until the end of World War I in 1918. Hence, we set $\mu = 0$ until 1918 in all scenarios. Once the war had concluded, however, union activity began: in all three scenarios presented below, the share of firms bargaining collectively begins to rise in 1919. In both our preferred baseline and in the maximal scenarios, μ increases in annual steps of 0.25 between 1919 and 1921. That is, by the trough of the business cycle, 3/4 of firms are explicitly or implicitly bargaining collectively with their workers.[41] While this is likely to overstate the extent of collective bargaining in the entire private non-farm economy, it is not so far from the truth for those major industrial firms listed on the Dow. In the minimal scenario, we assume that μ rises from 0.25 in 1919 to 0.50 in 1920, and remains at $\mu = 0.50$ in 1921.

In December of 1921, the Supreme Court invalidated the pro-union provisions of the Clayton Act. Thus, we consider the economy's first collective bargaining phase to have ended in 1921. Beginning in 1922, workers were un-

[38] We did not choose $\sigma_{1913-21}$ so that the switch from IB to CB accounts for the entire 35% drop in the Dow, as it is likely that other factors, most prominently World War I, also had impact on stock markets during this period.

[39] Again, we do not attribute 100% of the increase in the Dow during the roaring 20s to our model, preferring to conservatively leave room for other factors.

[40] Cole and Ohanian (2004) have argued that monopoly power increased due to New Deal policies beginning in 1933. Since our focus is on the pre-1933 period, we do not consider variations in parameters after 1933.

[41] In the Appendix, we show that currently employed workers will indeed find it optimal to begin to bargain collectively when it becomes legal to do so, under fairly weak conditions on the level of product market competition.

able to picket firms, denying credibility to any threat to shut down a firm, and rendering collective bargaining ineffectual. Workers' only threat point would be to leave the firm, as in individual bargaining, so that from 1922-1928 we set $\mu = 0$ in all scenarios.[42]

In the course of 1929, it became clear that the legal environment was becoming more favorable for collective bargaining, as explained in detail in Section 3. In our preferred baseline and minimal scenarios, we assume that 25% of firms were bargaining collectively (implicitly or explicitly) in 1930, rising to half of all firms from 1931 onwards. In the maximal scenario, we allow the share of firms bargaining collectively to rise further to $\mu = 0.75$ in 1932 and further to $\mu = 1$ in 1933.

4.3.2 Baseline Scenario Results

Now, we turn attention to the results of our baseline scenario, which can be visualized in Figures 2a-2d. By assumption (i.e. by choosing the appropriate value for σ), the switch from individual to collective bargaining in the model is able to account for 60% of the drop in the Dow between 1913 and 1921. The reason is that stock prices drop is that collectively bargaining workers are able to capture a share of monopoly rents, reducing firms' values. Also by assumption (i.e. by allowing σ to decrease appropriately), the switch back to individual bargaining together with the increase in monopoly power accounts for 60% of the increase in the Dow between 1921 and 1929. Most of the increase in stock prices is due to the increase in monopoly power during the 1920s: monopoly rents increase and under individual bargaining, all increases accrue to the firms' owners (shareholders), as rents are not shared with workers. The behavior of the stock market index from 1930 onwards is 'free', in the sense that the parameter σ is not chosen so as to match the data. The model is able to generate a substantial decline in asset prices beginning in 1930, although it does clearly fall short of the dramatic drop in the data.[43] This is not surprising. As a consequence of the sharp contraction at the onset of the Great Depression, a financial crisis began in May 1931. As recent experience shows, a financial crisis is generally associated with further drops in asset prices. Modelling the consequences of a financial crisis is beyond the scope of this paper.

Now, we turn our attention to output, unemployment and wages. Clearly, the model does a very good job of accounting for the behavior of output and unemployment throughout the interwar period. In the model, the shift towards collective bargaining leads to a decline in GDP to 89.8% of trend at the trough of the 1920-21 recession, compared to 87.6% of trend in the data. The reason is that the collectively bargaining workers are able to garner a share of

[42] Recall that these Supreme Court decisions made it impossible for workers to picket their workplace, depriving them of the ability to shut down firms. Hence, although union membership did not decline to zero during this period, unions' threat point was only for all workers to walk away, making the unions' threat point that of individually bargaining workers. It is the threat point that is crucial in our model, not union membership.

[43] Again, this is due to the ability of collectively bargaining workers to capture a share of monopoly rents, reducing firms' profits and hence values.

monopoly rents, increasing their wages, and decreasing the optimal employment and output levels. Unemployment in the model also increases, as lower steady employment levels lead to lower levels of vacancies, lower labor market tightness and hence higher unemployment rates. The model also does a good job of accounting for the level of unemployment at the business cycle trough of 1921: model unemployment rises to 15.2%, while non-farm unemployment in the data peaks at 16.3% in 1921.

Further, the model accounts well for the recovery beginning in 1922, as the switch back to IB weakens the incentives of firms and workers to restrict output.[44] In both the model and the data, unemployment falls rapidly beginning in 1922, averaging 5.9% in the model and 5.8% in the data between 1923 and 1929.[45]

A key result is that the model also does very well at replicating the fact that GDP growth was about at trend between 1923 and 1929, although the growth in stock market indices was far above trend. This is due to the fact that in the model, a large part of the stock market boom is due to the increase in monopoly power during the laissez-faire Coolidge administration. An increase in monopoly power leads to an increase in profits and hence firm values. This is consistent with the historically high levels of corporate profits as a share of GDP reported in McGrattan and Prescott (2004) for the late 1920s, and with the increase in the factor share for capital between 1923 and 1929 reported in Keller (1973). At the same time, however, output remains about constant (i.e. at trend), as long as firms engage in individual bargaining. In contrast, in a business cycle accounting model, an increase in productivity would cause both GDP and the value of firms to rise about proportionately. In addition, the model does well at capturing the drop in GDP at the onset of the Great Depression. In the model, the increase in the share of workers bargaining collectively causes output to decline from 100% to 82.6% of trend, while in the data, GDP drops to 79.6% of trend in 1931. Hence, the model captures most of the pre-financial crisis output drop.

