The Falling Labor Share Dampens Unemployment Fluctuations

Jonathon Hazell*

December 2019

The labor share fell in the US and worldwide after the 1980s. This paper argues the falling labor share dampens unemployment fluctuations, in two steps. First, the paper studies a class of labor search models with capital. The falling labor share lowers the sensitivity of unemployment to labor demand shocks, regardless of whether rising capital or rising rents govern the labor share. The peak-to-trough fall in the US labor share lowers the sensitivity of unemployment to labor demand shocks by 30%. Second, the paper provides evidence for dampening. I exploit labor share variation within industries and between regions, to show that low labor share markets are less sensitive to the aggregate business cycle. Then I identify variation in the labor share using the passage of statewide reforms. After these reforms pass, the labor share falls, and state unemployment becomes less sensitive to aggregate business cycles.

*Hazell: Massachusetts Institute of Technology, Department of Economics (email: jhazell@mit.edu). I thank Iván Werning, Daron Acemoglu, Jonathan Parker and Emi Nakamura for invaluable support and guidance. I also thank Dan Greenwald, Erik Hurst, Gwen Jing, Chen Lian, Christina Patterson and Jón Steinsson; as well as participants at the MIT Macro Lunch, the MIT Labor Lunch and the Berkeley Macro Colloquium for their comments; and the Becker-Friedman Institute at the University of Chicago for its hospitality.

1 Introduction

After the 1980s, the share of output paid to workers—often termed the labor share—fell in the United States and worldwide. Consider two leading explanations. In one explanation, the capital share rose. Changes in technology or falling cost of capital led to capital deepening (Karabarbounis and Neiman, 2013; Acemoglu and Restrepo, 2019). In a second explanation, the rent share rose. Due to greater product or labor market power, firms' sales in excess of their marginal costs increased (De Loecker, Eeckhout, and Unger, 2018; Barkai, 2019). Both capital and rents seem to have contributed to the falling labor share. But with existing data, measuring their relative importance is hard (Karabarbounis and Neiman, 2018).

This paper asks how the falling labor share affects unemployment fluctuations. Though the *causes* of the falling labor share are manifold, the *consequences* may be more straightforward. I argue that the falling labor share should dampen unemployment fluctuations—if either rents or capital caused the fall. I make two contributions. First, the paper studies a canonical labor search model, which I augment with sunk capital. In the model, the falling labor share reflects some combination of rising rents and rising capital. When the labor share falls, due to either capital or rents, unemployment responds less to labor demand shocks. Second, I present some empirical evidence of dampening. The paper documents a comovement consistent with the theory: employment in high labor share markets is more sensitive to aggregate business cycles. Then I study the passage of two statewide reforms, which identify changes in the labor share due to either rents or capital. After the passage of both reforms, the labor share falls, and the sensitivity of state unemployment to aggregate business cycles also falls.

In its first part, the paper develops a model that links the labor share to unemployment. I study a Diamond-Mortensen-Pissarides-style labor search model. This model is a natural starting point, being the standard model of unemployment fluctuations. Firms match with workers in frictional labor markets, and then bargain over wages. There is free entry in vacancy creation. The sole departure from the standard model is *sunk capital*.[1] Firms make irreversible investments. Firms purchase capital before trying to match with workers, and cannot resell the capital if they fail to match. As a consequence, firms become the owners of the capital stock. Firms' profits then include rents and the return to capital. Sunk capital is the empirically relevant assumption—reselling used capital or reversing investments is typically costly (Lanteri, 2018).[2]

In the model, changes in the labor share come from two sources: either rising capital or

[1] The standard model either abstracts from capital, or introduces frictionless capital rental markets. In either case, changes in the capital share do not affect unemployment dynamics (Pissarides, 2000).

[2] I develop an extension of the benchmark model which replaces the sunk capital assumption with capital adjustment costs. The two formulations are equivalent when capital adjustment costs are large.

rising rents. The rent share rises if worker bargaining power declines, because wages then fall relative to output per worker. The capital share rises if changes in either the cost of capital or the form of technology lead to capital deepening. So, the model allows several forces—each seen as important by past work—to affect the labor share.

The model predicts that after a shock to labor demand, unemployment responds by less if the labor share is low. By lowering the labor share, rising rents and rising capital both affect unemployment fluctuations through a common mechanism. The result builds on Hagedorn and Manovskii (2008) and Ljungqvist and Sargent (2017). Two effects combine to create dampening. First, there is a *labor leverage* effect.[3] When the labor share is high, the profit share is low. So, in proportionate terms, profits are more sensitive to changes in output per worker. Put differently, profits are the residual claim on output per worker, after deducting wages. When the profit share is low, the residual claim becomes more levered with respect to output per worker. In the model, changes in output per worker reflect labor demand. The second effect comes from *free entry*: when profits increase, firms create jobs in order to realize these profits, and unemployment falls. These two effects combine to generate dampening. Given labor leverage, the falling labor share lowers the sensitivity of profits to labor demand. Given free entry, as profits become less sensitive to labor demand, so too does unemployment.

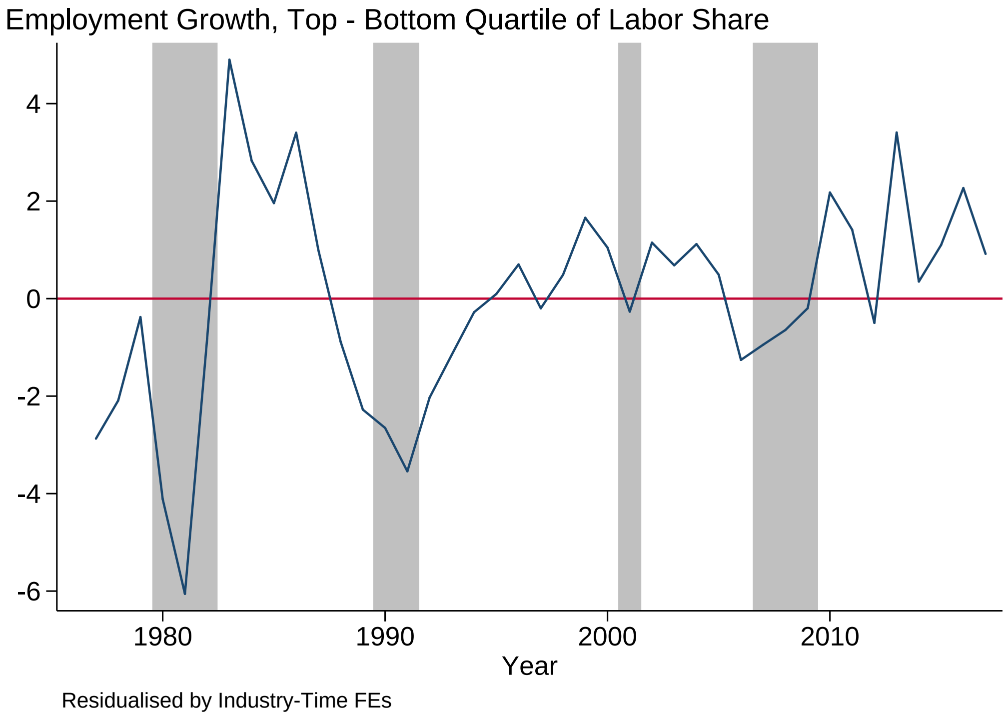
The assumption of sunk capital is crucial to the result. Since firms own the capital, profits include the return to capital as well as rents. So increases in either capital or rents raise the profit share, reduce labor leverage, and lead to the same kind of dampening. I show the same dampening mechanism arises in a broad range of labor search models, for example with product market power, capital adjustment costs, sticky prices, decreasing returns to scale or various wage setting protocols. A back of the envelope exercise suggests that dampening is quantitatively important. Feeding the peak-to-trough fall in the US labor share into the model reduces the sensitivity of unemployment to labor demand shocks by 30%.

In its second part, the paper provides new evidence of dampening. I study the sensitivity of employment, in region-by-industry labor markets, to aggregate unemployment. Region-by-industry data is helpful for two reasons. First, we can add industry-time fixed effects to the regressions. Some industries, such as durable manufacturing, have high labor shares and are cyclical for unrelated reasons. Industry-time fixed effects control for such differences. Second, conditional on industry composition, I document that proxies for rents and capital—such as minimum wages, unionization rates, and regional taxes on capital—are the main correlates of regional labor shares. So, regional labor shares are governed by the forces that the model is designed to capture.