Unemployment in the model rises slightly more than the data at the onset of the Great Depression between 1929 and 1931. By 1931 model unemployment has surged to 22.0%, while in the data, unemployment in 1931 had risen to 19.1%. Once again, the decrease in output due to a switch to collective bargaining also makes it optimal for firms to reduce the number of vacancies opened in steady state, causing labor market tightness to decrease and unemployment to increase.

Comparing the model's behavior with respect to wages to the data for the early part of the interwar period is difficult, due to a lack of comprehensive and consistent data. We do, however, have some observations on factor shares for the

[44] Although the recovery in the data is sharp, it is even sharper in the model. This may be due to some residual uncertainty about the political will to enforce the Supreme Court's picketing ban. Firms which had signed collective bargaining contracts may have been reluctant to break them, fearing that the executive branch (be it local, state or national) might hesitate to use force to remove picketing workers - and recalling the extreme labor unrest of the 1919-21 period.

[45] Once again, unemployment drops more quickly in the model than in the data, reaching about 5% in 1923 in the data and in 1922 in the model.

pre-1929 period. Using Kuznets' national income data, Keller (1973) calculates that the wage share declined from 77.9% in 1923 to 72.0% in 1929, consistent with the decline in wages predicted by our model. [46] In a similar vein, Hanes (1996) finds that wages are countercyclical during the interwar period 1923-41, consistent with our model, but procyclical after WWII.

In contrast, there is a relative wealth of wage data beginning in 1929. Hence, we will focus on the behavior of real wages from 1929 onwards. Here, the model is able to capture the surprising increase in real wages after 1929.[47] In the model, wages increase to 102% of trend by 1930 and to 105% of trend in 1931, which compares favorably with the behavior of wages in the data. In the data, real wages increase from 100% to 105.4% of trend between 1929 and 1930, further rising to 113.3% of trend by 1931. Although the model understates the increase in wages to 1931, it is roughly consistent with the level of wages in 1932-36. The reason that real wages increase in the model, despite the increase in unemployment and the drop in output, is that collectively bargaining workers are able to increase their surplus by garnering a share of monopoly rents.

Summing up, the model does a remarkably good job at accounting for the behavior of major macroeconomic variables between the end of World War I and the beginning of the Great Depression. Moreover, the model's predictions on asset prices, output, unemployment and wages are roughly consistent with the behavior of the economy in the late 1930s, after the effects of the financial crisis can be assumed to have dissipated.

4.3.3 Minimal Scenario Results

Results for the minimal scenario are presented in Figures 3a-3d. The baseline and minimal scenarios are nearly identical, only differing slightly for the year 1921. In particular, the more conservative minimal scenario assumes that the fraction of workers bargaining collectively rises to 50% of the non-farm private workforce in 1921, rather than 75% in the baseline scenario. As a result, model unemployment only rises to 12.0% at the 1921 trough (vs 16.3% in the data), and model output only drops to about 93.3% of trend at the 1921 trough (vs. 87.6% in the data). Still, the model is able to capture more than half the rise in unemployment and drop in output of a very severe recession.

4.3.4 Maximal Scenario Results

Results for the maximal scenario are presented in Figures 4a-4d. The maximal scenario is also quite similar to the baseline, differing only beginning in 1932. The goal of this scenario is to demonstrate that the model could, in principle,

[46] Keller (1973) also notes that a decline in the labor share during an expansion is unusual. During the earlier expansion of 1899-1907, he reports that the labor share increased slightly from 75.3% to 77.3%, while in the post-war expansion of 1948-1957, labor's share increased from 74.2% to 79.7%.

[47] We compare our model results to the Hanes (1996) nominal wage series, deflated by the Producer Price Index for industrial commodities. This is the appropriate deflator, since we are interested in the role of wage costs in firm's decisions and wage bargaining behavior.

generate a recession that matches the peak-to-trough drops during the Great Depression. Rather than assuming that the share of firms bargaining collectively remains at 50% throughout the 1930s, the maximal scenario assumes that all non-farm private firms are bargaining collectively by 1933. Predictably, the model is able to generate significantly larger drops in output and asset prices and larger increases in unemployment and wages. Now, model unemployment climbs to 39.1% (versus 36.2% at the 1933 trough) while output drops to 64.5% of trend (versus 60% of trend at the 1933 trough). Still, the Great Depression was a complex event, and we do not wish to assert that monopoly power and collective bargaining were the only factors playing a role in the downturn.

5 Conclusions

The model is able to account well for the behavior of the interwar business cycle. In particular, we link changes in the legal environment for organized labor to business cycle movements. When workers' right to strike and picket is legally protected, as in the Clayton Era period, workers can use their collective bargaining threat point to obtain a share of profits. This induces a drop in the stock market and also in output, and an increase in unemployment. The magnitude of this collective bargaining-induced recession depends on the degree of monopoly power in the economy. This implies that the increases in monopoly power during the 1920s were important, as they help explain why the Great Depression was more severe than its precursor in the early 1920s. Moreover, we are able to account for the otherwise puzzling countercyclical behavior of wages during the interwar period, both in the sense that the labor share was decreasing during the roaring 1920s expansion and that real wages were above trend during the Great Depression.