I document a comovement consistent with the theory. Employment in high labor share mar-

[3] See Donangelo, Gourio, Kehrig, and Palacios (2019) for an earlier use of this term.

Figure 1: High Labor Share Markets Are Cyclical



Notes: this graph studies annual employment growth and labor shares at the labor market level, from the Quarterly Census of Employment and Wages and the Bureau of Economic Analysis' Regional Economic Accounts. Labor markets are industry sectors within states, excluding the financial and government sectors. Labor shares are compensation / (compensation + gross value added). The graph plots the difference in employment growth between labor markets in the top and bottom quartile of labor shares, in each year, after controlling for industry-time fixed effects.

kets is more sensitive to aggregate business cycles, than low labor share markets in the same industry but a different region. For example, when aggregate unemployment rises, manufacturing employment contracts more in Michigan than in Texas. Manufacturing in Michigan has a high labor share, manufacturing in Texas has a lower labor share. Figure 1 depicts the result. The figure plots employment growth for markets with labor shares in the top quartile, relative to markets with labor shares in the bottom quartile. The figure residualizes employment growth against industry-by-time fixed effects, to control for industry cyclicality. High labor share markets grow more during booms and contract more during recessions. The comovement is quantitatively large and holds across industries and time periods. Similar results hold when studying identified monetary or oil shocks.

However, the comovement may reflect omitted variables. Many factors other than labor shares contribute to regional cyclicality.

The paper then identifies variation in the labor share with a difference-in-differences framework. I study the passage of two statewide reforms. These reforms isolate falls in the labor share due to either worker bargaining power or the cost of capital. After the passage of both reforms, the labor share falls, and the sensitivity of state unemployment to aggregate business cycles also falls. So there is dampening—if either rents or capital cause the labor share to change.

The first statewide reform is right to work laws (Farber, 1984). These laws reduce the ability of workers to unionize, and therefore lower worker bargaining power. The identification assumption is that right to work laws did not pass at the same time as other factors affecting states' sensitivity to aggregate business cycles. The absence of pre-trends in the labor share and robustness to state-specific trends supports this assumption. The second statewide reform is property tax changes associated with school financing reforms (Hoxby, 2001). In the United States, localities fund schooling through property taxes. Various legal challenges to school financing led to changes in property taxes. Non-residential property taxes are typically levied on both structures and equipment investment, so affect the cost of capital (Lincoln Institute of Land Policy, 2015). Previous work argues that the timing of school finance reforms is quasi-random (e.g. Jackson, 2018; Lafortune, Rothstein, and Schanzenbach, 2018). This paper appears to be the first to use school financing reforms to identify changes in the cost of capital.

Finally, we briefly study worldwide evidence. We find that in countries with trend declines in their labor shares also have trend falls in unemployment volatility.

Related Literature. There is a large and growing literature on the causes of the falling labor share. The labor share fell starting from the late 1980s through to the 2010s, both in the United States and worldwide. Though papers disagree on its causes, there is some consensus that the fall in the US was large, ranging from 3 to 6 percentage points depending on the measure (Elsby et al., 2013; Rognlie, 2018).[4] Consider two leading explanations. First, the falling labor share could reflect a rising capital share. Automation may have encouraged capital-intensive production (Acemoglu and Restrepo, 2019). Falling relative investment prices may have led to capital deepening (Karabarbounis and Neiman, 2013). Intangible capital has risen in recent decades (Koh, Santaeulalia-Llopis, and Zheng, 2016). Second, the falling labor share could reflect a rising rent share. Several papers make this case, including De Loecker et al. (2018) and Barkai (2019).[5] These papers often assume that rents arise from product and not from labor market power, though in most cases either interpretation is consistent with the data. Both rents and capital likely matter for the falling labor share. Measuring the relative contribution of each factor to

[4] Gutiérrez and Piton (2019) argue that labor shares have been stable outside the United States over this time period, after accounting for the housing sector.

[5] An incomplete list of papers arguing that rents have risen, and proposing explanations, include Rognlie (2016), Hall (2018), Bornstein (2018), Traina (2018), Edmond, Midrigan, and Xu (2018), Farhi and Gourio (2018), Eggertsson, Robbins, and Wold (2018) and Covarrubias, Gutiérrez, and Philippon (2019). Berger, Herkenhoff, and Mongey (2019) argue employer concentration has not contributed to rising rents. Elsby et al. (2013) find evidence that trade and unionization rates explain industry labor shares, which may also relate to rents.

the falling labor share is challenging, and varies substantially across different, but reasonable, assumptions (Karabarbounis and Neiman, 2018).

Relative to this literature there are two contributions. In the primary contribution, I try to make progress on understanding the consequences of the falling labor share, even though the causes of the fall are manifold.[6] According to this paper, unemployment fluctuations should become smaller. In a secondary contribution, I help to understand the causes of the falling labor share, using statewide reforms. With the first statewide reform, I provide regional evidence that a lower cost of capital raises the labor share. Karabarbounis and Neiman (2013) present cross-country evidence for the same idea. With the second statewide reform, I show that lower unionization lowers the labor share. This evidence complements Elsby, Hobijn, and Şahin (2013), who suggest some role for trade unions in explaining the falling labor share.

A previous literature uncovers the importance of labor leverage in the standard Diamond-Mortensen-Pissarides labor search model. Hagedorn and Manovskii (2008) and Ljungqvist and Sargent (2017) are key papers making this argument.[7] But the standard model either omits capital, or include frictionless capital rental markets. Changes in the labor share are driven only by rents, and capital has minimal effects on the dynamics of unemployment (Pissarides, 2000). This paper contributes by augmenting the standard model with sunk capital, similarly to Acemoglu and Shimer (1999) and Hornstein, Krusell, and Violante (2007). I then argue that the standard model makes the same prediction about the effect of the falling labor share on unemployment fluctuations, regardless of whether rents or capital is the cause.[8]

This paper also contributes to empirical work on the effects of the falling labor share. For example, Schoefer (2015) shows that employment in low labor share industries is less sensitive to business cycles. Donangelo et al. (2019) show that low labor share firms have less cyclical operating profits and a lower expected return on equity. The empirical contribution of this paper is twofold. First, I provide evidence that low labor share regions are less sensitive to business cycles, while controlling for industry cyclicality. Second, I identify variation in labor shares due to either worker bargaining power or the cost of capital, using statewide reforms.

[6] A literature studies how changes in the labor share affect the *level* of unemployment, contrasting the experience of Anglo-Saxon and European labor markets in the 1970s through 1990s (e.g. Blanchard, 1997). Instead, I focus on how the labor share affects the *sensitivity* of unemployment to labor demand shocks.

[7] Elsby and Michaels (2013) extend the insight to a heterogenous firm model. Schoefer (2015) argues for a different mechanism through which high labor shares can increase unemployment fluctuations, via the interaction between incumbent wage rigidity and financial frictions.

[8] Our paper therefore relates to Hagedorn, Manovskii, and Mitman (2019), who also test core predictions of the Diamond-Mortensen-Pissarides model—in their case, using variation in unemployment benefits.

2 Model: Falling Labor Share and Unemployment Fluctuations

This section develops a model to link the labor share to unemployment fluctuations. I study the Diamond-Mortensen-Pissarides model. This model, as the standard tool for analyzing unemployment fluctuations, is a natural starting point. I enrich the model with sunk capital and show that in the model, the labor share is governed by a combination of capital and rents. The model predicts that if either the rent or capital share rises, unemployment becomes less sensitive to labor demand shocks. By lowering the labor share, rents and capital act through a common channel.

2.1 Model Setup

2.1.1 Environment

I study a standard Diamond-Mortensen-Pissarides (DMP) model, with rigid wages as in Hall (2005). Time is discrete. Business cycles are driven by labor productivity, A_t, which follows a driftless random walk.[9] So, A_t satisfies

$$A_t = A_{t-1} + \varepsilon_t \quad \varepsilon_t \sim N(0, \sigma^2). \tag{1}$$

A_t is a measure of labor demand.[10]

2.1.2 Workers

Workers behave as in the standard DMP model. There is a unit measure of workers in the labor market. n_t are employed. u_t are unemployed and searching for work. Workers are risk neutral, and derive utility from consumption only. Workers have discount factor $\beta \in (0,1)$ over future utility flows. Workers consume their wage in the periods that they are employed, and receive a flow payoff z from unemployment.

2.1.3 Frictional Labor Market

The model of search frictions in the labor market also follows the standard DMP model. At the end of the prior period $t-1$, an exogenous share s of the n_{t-1} employed workers separate from

[9] I make this assumption for simplicity, but is a reasonable approximation because labor productivity is highly persistent (Shimer, 2005).

[10] If there is nominal rigidity, shocks other than productivity may affect labor demand, such as monetary shocks For simplicity, we focus on productivity in the baseline model, and discuss a generalization to nominal rigidity at the end of the section.

their jobs. So at the start of period t, u_t unemployed workers search for jobs, where u_t satisfies

$$u_t = 1 - (1 - s)\, n_{t-1}. \tag{2}$$

Firms post v_t vacancies, in total, to match with the unemployed workers. In period t, total matches are given by a matching function $M(u_t, v_t) = v_t^{\alpha} u_t^{1-\alpha}$. After a firm and worker match, the firm produces output and pays a wage to the worker.

The key state variable governing the labor market is labor market tightness

$$\theta_t \equiv v_t / u_t. \tag{3}$$

The job finding rate of an unemployed worker is $f(\theta_t) = M/u_t = \theta_t^{1-\alpha}$. The job finding rate is increasing in θ_t—in a tight labor market, workers find jobs easily. The vacancy filling rate is $q(\theta_t) = M/v_t = \theta_t^{-\alpha}$. The vacancy filling rate is decreasing in θ_t—in a tight labor market, firms cannot find workers easily. Workers start working in the same period that they are hired.

Tightness θ_t measures the state of the labor market. Tightness and unemployment move inversely. When the labor market is tight, firms hire many workers and unemployment falls.

2.1.4 Wages

Wages are rigid, following the version of the DMP model in Hall (2005). For each period of a match, the firm pays the worker an exogenous and constant wage $\bar{w}$. Since $\bar{w}$ does not vary, there is wage rigidity.

$\bar{w}$ is in the *bargaining set* of the firm and the worker—between the minimum wage acceptable to the worker, and the maximum wage acceptable to the firm. So, $\bar{w}$ can be the outcome of a wage bargaining game between the worker and the firm. $\bar{w}$ must satisfy two conditions. First, $\bar{w}$ is greater than the worker's flow payoff from unemployment. Second, $\bar{w}$ is low enough that the firm makes non-negative profits from the match. Given these two conditions, the wage must satisfy

$$z \le \bar{w} \le y_t - c\left[1 - \beta(1 - s)\right], \tag{4}$$

that is, the wage is greater than the worker's flow value of unemployment, and low enough to ensure a profit for the firm.[11]

I do not model the details of the wage bargaining game that determines $\bar{w}$. In the analysis to come, changes in $\bar{w}$ will reflect exogenous changes in worker bargaining power.

[11] Partial wage flexibility, from wage bargaining protocols such as Hall and Milgrom (2008) or Blanchard and Gali (2010), deliver similar results and intuition, as I will discuss at the end of the section. Pissarides (2009) points out that rigidity in the wage for new hires is relevant. Hazell and Taska (2019) provide evidence for wage rigidity on this margin.

2.1.5 Firms and Sunk Capital

There is sunk capital. This feature is the point of departure from the standard Hall-DMP model.

There is a large measure of risk neutral firms, with discount factor $\beta \in (0,1)$, who maximize expected profits. Firm i is inactive until it buys capital k_{it}, at exogenous price p. The firm can then post a vacancy. If the firm fills the vacancy with a worker, the worker operates the capital. A vacancy filled at time t produces output $A_{t+j} f(k_{it})$ in each subsequent period $t+j$, and also pays a wage $\bar{w}$ to the worker. f is strictly increasing, concave, and satisfies the usual Inada conditions. The firm sells the output to consumers, in a competitive market, at a price normalized to unity. The match is destroyed with exogenous probability s in each period, in which case the worker becomes unemployed and the firm becomes inactive. If the firm fails to fill the vacancy, the capital fully depreciates.[12]

I now describe the firm's problem in this setting. The firm selects capital in order to maximize profits per vacancy. The value of an unfilled vacancy depends on the chance that a vacancy is filled, and the value of a filled vacancy, given the capital that firm i has sunk into the vacancy. So, if $V(A_t, k_{it}, \theta_t)$ is the value of an unfilled vacancy posted at time t and $J(A_t, k_{it})$ is the value in period t of a vacancy that is filled in period t, V is given by

$$V(A_t, k_{it}, \theta_t) = q(\theta_t) J(A_t, k_{it}). \tag{5}$$

Unfilled vacancies have no continuation value because capital is destroyed if the match is not successful. The value of a filled vacancy to firm i is the flow profit, and the continuation value, after deducting the risk of job destruction. J is given by

$$J(A_t, k_{it}) = A_t f(k_{it}) - \bar{w} + \beta(1-s)\mathbb{E}_t J(A_{t+1}, k_{it}). \tag{6}$$

Then the profit from buying capital and posting a vacancy is

$$\pi(A_t, k_{it}, \theta_t) = V(A_t, k_{it}, \theta_t) - p k_{it}.$$

Firm i optimally chooses capital

$$k_t^* = \arg\max_{k_{it}} [\pi(A_t, k_{it}, \theta_t)], \tag{7}$$

which has a unique interior solution for any firm i.

Let me highlight two features of the model. First, capital is sunk, so firms become the own-

[12] This model of sunk capital is similar to Acemoglu and Shimer (1999) and Hornstein, Krusell, and Violante (2007).

ers of capital. Firms purchase capital before posting a vacancy. The investment is irreversible. Firms cannot resell the capital if they fail to match. As a consequence, firms own the capital stock. As the owners, firms receive the return from the capital that they have sunk into vacancies—so, firms' profits include the return to capital.[13]

Sunk capital differs from the standard DMP model. The standard DMP model assumes frictionless rental or resale markets for capital.[14] In the standard model, firms do not own capital, and firms' profits do not include the return to capital. Instead, firms rent capital from households after a match has been successfully filled, and pay households the return on capital.

Sunk capital may be a more reasonable assumption than frictionless rental markets, even in this stylized setting. In the data, reselling used capital is costly in the cases where it is possible (e.g. Lanteri, 2018). But either renting capital or reselling used capital is not common (Lian and Ma, 2018).[15]

A second important feature of the model in this paper is that—as in the standard DMP model—there is no product market power. So, the model abstracts from the role of rising product market power in increasing rents and lowering the labor share. Rents are determined in the labor market. In a later extension, I generalize the model to include product market power. The main results and intuition do not change.

2.1.6 Free Entry and Equilibrium

There is free entry in vacancy posting. Vacancy posting continues until the labor market becomes tight. Then vacancies are hard to fill, driving the ex ante value of vacancies to zero. Free entry implies

$$\pi(A_t, k_{it}, \theta_t) \geq 0 \quad v_{it} \geq 0 \tag{8}$$

for all firms i, and for all t, with complementary slackness. When labor productivity rises, job creation becomes more profitable. Firms create many vacancies and the labor market tightens.

An equilibrium is a collection of stochastic processes $\{v_t, n_t, u_t, \theta_t, k_{it}\}_{t=0}^{\infty}$ such that:

1. u_t, v_t and θ_t satisfy the law of motion for unemployment (2) and the definition of labor market tightness (3).

2. There is a wage $\bar{w}$ in the bargaining set (4).

[13]This paper defines profits as the sum of rents and the return to capital, as in the convention of Farhi and Gourio (2018) and others.

[14]This formulation is equivalent to omitting capital, and assuming a linear production function in labor only (Pissarides, 2000).

[15]In an extension, I replace the sunk capital assumption with capital adjustment costs. There is also evidence for capital adjustment costs (e.g. Eberly, Rebelo, and Vincent, 2012). That extension will deliver the same intuition and results as the model with sunk capital.

3. All firms i posting vacancies at time t solve the firm's problem (7), so $k_{it} = k_t^*$ for all i.

4. The free entry condition (8) holds.

The equilibrium is conditional on initial employment n_{-1} and a random walk process (1) for labor demand.

2.2 Comparative Statics of the Labor Share

I now study the comparative statics of the labor share in the model. I show that a variety of forces seen as important by past work—namely rents, cost of capital and technological change—can cause the labor share to fall. Since the model accommodates several likely causes of the falling labor share, it is well placed to examine the effects of the fall on unemployment fluctuations.