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6 Tables

Table 1a: Labor Union Activity 1916-1920

		1916	1917	1918	1919	1920
Trade union density (% of labor force)	(1)	9.9	10.9	12.6	14.3	16.7
Workers involved in strikes (1000s)	(2)	1599	1227	1240	4160	1463
Average duration (days)	(3)	23	19	17	34	39
Total days lost (1000s)	(4)	29201	14396	16735	98452	33848

Table 1b: Labor Union Activity 1921-1928

		1921	1924	1926	1928
Trade union density (% of labor force)	(1)	15.5	10.3	10.2	9.6
Workers involved in strikes (1000s)	(2)	1099	655	330	314
Average duration (days)	(3)	51	30	25	27
Total days lost (1000s)	(4)	39521	20930	7767	12600

Sources and Methods	(1)	Wolman (1936), Bain and Price (1980)
	(2)	Peterson (1938)
	(3)	*BLS Monthly Labor Review*, July 1929
	(4)	Own calculations from the sources in (3), using 1928 proportions

Table 2: Parameter Values

Parameter	Value	Target
A	1.0	normalization
r	0.01	4% annual r
η	0.50	empirical estimates
β	0.50	Hosios condition
b/w	0.30	post-war $b/w \geq 0.40$
χ	0.118	BLS data
κ	0.19	perf. comp. $u = 5.0\%$

Table 3: Interwar Scenarios

Year	σ	**Markup** $\frac{\sigma-\beta}{\sigma-1}$	μ **Preferred**	μ **Maximal**	μ **Minimal**
1913-1917	4.0	16.7%	0	0	0
1918	4.0	16.7%	0	0	0
1919	4.0	16.7%	0.25	0.25	0.25
1920	4.0	16.7%	0.50	0.50	0.50
1921	4.0	16.7%	0.75	0.75	0.50
1922-1924	4.0	16.7%	0	0	0
1925-1926	3.5	20%	0	0	0
1927	3.0	25%	0	0	0
1928	2.5	33.3%	0	0	0
1929	2.3	38.5%	0	0	0
1930	2.3	38.5%	0.25	0.25	0.25
1931	2.3	38.5%	0.50	0.50	0.50
1932	2.3	38.5%	0.50	0.75	0.50
1933	2.3	38.5%	0.50	1.0	0.50

7 Figures

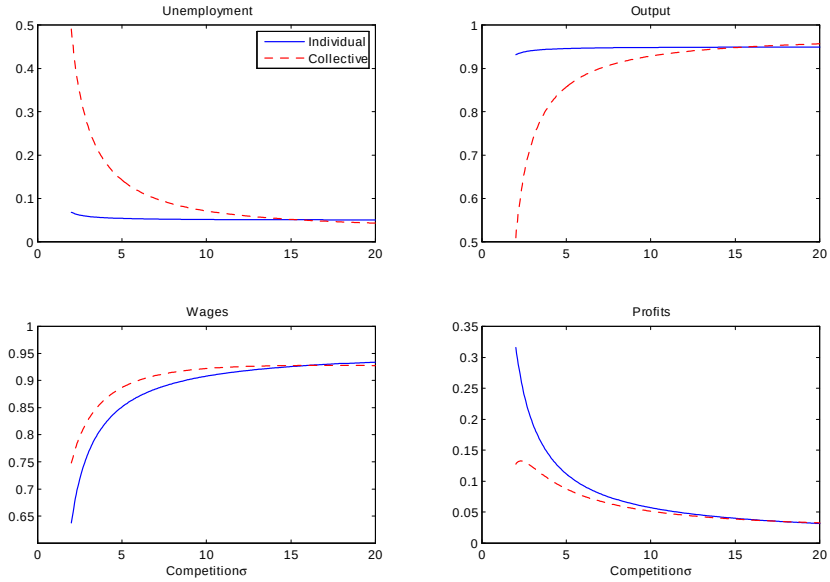

Figure 1: Key model variables as a function of competition (demand elasticity σ) under individual and collective bargaining

7.1 Baseline Scenario

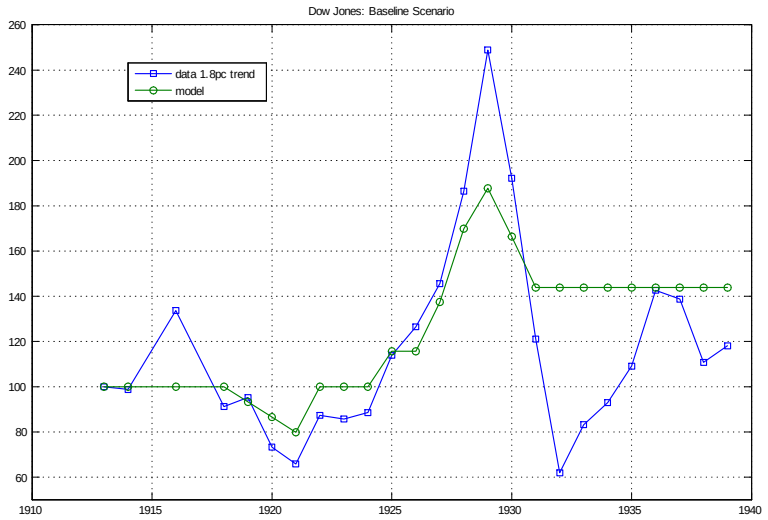

Figure 2a: Stock market values in the baseline scenario. The data is the Dow Jones Industrial Average deflated and relative to a 1.8% trend.

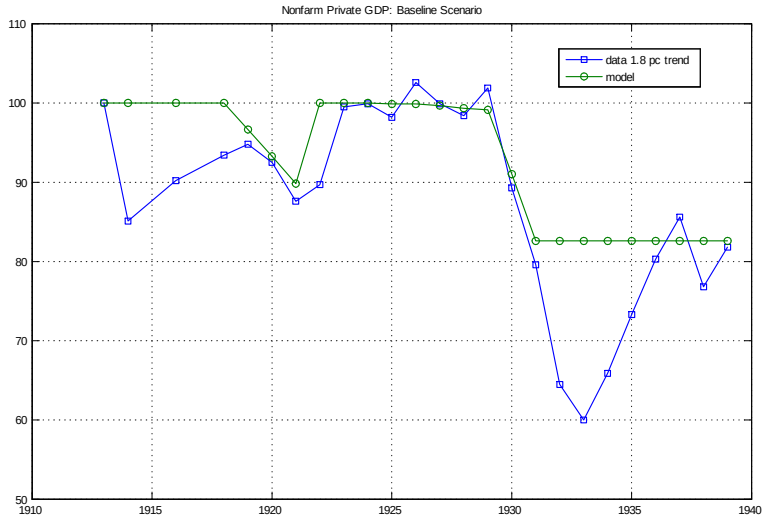

Figure 2b: Output in the baseline scenario. The data is private non-farm per capita GDP from Kendrick, deflated and relative to a 1.8% trend.

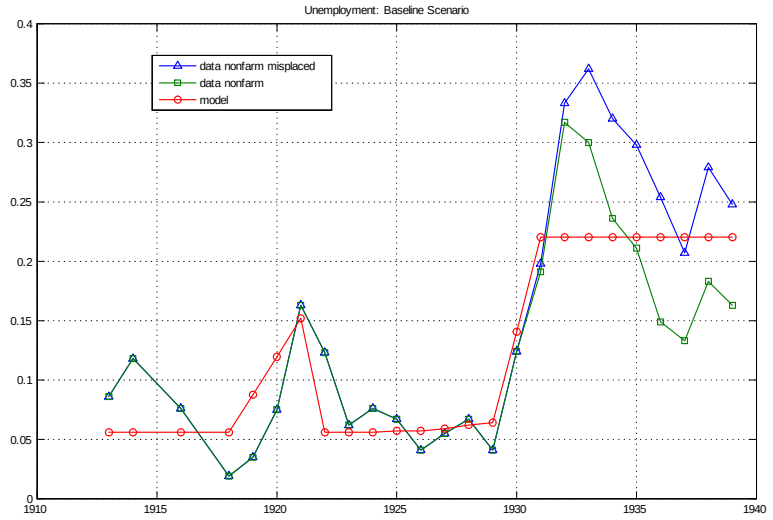

Figure 2c: Unemployment in the baseline scenario. Data is for non-farm unemployment. The two series differ according to whether Federal Emergency Workers are counted as employed or unemployed.

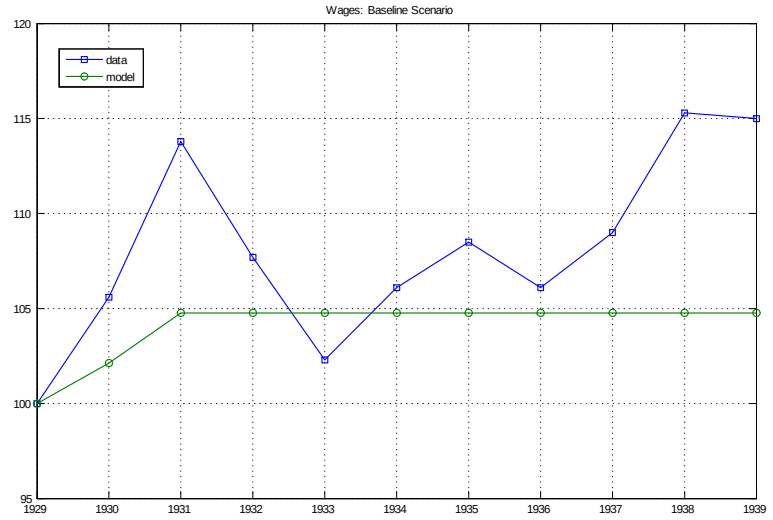

Figure 2d: Wages in the baseline scenario. Data are hourly wages in manufacturing from Hanes (1996), deflated by the PPI for Industrial Commodities and relative to a 1.8% trend.