Three pieces of notation will be useful to present the comparative statics. First, the flow cost of capital is $r \equiv [1-\beta(1-s)]\,p$. That is, r is the annuity value of the price of capital p, after accounting for the risk of job destruction at rate s. Second, let Φ be a collection of the exogenous parameters $r, f()$ and $\bar{w}$. I will carry out comparative statics of the labor share with respect to these parameters. Third, I define the equilibrium labor share as

$$LS(A_t;\Phi) \equiv \frac{\bar{w}}{A_t f\left(k_t^*(A_t;\Phi)\right)}.$$

The equilibrium labor share is the ratio of wages $\bar{w}$ to output per worker $A_t f\left(k_t^*(A_t;\Phi)\right)$. The optimal choice of capital, $k_t^*(A_t;\Phi)$, depends on labor demand A_t, as well as the exogenous parameters in Φ.

I now derive the comparative statics of the labor share with respect to the parameters in Φ.

Proposition 1. *The equilibrium labor share satisfies the following comparative statics:*

1. *When the cost of capital rises, the labor share rises, so*

$$\frac{\partial}{\partial r} LS(A_t;\Phi) > 0$$

2. *For changes in the production function $f()$ such that k_t^* falls, $LS(A_t;\Phi)$ rises.*

3. *When worker bargaining power rises, the labor share rises, so*

$$\frac{\partial}{\partial \bar{w}} LS(A_t;\Phi) > 0$$

Proof: Appendix.

The comparative statics explained in Proposition 1 are intuitive. In the model, changes in rents, cost of capital, or technology, can cause the labor share to fall. Part (1) shows that when the cost of capital r falls, the labor share LS falls. As the cost of capital falls, there is capital deepening. As capital increases relative to labor, a greater share of output is paid to capital, so the labor share falls. Part (2) shows that when changes in the production function $f()$ lead to capital deepening, again the labor share falls. Part (3) shows that when worker bargaining power falls, reflected in declining $\bar{w}$, the labor share falls. Since firms' marginal costs have fallen, the rent share has risen.

Two more comments about Proposition 1 are in order. First, the falling labor share can reflect several forces emphasized in previous work, relating to either capital or rents. A lower cost of capital can lower the labor share, as argued by Karabarbounis and Neiman (2013). Technological change that leads to capital deepening, such as automation or factor augmenting technology, can lower the labor share (Acemoglu and Restrepo, 2019). In the model, rising rents can lower the labor share, consistent with the empirics by De Loecker et al. (2018), Barkai (2019) and others. By nesting various potential *causes* of the falling labor share, the model can speak to the *consequences* of the falling labor share for unemployment fluctuations.

Second, Proposition 1 reveals an additional feature of this economy. Capital deepening—from either technological change or a lower cost of capital—always lowers the labor share. By contrast, in a standard neoclassical economy, falls in the cost of capital lower the labor share if and only if the elasticity of substitution between labor and capital is greater than unity. The difference stems from wage setting. In the model of this paper, wages are rigid, and do not change after capital deepening. In a neoclassical economy, wages are equal to marginal products. So, wages rise when there is capital deepening.[16]

2.3 Result: Falling Labor Share Dampens Unemployment Fluctuations

We have seen that the model allows changes in rents or capital to affect the labor share. I now introduce the main theory result. I argue that by lowering the labor share, increases in capital or rents dampen unemployment flucftuations. So, the causes of the falling labor share may be complicated—reflecting some combination of rising rents and rising capital. But the effect on unemployment fluctuations may be more straightforward.

To understand how the labor share affects unemployment fluctuations, I characterize the elasticity of market tightness with respect to labor demand, $d\log\theta_t/d\log A_t$. Then I carry out comparative dynamics on $d\log\theta_t/d\log A_t$ as the labor share varies. I focus on $d\log\theta_t/d\log A_t$

[16]In an extension to the basic model, which I discuss later on, I introduce partial wage flexibility, so wages rise as labor productivity rises. Then, as in the neoclassical model, the elasticity of substitution between labor and capital governs whether capital deepening raises the capital share.

to understand unemployment fluctuations because in the model, log tightness and log unemployment are inversely proportionate. When tightness is high, there are many vacancies and few unemployed workers searching for jobs, so workers find jobs quickly, and unemployment falls.[17] So, if tightness response less to labor demand, then unemployment also responds less to labor demand, and unemployment fluctuations are dampened. It is convenient to characterize the dynamics of θ_t rather than u_t, because as equation (2) shows, unemployment is predetermined whereas θ_t is a jump variable.

I now characterize the elasticity of tightness with respect to labor demand.

Proposition 2. *(Dampening Result). In equilibrium, the elasticity of tightness with respect to demand is*

$$\frac{d\log\theta_t}{d\log A_t} = \frac{1}{\alpha}\frac{1}{1 - LS(A_t;\Phi)} \tag{9}$$

Proof: Appendix

Corollary 3. *(Comparative Dynamics). Suppose that Φ changes and α is fixed. Then for any value of A_t, $d\log\theta_t/d\log A_t$ falls if and only if $LS(A_t;\Phi)$ falls.*

Proposition 2 is the dampening result—that is, the falling labor share dampens unemployment fluctuations. The elasticity of tightness to labor demand, which measures the sensitivity of unemployment to labor demand, depends multiplicatively on two terms. The first term captures the effect of search frictions, through the matching function parameter α. The second term is increasing in the labor share LS. So, as the labor share falls, $d\log\theta_t/d\log A_t$ falls. There is dampening—unemployment becomes less sensitive to labor demand shocks.

Corollary 3 shows the comparative dynamics. As Φ changes, the labor share $LS(A_t;\Phi)$ also changes, due to some combination of rising rents, falling cost of capital, and technological change. But in the model, the consequences of these forces for unemployment fluctuations depend only on how they affect the labor share. As long as the labor share falls, there is dampening. So, both rents or capital affect $d\log\theta_t/d\log A_t$ through a common mechanism—the labor share is a *sufficient statistic,* in the sense of Chetty (2009).

Taken together, Proposition 2 and Corollary 3 make the main point of the paper. Though the causes of the falling labor share are complex, the consequences for unemployment fluctuations may be more straightforward. As long as the labor share falls, the model of this paper predicts dampening. So, the result lets us sidestep many complications. We do not need to take a stand on whether the falling labor share reflects rising capital or rising rents. This feature is attractive because in practice, distinguishing rising capital from rising rents is challenging (Karabarbounis and Neiman, 2018). Nor do we need hard-to-measure parameters such as the elasticity of

[17] In particular, in the model, we have $d\log u_t \approx -(1-\alpha)(1-u_t)\,d\log\theta_t$.

substitution between capital and labor. Equation (9) shows that $d\log\theta_t/d\log A_t$ only depends on α and the labor share.

Intuitively, two effects combine to lead to dampening. First, there is a *labor leverage* effect (Donangelo et al., 2019). When the labor share is high, the profit share is low. So, in proportionate terms, profits must be more sensitive to changes in output per worker. Formally, if y_t is output per worker, then the percentage change in profits is

$$d\log(y_t - w_t) = \frac{y_t}{y_t - w_t} d\log y_t = \frac{1}{1 - LS_t} d\log y_t.$$

On the left hand side is the log change in profits per worker. On the right hand side is the log change in output per worker, scaled by a factor that depends positively on the labor share. The equation shows that when the labor share is high, profits are sensitive to changes in output per worker, in proportionate terms. For an alternative intuition, note that profits are a residual claim on output per worker, after deducting wages. When the profit share is low, the residual claim becomes more levered as output per worker changes.

In the model, changes in output per worker reflect labor demand. So, when the labor share is high, profits are proportionately more sensitive to labor demand shocks—because of the labor leverage effect.