7.2 Minimal Scenario

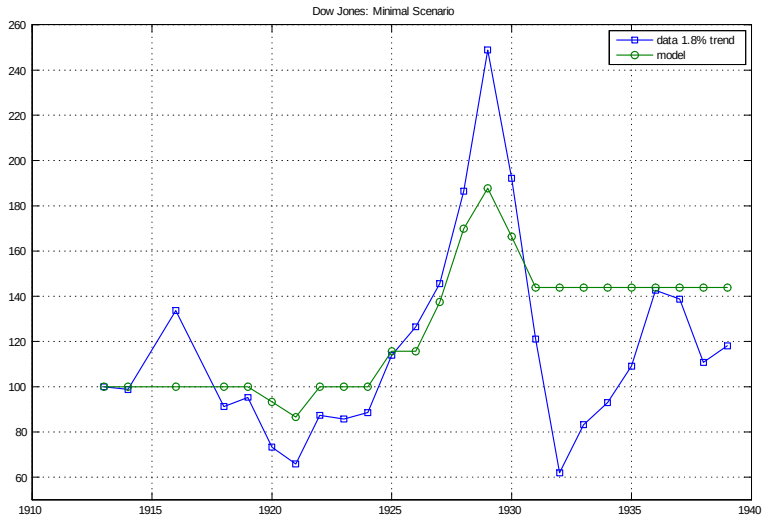

Figure 3a: Stock market values in the minimal scenario

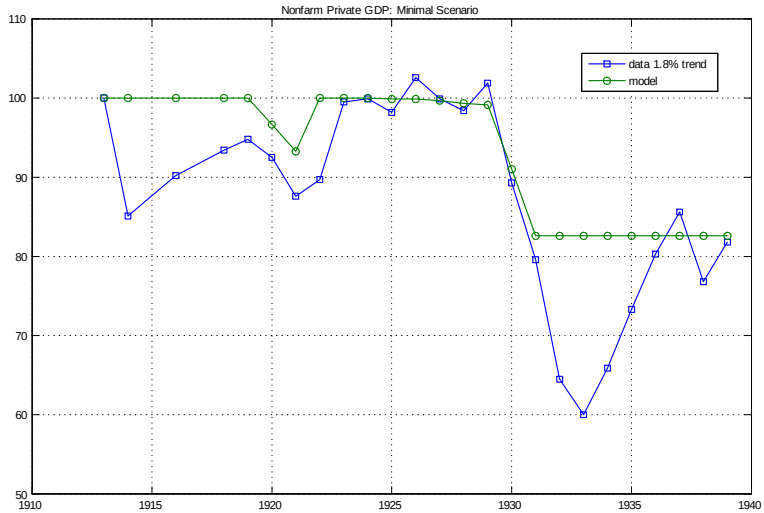

Figure 3b: Output in the minimal scenario

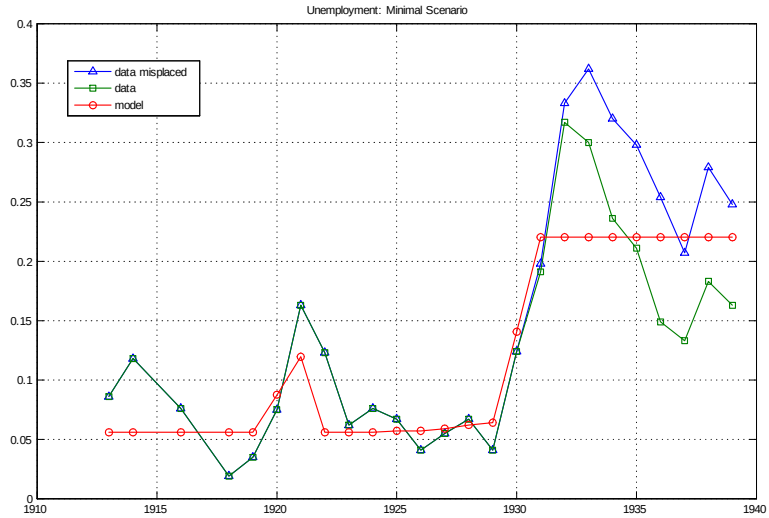

Figure 3c: Unemployment in the miniimal scenario

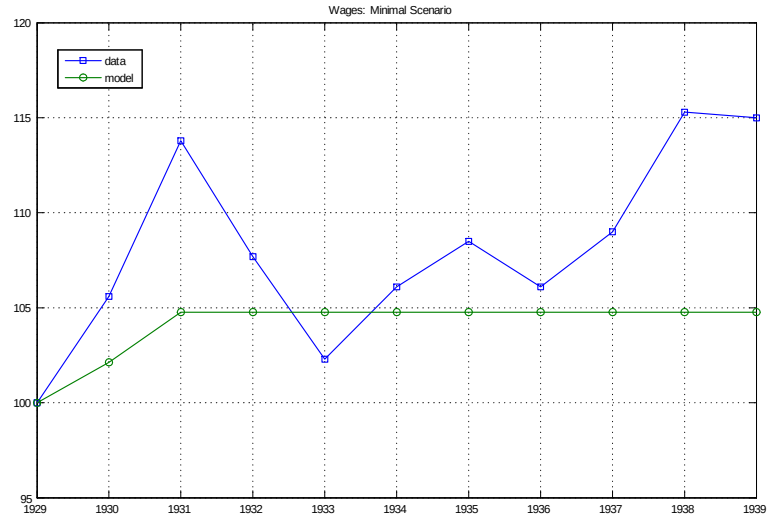

Figure 3d: Wages in the minimal scenario

7.3 Maximal Scenario

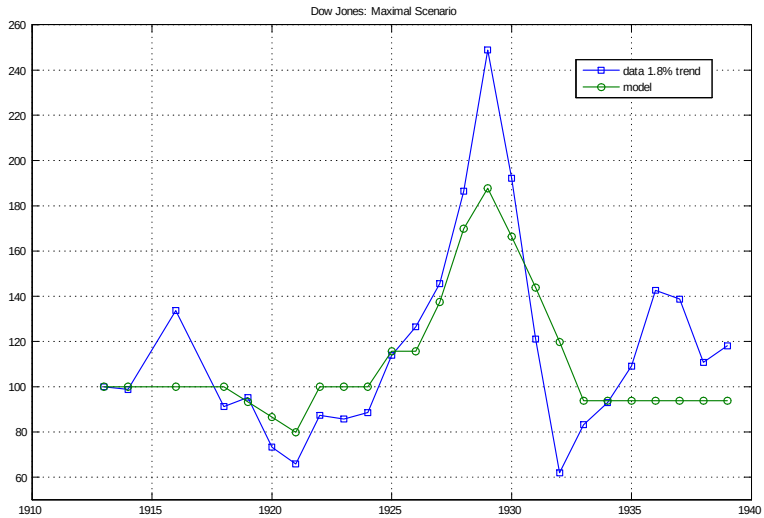

Figure 4a: Stock market values in the maximal scenario

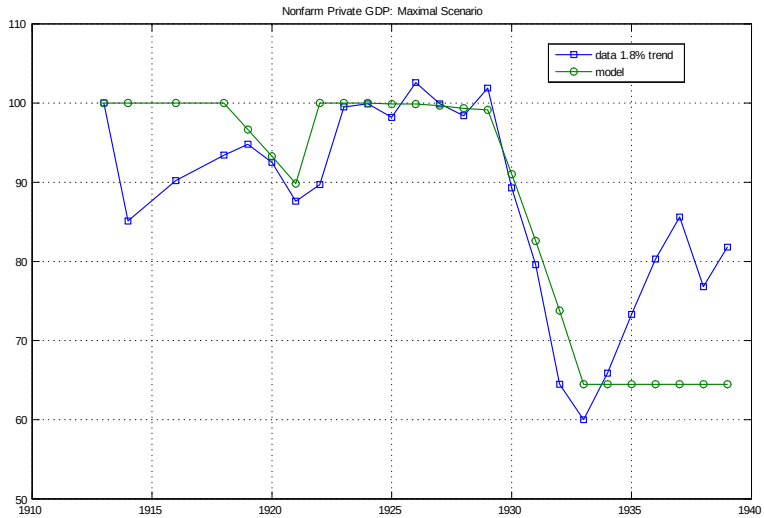

Figure 4b: Output in the maximal scenario

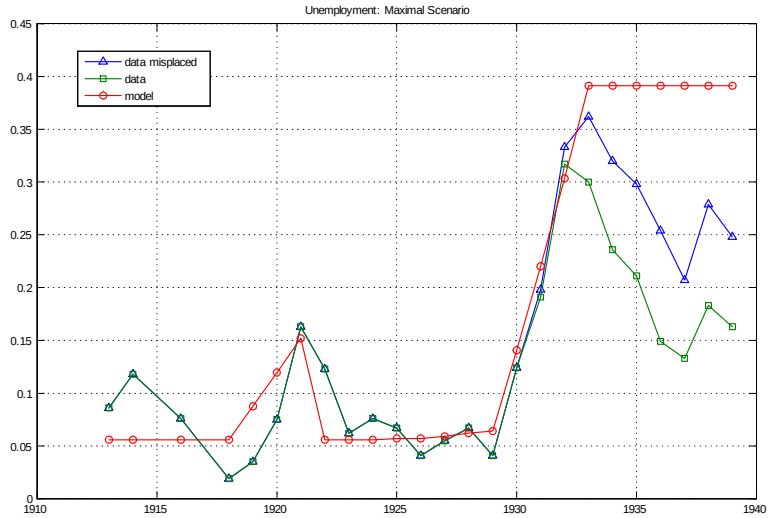

Figure 4c: Unemployment in the maximal scenario

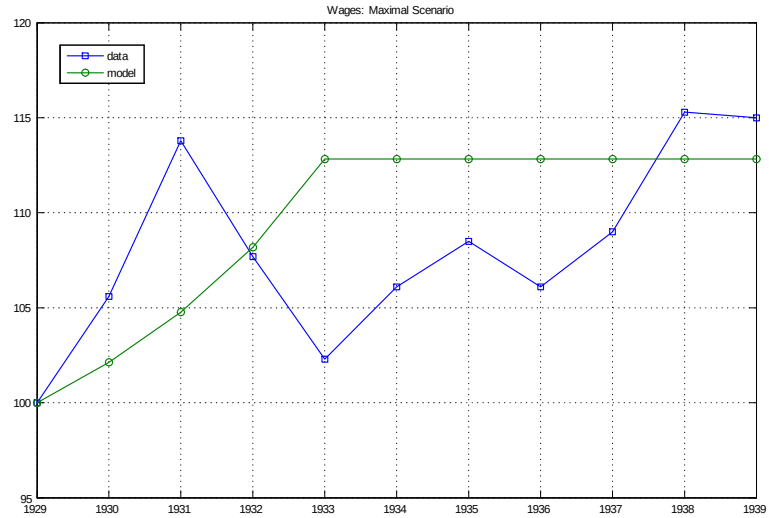

Figure 4d: Wages in the maximal scenario

8 Appendix

8.1 Derivation of Envelope Condition (11)

First, differentiate $V_k^J(h_k)$ from (5) with respect to h_k to obtain

$$\frac{\partial V_k^J(h_k)}{\partial h_k} = \frac{p(y_k)}{P}\frac{\partial y_k}{\partial h_k} + y_k \frac{\partial p(y_k)/P}{\partial y_k}\frac{\partial y_k}{\partial h_k} - w_k - h_k\frac{\partial w_k}{\partial h_k} + \frac{1}{1+r}\frac{\partial V_k^J(h_k')}{\partial h_k}\frac{\partial h_k'}{\partial h_k}$$

Next, substitute in for $\frac{\partial y_k}{\partial h_k} = A$ and $\frac{\partial h_k'}{\partial h_k} = 1-\chi$ to get

$$\frac{\partial V_k^J(h_k)}{\partial h_k} = A\frac{p(y_k)}{P} + y_k A\frac{\partial p(y_k)/P}{\partial y_k} - w_k - h_k\frac{\partial w_k}{\partial h_k} + \frac{1-\chi}{1+r}\frac{\partial V_k^J(h_k')}{\partial h_k}$$

Now rearrange slightly, factoring out $A\frac{p(y_i)}{P}$:

$$\frac{\partial V_k^J(h_k)}{\partial h_k} = A\frac{p(y_k)}{P}\left[1 + \frac{\partial p(y_k)/P}{\partial y_k}\frac{y_k}{p(y_k)/P}\right] - w_k - h_k\frac{\partial w_k}{\partial h_k} + \frac{1-\chi}{1+r}\frac{\partial V_k^J(h_k')}{\partial h_k}$$

Finally, using that the price elasticity of demand can be expressed as $\frac{\partial p(y_k)/P}{\partial y_k}\frac{y_k}{p(y_k)/P} = -\frac{1}{\sigma}$ yields (11).

8.2 Deriving the IB wage curve

Ignoring the constant terms for now, the first order linear differential equation (16) becomes:

$$w_I(h_I) = \beta\left[\frac{\sigma-1}{\sigma}A\frac{p(y_I)}{P} - h_I\frac{\partial w_I}{\partial h_I}\right] \tag{37}$$

Begin by focusing attention on the homogenous equation

$$\frac{w_I(h_I)}{\beta h_I} + \frac{\partial w_I}{\partial h_I} = 0$$

which has solution

$$w_I(h_I) = K h_I^{-\frac{1}{\beta}} \tag{38}$$

where K is a constant of integration. Next, assume that $K = K(h_I)$ and take the derivative of both sides of (38) to obtain

$$\frac{\partial w_I}{\partial h_I} = -\frac{1}{\beta}K(h_I)\,h_I^{-\frac{1}{\beta}-1} + h_I^{-\frac{1}{\beta}}\frac{\partial K}{\partial h_I} \tag{39}$$

Next, substitute (38) and (39) back into (37) to obtain

$$\frac{\partial K}{\partial h_I} = \frac{\sigma-1}{\sigma}A\frac{p(y_I)}{P}h_I^{\frac{1}{\beta}-1}$$

where $\frac{p(y_I)}{P} = \left(\frac{y_I}{I}\right)^{-\frac{1}{\sigma}} = \left(\frac{Ah_I}{I}\right)^{-\frac{1}{\sigma}}$ so that

$$\frac{\partial K}{\partial h_I} = \frac{\sigma - 1}{\sigma} A \left(\frac{A}{I}\right)^{-\frac{1}{\sigma}} h_I^{\frac{1}{\beta}-1-\frac{1}{\sigma}} \tag{40}$$

Integrating both sides of (40) yields

$$K = \frac{\sigma - 1}{\sigma} A \left(\frac{A}{I}\right)^{-\frac{1}{\sigma}} \int h_I^{\frac{1}{\beta}-1-\frac{1}{\sigma}} dh_I$$

which has solution

$$K = \frac{\sigma - 1}{\sigma} A \left(\frac{A}{I}\right)^{-\frac{1}{\sigma}} \frac{1}{\frac{1}{\beta} - \frac{1}{\sigma}} h_I^{\frac{1}{\beta}-\frac{1}{\sigma}} + J$$

which reduces to

$$K = \beta \frac{\sigma - 1}{\sigma - \beta} A \frac{p(y_I)}{P} h_I^{\frac{1}{\beta}} + J \tag{41}$$

Substitute (41) back into (38) to obtain

$$w_I(h_I) = \beta \frac{\sigma - 1}{\sigma - \beta} A \frac{p(y_I)}{P} + J h_I^{-\frac{1}{\beta}}$$

Assuming that $\lim_{h_I \to 0} h_I w(h_I) = 0$ pins down the constant $J = 0$. Adding back the constant terms gives the solution to the differential equation (16):

$$w_I(h_I) = (1 - \beta) \frac{r V_I^U}{1 + r} + \beta \frac{\sigma - 1}{\sigma - \beta} A \frac{p(y_I)}{P}$$

8.3 Derivation of IB firm's Euler equation (18)

Differentiating (17) with respect to h_I to obtain:

$$\frac{\partial w_I}{\partial h_I} = \beta \frac{\sigma - 1}{\sigma - \beta} A \frac{\partial p(y_I)/P}{\partial y_I} \frac{\partial y_I}{\partial h_I}$$

Using that $\frac{\partial y_I}{\partial h_I} = A$ and multiplying both sides by h_I yields

$$h_I \frac{\partial w_I}{\partial h_I} = \beta \frac{\sigma - 1}{\sigma - \beta} A \frac{\partial p(y_I)/P}{\partial y_I} y_I$$

Multiplying the right-hand side by $\frac{p(y_I)/P}{p(y_I)/P}$ and using that the price elasticity of demand may be expressed as $\frac{\partial p(y_I)/P}{\partial y_I} \frac{y_I}{p(y_I)/P} = -\frac{1}{\sigma}$ gives

$$h_I \frac{\partial w_I}{\partial h_I} = -\frac{\beta}{\sigma} \frac{\sigma - 1}{\sigma - \beta} A \frac{p(y_I)}{P}$$

Finally, substitute this last expression for $h_I \frac{\partial w_I}{\partial h_I}$ into the firm's Euler equation (12) yields (18).

8.4 Derivation of CB firm's Euler equation

Begin by differentiating the collective bargaining wage curve with respect to h_C:

$$\frac{\partial w_C}{\partial h_C} = \beta A \frac{\partial p\left(y_C\right)/P}{\partial y_C} \frac{\partial y_C}{\partial h_C}$$

Using that $\frac{\partial y_C}{\partial h_C} = A$ and multiplying both sides by h_C yields

$$h_C \frac{\partial w_C}{\partial h_C} = \beta A \frac{\partial p\left(y_C\right)/P}{\partial y_C} y_C$$

Expanding by $\frac{p(y_C)/P}{p(y_C)/P}$ and using that the price elasticity of demand can be expressed as $-\frac{1}{\sigma}$ yields

$$h_C \frac{\partial w_C}{\partial h_C} = -\frac{\beta}{\sigma} A \frac{p\left(y_C\right)}{P}$$

8.5 Deriving the reservation wage:

First, using (2) and (**??**) yields:

$$\frac{r}{1+r} V_k^U = \frac{r+\chi}{r+f\left(\theta_k\right)+\chi} b + \frac{f\left(\theta_k\right)}{r+\chi+f\left(\theta_k\right)} w_k$$

where $k \in \{I, C\}$. Next, substitute out for equilibrium wages w_k from (20) and (28) to obtain expressions for $\frac{r}{1+r} V_k^U$ as a function of tightness θ_k:

$$\begin{aligned}
\frac{r}{1+r} V_I^U &= b + \frac{\beta}{1-\beta} \kappa \theta_I \\
\frac{r}{1+r} V_C^U &= \frac{r+\chi}{r+\chi-f\left(\theta_C\right)\frac{\beta}{\sigma-1}} b + \frac{f\left(\theta_C\right)\frac{\beta}{\sigma-1}}{r+\chi-f\left(\theta_C\right)\frac{\beta}{\sigma-1}} \frac{\kappa}{q\left(\theta_C\right)} \left(\frac{r}{1-\beta}\sigma+\chi\right)
\end{aligned}$$

Finally, use that agents must be indifferent between searching in the two sectors, so that $V_I^U = V_C^U$. This yields expression (32) relating equilibrium tightnesses in the two sectors.

8.6 Deriving the Equilibrium Condition

First, substitute out for $\frac{rV_C^U}{1+r}$ and $\frac{rV_I^U}{1+r}$ to obtain:

$$\begin{aligned}
A^{1-\sigma} &= (1-\mu)\left\{\frac{\sigma-\beta}{\sigma-1}\left[b + \frac{\beta}{1-\beta}\kappa\theta_I + \frac{1}{1-\beta}\left(r+\chi\right)\frac{\kappa}{q\left(\theta_I\right)}\right]\right\}^{1-\sigma} \\
&\quad +\mu\left\{\frac{\sigma}{\sigma-1}\left[\begin{array}{c} \frac{r+\chi}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}} b + \frac{f(\theta_C)\frac{\beta}{\sigma-1}}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}} \frac{\Phi_V}{q(\theta_C)}\left(\frac{r}{1-\beta}\sigma+\chi\right) \\ +\frac{\Phi_V}{q(\theta_C)}\left(\frac{1}{1-\beta}r+\chi\right) \end{array}\right]\right\}^{1-\sigma}
\end{aligned}$$

Then, substitute out for θ_I using (32) to obtain an expression for equilibrium θ_C.