The second effect that contributes to dampening comes from *free entry.* Suppose profits from vacancy creation increase. Then by free entry, firms create many additional vacancies, until the labor market becomes tight. Then vacancies are hard to fill, and the ex ante profit of vacancy creation falls back to zero. As a result, many jobs are created and unemployment falls. Formally, changes in profits and changes in tightness are proportionate. In the model we have:

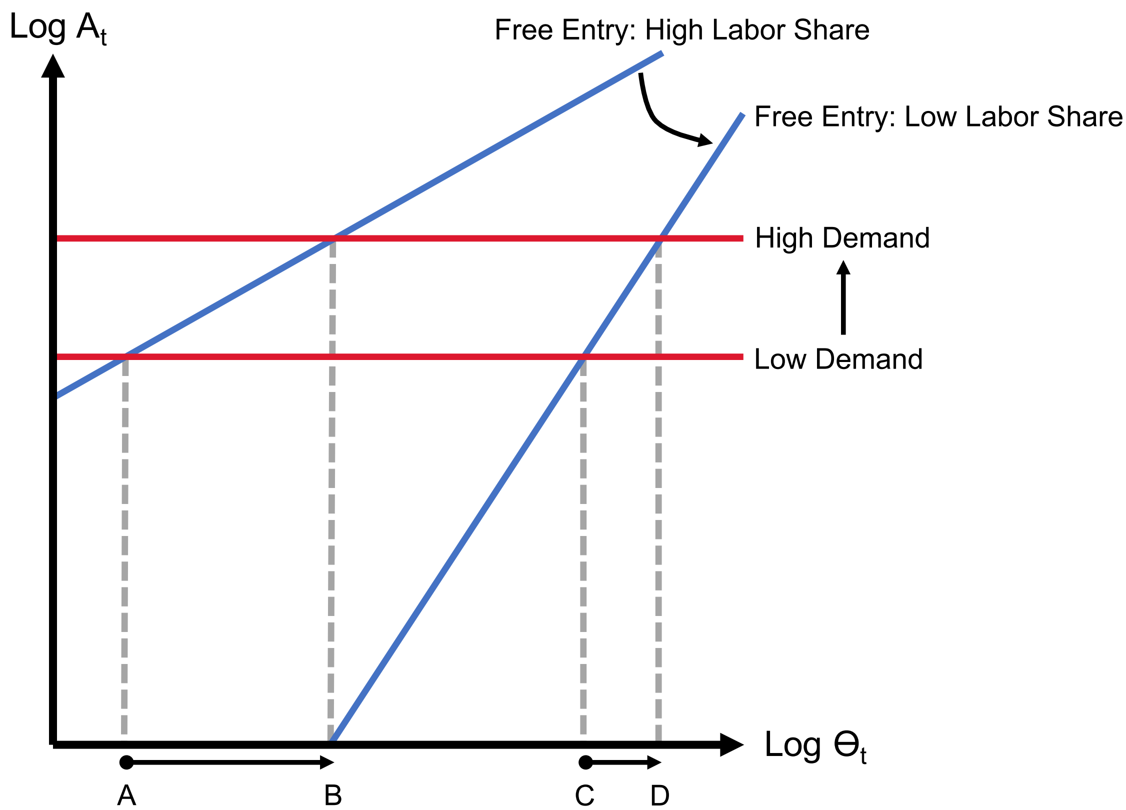
$$d\log(y_t - w_t) = \alpha d\log\theta_t.$$

The log change in profits equals the log change in tightness. As profits increase, so too does labor market tightness.

Free entry and labor leverage combine to create dampening. Given labor leverage, the falling labor share reduces the sensitivity of profits to labor demand. Given free entry, as profits become less sensitive to labor demand, so too does vacancy creation. In turn, unemployment must become less sensitive to labor demand shocks.

If the labor share falls due to either a rising rent or a rising capital share, there is dampening. Sunk capital is crucial to this result. Given the assumption of sunk capital, firms own the capital stock. So, firms' profits include the return to capital, as well as rents. Profits rise if either the capital share or the rent share rises. Either way, the labor share falls, which reduces labor lever-

Figure 2: Dampening in a Diagram



age and leads to dampening. By contrast, in the standard DMP model, firms rent capital from households. So, households receive the return to capital, which does not contribute to firms' profits. As a result, in the standard model, changes in the capital share have minimal effects on model dynamics (Pissarides, 2000). So, the standard DMP model cannot analyze how changes in the capital share affect unemployment dynamics—the object of interest in this paper.

Still, the dampening result does have precursors. Hagedorn and Manovskii (2008) and Ljungqvist and Sargent (2017), in particular, uncover the importance of labor leverage in the standard DMP model without sunk capital. In these models, only changes in the rent share affect labor leverage, changes in the capital share are unimportant.

Figure 2 displays the intuition for dampening in a diagram. On the y axis is log labor demand A_t. On the x axis is log market tightness θ_t. The red lines indicate labor demand, pinned down by the exogenous value of A_t. The blue lines trace out the locus of points implied by the free entry condition. The free entry locus is upward sloping, and resembles a quasi-supply curve. As A_t rises, profits rise. By free entry, firms create many vacancies and labor market tightens. As the labor share falls, the free entry line pivots, and becomes less elastic. After a given rise in labor demand, log profits increase by less, because there is less labor leverage. Since profits increase by less, firms create fewer new jobs, and tightness rises by less.

Figure 2 shows dampening. Suppose the labor share is relatively high. Then increases in labor demand result in a large increase in tightness, from point A to point B on the x axis. Suppose the labor share is lower. Then increases in labor demand result in a small increase in tightness, from point C to point D on the x axis.

2.4 Back of the Envelope Exercise

A simple exercise suggests the falling in labor share has quantitatively large effects on unemployment fluctuations.

I undertake a calibration using equation (9). To measure the labor share, I follow Rognlie (2018). I measure the labor share as the ratio of labor compensation, to the sum of labor compensation and net operating surplus, in the corporate sector. Net operating surplus is the sum of rents and the net return to capital. This measure considers only the corporate sector, to avoid imputing labor or capital income for the self-employed or studying the public sector.[18] The measure also deducts depreciation and production taxes, and ignores foreign profits. This series is readily available in the National Income and Product Accounts (NIPA). I retrieve values for the labor share in 1992 and 2014. The labor share falls from 0.83 to 0.75. This decline is the peak-to-trough fall in the recent history of the US labor share, excluding a brief cyclical spike in the labor share in 2001.[19] With no further information, one can calculate the proportionate decline in $d\log\theta_t/d\log A_t$, by plugging values of the labor share in 1992 and 2014 into equation (9), assuming that α does not change.

According to this exercise, $d\log\theta_t/d\log A_t$ falls by 30%. So, the falling labor share has a large dampening effect on the sensitivity of tightness to labor demand. As a result, unemployment has also been dampened by the falling labor share.

This simple exercise is only a first pass at understanding quantitative effects. Still, two aspects are appealing. First, there are no free parameters in the calibration. To calculate the decline in the sensitivity of tightness to labor demand, one only needs to measure the labor share. Hard-to-measure concepts, such as the magnitude of search frictions, the division of profits between capital and rents, the elasticity of substitution between capital and labor, and so on, do not matter in the exercise. Second, the model fits unemployment dynamics reasonably well, prior to the decline of the labor share. In 1992, the model predicts $d\log\theta_t/d\log A_t = 11.8$.[20] Pissarides (2009) calculates that, in postwar US data, $d\log\theta_t/d\log A_t = 7.56$. So, the model is a

[18]See Elsby et al. (2013) for alternative strategies to deal with self employment income.

[19]Elsby et al. (2013) argue this spike relates to idiosyncratic features of compensation in the tech sector.

[20]To calculate this value, equation (9) shows we need a value for α. I choose $\alpha = 0.5$ following the consensus value of Petrongolo and Pissarides (2001).

reasonable tool for understanding unemployment dynamics.[21]

Still, caveats are in order, because the model omits many realistic features of unemployment fluctuations. Here, I discuss one important concern, and then consider other model extensions in the next subsection. There is a disconnect between the concept of the labor share in the model and in the data. The measure of the labor share in the data is the *average* labor share, averaging over both continuing and newly hired workers at a given point in time. But in the model, the labor share for newly hired workers is relevant (Pissarides, 2009). If wages for continuing workers and new hires differ, the average labor share must differ from the labor share for new hires. However Hazell and Taska (2019) show that the cyclical dynamics of the wages for continuing workers and new hires are similar. So, the average labor share should be close to the labor share for new hires, minimizing this concern. Regardless, the disconnect is an important caveat to the exercise.

2.5 Dampening in Other Labor Search Models

This subsection outlines the scope of the dampening result. I discuss various labor search models that extend the baseline model of this paper. In these models, version of the same dampening result apply. I briefly discuss the model extensions here, and refer the reader to the Appendix for more information.

I do not consider models without labor search. As the discussion of proposition 2 makes clear, the dampening result comes from a link between profits and job creation, due to a free entry condition. This feature is particular to labor search models. So, models without labor search features may not yield the same result.