$$A^{1-\sigma} = (1-\mu)\left\{\frac{\sigma-\beta}{\sigma-1}\left[\begin{array}{c}\left(\frac{f(\theta_C)\frac{\beta}{\sigma-1}}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}}+1\right)b \\ +\frac{f(\theta_C)\frac{\beta}{\sigma-1}}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}}\frac{\kappa}{q(\theta_C)}\left(\frac{r}{1-\beta}\sigma+\chi\right) \\ +\frac{1}{1-\beta}(r+\chi)\frac{\kappa}{s}\left[\frac{1-\beta}{\beta}\frac{f(\theta_C)\frac{\beta}{\sigma-1}}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}}\frac{1}{\kappa}\left\{b+\frac{\kappa}{q(\theta_C)}\left(\frac{r}{1-\beta}\sigma+\chi\right)\right\}\right]^{\eta}\end{array}\right]\right\}^{1-\sigma}$$

$$+\mu\left\{\frac{\sigma}{\sigma-1}\left[\begin{array}{c}\frac{r+\chi}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}}b+\frac{f(\theta_C)\frac{\beta}{\sigma-1}}{r+\chi-f(\theta_C)\frac{\beta}{\sigma-1}}\frac{\kappa}{q(\theta_C)}\left(\frac{r}{1-\beta}\sigma+\chi\right) \\ +\frac{\kappa}{q(\theta_C)}\left(\frac{1}{1-\beta}r+\chi\right)\end{array}\right]\right\}^{1-\sigma}$$

8.7 Which Bargaining Institution?

One question which arises naturally is whether already employed workers will choose to switch to collective bargaining when it becomes legal.[48] That is, we wish to know whether a given firm's workers would find it optimal to organize and begin to bargain collectively with their current employer once it becomes legally possible to implement their collective bargaining threat point.

To answer this question, we compare workers' values of employment under collective and individual bargaining. Employed workers should prefer to switch to collective bargaining if their surplus exceeds that under individual bargaining. Because the CB surplus is essentially a share of the firm's monopoly rents, switching to collective bargaining will turn out to be attractive when monopoly power is high enough.

Formally, if the switch to collective bargaining involves an increase in employment, then workers will choose to switch whenever the value of bargaining collectively is larger, $V_C^E \geq V_I^E$. If the switch to collective bargaining involves layoffs, so that $h_C < h_I$, however, then we must also consider the welfare of the laid-off workers. We assume that any layoffs when switching bargaining regimes are random, so that the (risk-neutral) workers will prefer to switch whenever it gives them higher expected utility. The probability of continuing after the switch is $\min\left\{\frac{h_C}{h_I},1\right\}$, while the probability of being laid off is $1-\min\left\{\frac{h_C}{h_I},1\right\}$. The gain to those retaining their jobs is $V_C^E - V_I^E$, while the loss to the laid off is $V_I^E - V_I^U$. Hence, the expected utility from switching is positive if:

$$\min\left\{\frac{h_C}{h_I},1\right\}\left(V_C^E - V_I^E\right) - \left(1-\min\left\{\frac{h_C}{h_I},1\right\}\right)\left(V_I^E - V_I^U\right) \geq 0 \qquad (42)$$

Alternatively, one can assume that layoffs are non-random, i.e. that workers know in advance who would be laid off in the event of a switch in bargaining

[48] Recall that under directed search, *unemployed* workers are indifferent between the two bargaining regimes.

regime. In this case, condition (42) amounts to it being possible for the continuing workers to make compensatory transfer payments to the laid-off, since the gains to stayers exceed the losses to the laid off.

8.7.1 Case I: $\frac{h_C}{h_I} \geq 1$

First consider the case that a switch to collective bargaining would not involve layoffs among currently employed workers, i.e. that $\frac{h_C}{h_I} \geq 1$. In this case, the condition for switching (42) reduces to $w_C > w_I$, which holds whenever demand elasticity is low enough. Precisely, currently employed workers should be in favor of switching to collective bargaining whenever:

$$\sigma < \frac{(1-\beta)\, b + \beta\kappa\theta_I + (1-\beta)\, \frac{\kappa}{q(\theta_C)}\chi + (r+\chi)\, \frac{\kappa}{q(\theta_I)}}{(r+\chi)\, \frac{\kappa}{q(\theta_I)} - \frac{\kappa}{q(\theta_C)} r}$$

where we have used that unemployed workers must always be indifferent about which segment to search in. In addition, recall that there is a continuum of firms, so that workers at each firm do not consider the impact of their decision on μ.

8.7.2 Case II: $\frac{h_C}{h_I} < 1$

Now the condition for switching to CB (42) becomes:

$$\frac{h_C}{h_I}\left(V_C^E - V_I^E\right) - \left(1 - \frac{h_C}{h_I}\right)\left(V_I^E - V_I^U\right) \geq 0$$

which reduces to

$$\frac{h_C}{h_I} V_C^E - V_I^E + V_I^U \left(1 - \frac{h_C}{h_I}\right) \geq 0$$

Substituting out for the values of employment and unemployment using the steady state version of (2) and (30) can again be used to yield a condition on σ.

$$\begin{aligned} & \frac{h_C}{h_I}(1+r)\frac{\beta}{\sigma-1}\frac{\kappa}{q(\theta_C)}\left(\frac{r}{1-\beta}\sigma + \chi\right) \\ & -(1+r)\frac{\beta}{1-\beta}(r+\chi)\frac{\kappa}{q(\theta_I)} + \chi\frac{rV_I^U}{1+r}\left(1 - \frac{h_C}{h_I}\right) + \frac{\beta}{\sigma-1}\frac{h_C}{h_I} r V_I^U \\ \geq \quad & 0 \end{aligned}$$

When $\mu = 0$, the critical demand elasticity is 15.45, so that workers prefer collective bargaining if markups are less than 3.5%.[49] [At critical demand elasticity, $u_I = u_C$ as well.] The graph below shows that the critical values of demand elasticity for larger values of μ (i.e. when some fraction of workers is already bargaining collectively) are quite similar, never falling below $\sigma = 15$.

[49] Recall that the IB markup is given by $\frac{\sigma-\beta}{\sigma-1}$.