2.5.1 Capital Adjustment Costs

The baseline model features sunk capital. An alternative common assumption in business cycle models of investment, is capital adjustment costs. So, I consider a model extension which replaces sunk capital with capital adjustment costs.

In the model extension, there is a large continuum of firms. Each firm is endowed with a fixed amount of capital $\bar{k}$. Fixed capital is shortcut for modeling large capital adjustment costs. All other features of the model extension are the same as the baseline model.

This model extension delivers the same dampening result. As the labor share falls, unemployment becomes less sensitive to labor demand shocks. The basic intuition for this result is the same as the baseline model, coming from the combination of labor leverage and free entry.

[21] As in Hall (2005), our assumption of rigid wages overcomes the Shimer (2005) puzzle.

2.5.2 Partially Flexible Wages

The baseline model features rigid wages, as in Hall (2005). Wages are fixed, even as labor demand changes—a stark assumption. I consider extensions of the model that replace the assumption of rigid wages with various wage bargaining protocols. These wage bargaining protocols introduce partially flexible wages.

Specifically, I derive three model extensions in which wages are set according to either: 1) Nash wage bargaining 2) alternate-offer bargaining as in Hall and Milgrom (2008) or 3) a reduced form wage rule similar to Blanchard and Gali (2010) or Michaillat (2012). All other features of the model are the same as the baseline model.

These model extensions all deliver a version of the dampening result. All three model extensions deliver an equation linking unemployment fluctuations to the labor share, of the form

$$\frac{d\log\theta_t}{d\log A_t} = \frac{1}{\alpha}\left(1 - \frac{dw_t}{dy_t}\right)\frac{1}{1-LS_t}. \tag{10}$$

This equation is similar to equation (9), which describes the main dampening result.[22] There is a single difference, the term dw_t/dy_t, which measures the degree of wage flexibility. When dw_t/dy_t is high, then wages rise as labor demand rises. So, firms' profits increase by less. Job creation responds less to labor demand, tightness and unemployment are also less sensitive.

Equation (10) shows the dampening result holds with partially flexible wages. Suppose there is a change in structural parameters that lowers the labor share LS, but does not raise wage flexibility dw/dy. Then $d\log\theta/d\log A$ falls. So, the falling labor share dampens unemployment fluctuations, unless wage flexibility increases at the same time. The structural parameters that affect the labor share will differ, depending on the wage bargaining protocol. For example, in the model with either Nash or Hall-Milgrom bargaining, the labor share falls if unemployment benefits fall.

Intuitively, as the labor share falls, labor leverage works its effect as in the baseline model, and unemployment becomes less sensitive to labor demand shocks. But changes in wage flexibility, which also affect unemployment fluctuations, might create offsetting or reinforcing effects.

2.5.3 Product Market Power

A natural question is: if the rent share rises due to product market power, is there still dampening? In the baseline model, there is no product market power. Firms' output is sold in perfectly

[22] See Haefke, Sonntag, and Van Rens (2013), Kudlyak (2014), or Ljungqvist and Sargent (2017) for similar derivations, in DMP models without sunk capital.

competitive markets. Rents arise solely in the labor market. In reality, rising rents may reflect some combination of rising labor and rising product market power.[23]

This model extension enriches the baseline with product market power, and shows the same dampening result holds. The extension combines elements of the Dixit-Stiglitz model with the baseline model. Firms must pay a fixed cost to start producing a variety. Consumers have preferences with constant elasticity of substitution across varieties. Each firm produces a different variety, and there is free entry by firms. So, firms receive rents due to product market power. Otherwise, the extension shares the features of the baseline model. There is sunk capital. Firms post vacancies to match with workers in a frictional labor market. Wages are rigid.

The model extension delivers a similar equation to equation (9) from the baseline model. If the labor share falls, unemployment becomes less sensitive to labor demand shocks. However, the labor share can now fall due to rising markups in product markets, as well as the other forces from the baseline model. The intuition behind the result is essentially unchanged. When markups rise in product markets, firms' profit share is higher, so labor leverage is smaller.

2.5.4 Nominal Rigidity

In the baseline model, labor demand shocks are determined by labor productivity. There is no nominal rigidity, and shocks such as monetary policy have no effect on labor demand. But in practice, nominal rigidity is important. Monetary shocks affect labor demand and cause unemployment fluctuations (e.g. Christiano, Eichenbaum, and Trabandt, 2016).

I extend the model to account for nominal rigidity and aggregate demand shocks. The model extension shares features with Gertler, Sala, and Trigari (2008) and (Christiano et al., 2016). Most of the extended model is the same as the baseline. But firms in the labor market sell their output to a retail sector at a competitive price. The retail sector sells to consumers, and has sticky prices. So, there is nominal rigidity. Monetary shocks can affect labor demand.

In this model, as in the baseline, the falling labor share dampens the response of unemployment to labor demand shocks. But due to nominal rigidity, labor demand shocks may arise from aggregate demand shocks such as monetary or fiscal policy. Nevertheless, unemployment responds less to these shocks, when the labor share is low.

2.5.5 Decreasing Returns to Scale

In the baseline model, there is constant returns to scale. Labor demand is perfectly elastic. But in practice, firms may face decreasing returns to scale, labor demand may be inelastic. How

[23] De Loecker et al. (2018) or Farhi and Gourio (2018), amongst others, show that the rent share has risen. Their preferred interpretation is that product market power has risen. However, their exercises assume competitive labor markets. So, they rule out the possibility that rising labor market power may increase rents.

does this feature affect the dampening result?

I develop a model with decreasing returns to scale. There are two differences from the baseline model, which follow Michaillat (2012). First, firms can hire multiple workers. Each firm has a production function $f(k_t, n_t) = A_t k_t^a n_t^{1-a}$, $a \in (0,1)$, where n_t is the number of workers employed by the firm and k_t is the amount of (sunk) capital in the firm. Second, there is no free entry. Instead, there is a fixed measure of firms.[24] Firms hire until their marginal product equals the marginal cost of recruiting workers. In its other features, the extended model is the same as the baseline.

A version of the dampening result applies in the extended model. If the labor share of the *marginal* worker hired by the firm falls, then unemployment becomes less sensitive to labor demand shocks. So, there is dampening. But in this extension, the average and the marginal labor share differ. There is decreasing returns to scale, so the output of the marginal worker is lower than the output of the average worker hired by the firm.

Nevertheless if the *average* labor share falls in this economy, there is dampening. The marginal and the average labor share are positively related. As the average labor share falls, so too does the marginal labor share.

The intuition of the dampening result, from labor leverage, remains the same. If the marginal labor share falls, then marginal profits become less sensitive to labor demand shocks, and job creation also becomes less sensitive.

2.5.6 Labor Search Models with Heterogeneity

The baseline model assumes a representative firm. But in the data, there is a great deal of heterogeneity in firm characteristics. Developing a labor search model with heterogeneous firms is beyond the scope of this paper.

However a model with these features seems to support the dampening argument of this paper. Elsby and Michaels (2013) develop a DMP-style labor search model that is significantly richer than the model in this paper. Their model features 1) decreasing returns to scale at the firm level 2) heterogeneous firm productivity 3) no free entry 4) endogenous job separation and 5) Stole-Zwiebel wage bargaining.

In that model, when the marginal labor share is low, unemployment is less sensitive to demand shocks. So, there is dampening. Elsby and Michaels (2013) provide the same intuition as this paper, based on labor leverage. So, the lesson from this paper may hold when there is realistic heterogeneity.

[24] If firms face decreasing returns to scale, but there is free entry, the dynamics are identical to the baseline model. Though firm-level labor demand is inelastic, aggregate labor demand is perfectly elastic.

3 Regional Labor Shares and Unemployment Fluctuations

The previous section argued that the falling labor share should dampen unemployment fluctuations, if either rising rents or capital cause the fall. This section studies data on region-by-industry labor shares, and provides evidence for dampening in two steps. First, conditional on industry composition, regional labor shares are driven by proxies for rents and the cost of capital. So, regional labor shares correlate with precisely the variation in the labor share that the model is designed to accommodate. Second, I document a comovement consistent with the theory: employment in regional labor markets with high labor shares is more sensitive to aggregate business cycles.

3.1 Regional Labor Shares: Measurement and Descriptive Statistics

3.1.1 Measuring Regional Labor Shares

I now explain the measure of region-by-industry labor shares used in this paper. The region-by-industry labor share is

$$\frac{\text{labor compensation}}{\text{labor compensation} + \text{gross operating surplus} + \text{proprietors' income}}$$

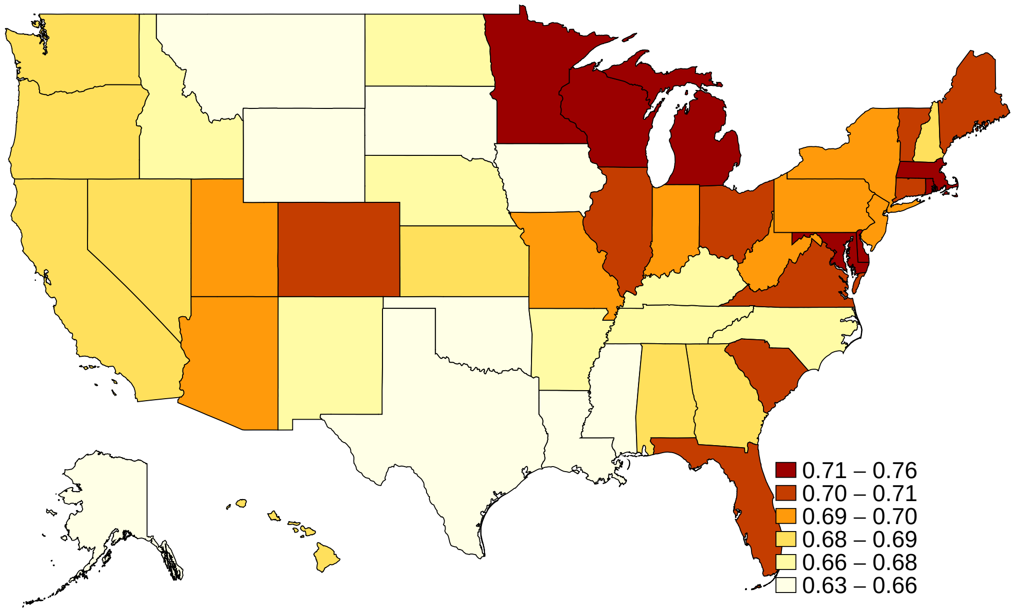
for each non-financial industry sector in the private sector and region, where a region is either a state or a census division.[25] Region-by-industry labor shares come from the Bureau of Economic Analysis' Regional Economic Accounts, at annual frequency. Labor compensation is payroll and some fringe benefits. Gross operating surplus is firms' gross profits, before deducting depreciation but after deducting production taxes.[26] Proprietors' income is income for the self employed. These data do not report region and industry specific depreciation rates, or separate gross operating surplus from proprietors' income. The industry sectors are retail trade, wholesale trade, transportation, construction, mining, agriculture, manufacturing and services.[27] State-by-industry data for more granular industries, such as 2 or 3 digit NAICS codes, is often censored and therefore unusable for business cycle analysis. I exclude labor shares from housing and financial services, since labor shares in these industries are strongly affected by asset prices.

[25] I divide the South Atlantic division into two separate units, because of its large size, as in Nakamura and Steinsson (2014).

[26] So, gross operating surplus is sales - intermediates - compensation - production taxes. The measure of the labor share used in the back of the envelope exercise of subsection 2.4 is labor compensation / (labor compensation + net operating surplus). The latter measure differs from our measure of the regional labor share by deducing proprietors' income and depreciation from the denominator.

[27] Before 1997, industry sectors follow the SIC classification. After 1997, industry sectors follow the NAICS classification. I splice in 1997.

Figure 3: Heatmap of Regional Labor Shares



Notes: this graph plots γ_s for each state. γ_s are the state effects from a regression $LS_{ist} = \alpha_i + \gamma_s + \varepsilon_{ist}$ where LS_{ist} is the labor share in industry i, state s and time t, and α_i is an industry fixed effect. The regression is employment weighted. I normalize γ_s by adding the employment weighted mean labor share to each value of γ_s. Labor shares are from the BEA's Regional Economics Accounts, for 1976-2017.

I will study how employment at the region-industry level responds to aggregate business cycles. So, I also consider annual region-industry employment from the Quarterly Census of Employment and Wages, and aggregate annual unemployment from the Bureau of Labor Statistics. These data start in 1976.

3.1.2 Descriptive Statistics of Regional Labor Shares

I now study regional variation in labor shares, conditional on industry composition. I show that regional variation in labor shares is large, and correlates with both rents and the cost of capital. This finding motivates the empirical strategy that follows.

I start by asking whether there is regional variation in labor shares independent from industries. Controlling for industry composition is important because industries have different labor shares, and are also spatially concentrated. For example, US manufacturing historically has a high labor share, and is concentrated in the Upper Midwest and the South. I run the regression $LS_{ist} = \alpha_i + \gamma_s + \varepsilon_{ist}$, where LS is a region-by-industry labor share, α_i is an industry effect and γ_s is a state effect. So, γ_s measures state-level labor shares after controlling for industry composition. I plot γ_s in a heatmap, in figure 3.

There is substantial variation in regional labor shares, conditional on industry composition.

This finding motivates our focus on regional labor shares in the rest of the empirics. For example, the difference in labor shares between Michigan and Texas is 14 percentage points. The Upper Midwest generally has a high labor share. The South and the Mountain West generally has a low labor share.

To benchmark the size of the variation in regional labor shares, as well as the numbers that follow, I compare to better-known statistics on changes in aggregate or industry labor shares. Depending on the measure, the aggregate US labor share fell by between 3 and 6 percentage points between the mid 1980s and the early 2010s (Elsby et al., 2013; Karabarbounis and Neiman, 2013; Rognlie, 2018). The drop was largest in manufacturing, at around 10 percentage points. Labor shares also fell, by a smaller magnitude, in retail and wholesale trade. So, variation in regional labor shares is quite large, relative to aggregate and industry trends in labor shares.

A caveat is in order. These data control for industry composition at an aggregated, industry sector level. So, differences in regional labor shares could partly reflect different detailed industries in each region.

I show that conditional on industry composition, proxies for rents and capital are strong correlates of regional labor shares. I consider three proxies.

First, I ask whether minimum wages correlate with regional labor shares. High minimum wages should raise the labor share, by increasing wages, and lowering firms' rents. I use the annual average state minimum wage from Vaghul and Zipperer (2016).

Second, I study how labor unions affect labor shares. Strong unions increase worker bargaining power, thereby raising workers' wages and lowering firms' rents. I study whether a state has a "right to work" law in a given year, sourced from Feigenbaum, Hertel-Fernandez, and Williamson (2018). Right to work laws limit the strength of unions, by allowing workers in unionized workplaces to opt out of membership. So, right to work laws should lower labor shares.

Third, I study how non-residential property taxes affect labor shares. In most localities in the US, non-residential property taxes are typically levied on both equipment and structures capital, and sometimes also inventory (Lincoln Institute of Land Policy, 2015). So, property taxes raise the cost of capital and can raise labor shares.[28] Property taxes are levied at the local level, so there is no direct data on marginal non-residential property taxes at the industry-state level. I approximate the average non-residential property tax rate with the ratio of production taxes paid by firms to their profits.[29] Property taxes are also an order of magnitude larger than

[28]A higher cost of capital lowers the capital share if the elasticity of substitution between labor and capital is greater than unity.

[29]Non-residential property taxes are roughly half of firms' taxes on production (see Fred series B249RC1Q027SBEA for non-residential property tax and Fred series W072RC1Q027SBEA for production taxes). So,

other taxes paid by firms, such as corporation tax.[30]

I regress region-by-industry labor shares on these factors. In particular, I regress annual region-by-state labor shares on dummy variables, for: 1) whether a state has a right-to-work law in place, 2) quartiles of the non-residential property tax rate distribution, and 3) quartiles of the minimum wage distribution. I run the regression with either industry fixed effects, or industry-by-time fixed effects—to control for effects on regional labor shares due to industry composition.

Table 1 reports the results of the regression. Non-residential property taxes, minimum wages, and right to work laws all closely correlate with regional labor shares. So, regional labor shares are at least partly driven by a combination of rents and the cost of capital. The first row and first column shows that states with right to work laws have labor shares that are 2 percentage points lower than states without right to work laws. So, states with lower worker bargaining power—as measured by restrictions on unions—have lower labor shares, conditional on industry composition. The fourth row and first column shows that if a state-industry is in the top quartile of property taxes, its labor share is 10 percentage points higher than a state-industry in the bottom quartile of property taxes. So, states with higher cost of capital—as measure by property taxes—have higher labor shares. The correlation of minimum wages with labor shares is weaker. Still, states with minimum wages in the third quartile of the minimum wage distribution have labor share roughly 3 percentage points higher than states with minimum wages in the bottom quartile. The partial R-squared is also large. The bottom row and first column of the table shows that these factors collectively explain 13% of the variation in the labor share, after controlling for industry. Cyclical variation and measurement error may explain much of the rest. I studied other plausible drivers of regional labor shares, and found small effects.[31]

So, regional labor shares seem to be governed by cost capital and rents. The model of this paper is designed to capture such forces. These forces are also thought to be important for explaining the aggregate labor share.

3.2 High Labor Share Markets Are More Cyclical

The dampening result, from the model section, has clear implications for regional data. Regional markets with high labor shares should have relatively large employment fluctuations. I document a comovement consistent with the theory.

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the approximate property tax rate should be accurate. The Appendix validates the approximation, by regressing states property tax receipts on the approximate tax rate. The two measures correlate closely.

[30] See Fred series B102RC1Q027SBEA for corporation taxes.

[31] In particular, I found low explanatory power for unemployment benefit replacement rates, corporation tax, personal income tax, and regional price levels.

3.2.1 Region-by-Industry Regression

I study a regression that tests whether the cyclicality of employment in different labor markets varies with the labor shares in these markets. The regression is

$$\Delta \log\left(\text{employment}_{ist}\right) = \alpha + \sum_{q=2}^{4} \beta_q \Delta \text{Unemployment}_t \times I(\text{labor share}_{is,t-1} \in \text{quartile}_q) + \text{industry-time FE}_{it} + \text{error}_{ist} \tag{11}$$

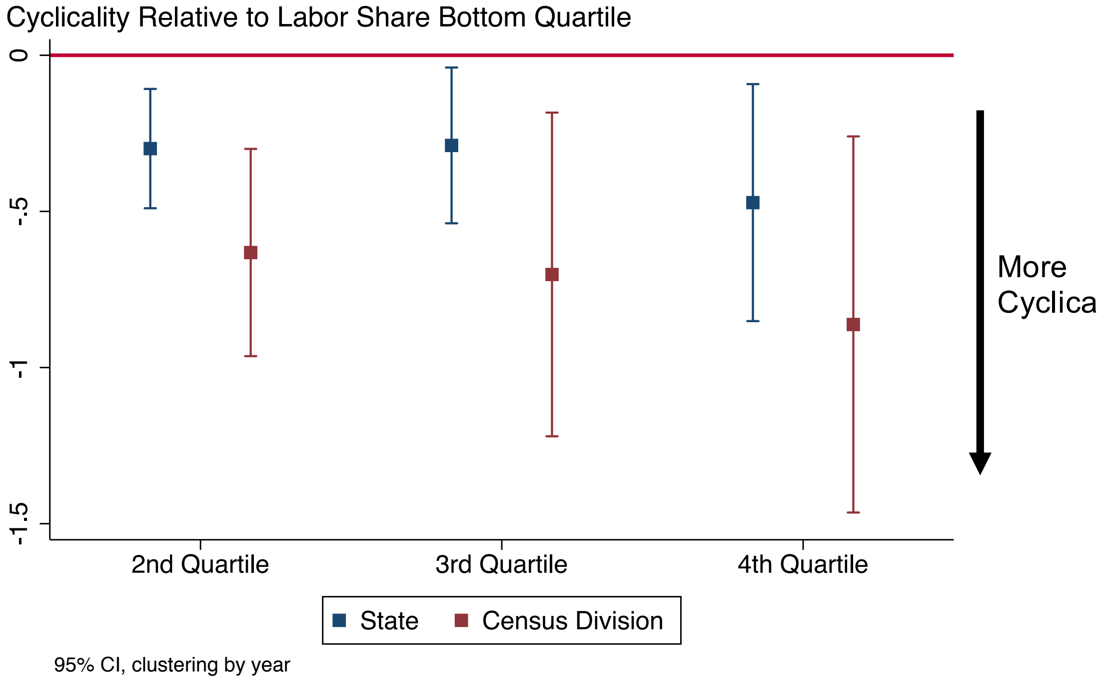
The outcome variable is employment growth in region s, either a state or census division; industry sector i and year t. The main regressor is the annual change in aggregate unemployment. I interact this regressor with dummy variables for each quartile of the labor share distribution. Finally, I include industry-by-time fixed effects. The data is 1976-2017 for the non-financial private sector. The regression is weighted by average employment, standard errors are clustered by time.

The main coefficients of interest are β_q. β_q measures how the response of employment growth in a labor market, to aggregate unemployment, changes with the market's labor share. The excluded dummy variable is for markets with labor shares in the bottom quartile. So, β_q measures cyclicality for labor markets with labor shares in quartile q, *relative to* labor markets in the bottom quartile. For example, β_4 measures the cyclicality of markets with labor shares in the top quartile, relative to markets with labor shares in the bottom quartile. The dampening result predicts that $\beta_4 < 0$. Then high labor share markets are more cyclical. Employment contracts by more in high than low labor share markets, as aggregate unemployment rises.

The regression controls for industry cyclicality. Between-region and within-industry variation identifies β_q, because there are industry-by-time fixed effects. So, β_q is the cyclicality of a high labor share market relative to a low labor share market *in a different region and the same industry.* For example, manufacturing in Michigan has a high labor share. Manufacturing in Texas has a low labor share. This regression asks whether manufacturing in Michigan is more sensitive to aggregate business cycles than manufacturing in Texas.

Studying regional variation, with industry controls, is useful for two reasons. First, the regression controls for industry cyclicality, which otherwise might confound the effect of labor shares. Some industries have high labor shares and are cyclical for unrelated reasons. For example, durable manufacturing historically has had a high labor share. Durables are also highly cyclical, due in part to product demand (Bils, Klenow, and Malin, 2013). So, the cyclicality of industry product demand is a confounding effect. Industry-time fixed effects control for the confounder. Second, one can interpret variation in regional labor shares through the lens of

Figure 4: Cyclicality in High and Low Labor Share Markets



Notes: this figure plots estimates of β_2, β_3 and β_4 from estimates of regression equation (11) at either the state or census division level, with 95% confidence intervals. The outcome variable is annual industry-by-region employment growth at either the census division or the state level. The regressors are changes in aggregate unemployment, interacted with dummy variables for quartiles of the labor share distribution, for each labor market. A dummy variable for the bottom quartile is excluded. Point estimates of β_2, β_3 and β_4 are squares. Standard errors are clustered by time. The figure reports 95% confidence intervals.

the theory. I previously documented substantial regional variation in labor shares, largely correlated with both rents and the cost of capital. So, the source of variation identifying β_q is consistent with the model, which allows labor shares to be driven by either capital or rents.

I add an important caveat. Omitted variables are a concern, because other factors could correlate with both labor shares and with regional cyclicality. For example states with high labor shares could have statewide policy that affect their cyclicality. So, documenting a comovement consistent with the theory is only a first step toward validating the dampening result. Later, I will identify variation in labor shares using statewide reforms, to overcome the omitted variables problem.

3.2.2 Result: High Labor Share Markets More Cyclical

I find a result consistent with dampening. Employment in high labor share markets is particularly sensitive to aggregate business cycles.

Table 2 and Figure 4 report the result. Figure 4 reports the regression coefficients β_2, β_3 and

β_4. Consider, first, the state level results. Suppose there is a one percentage point rise in national unemployment. Then the figure shows that employment for markets in the top quartile of the labor share distribution contracts by 0.5 percent more, than employment for markets in the bottom quartile of labor shares. This finding is the blue line, in the far right column of the figure. Similar results hold for labor markets in the second and third quartiles of labor shares, in the first and second columns of the figure. The same result holds at the census division level, given by the red lines. Of course, there are industry time fixed effects. So, employment contracts by more in a market with labor shares in the top quartile—compared with a market in the same industry, a different region, and with a lower labor share. For example, when aggregate unemployment rises, manufacturing employment should contract by more in Michigan than in Texas. Manufacturing in Michigan has a high labor share, manufacturing in Texas has a lower labor share. Table 2 reports the same results as the figure.

Figure 1, from the introduction, shows non-parametrically that high labor share markets are more cyclical. I plot employment growth in high labor share markets, relative to low labor share markets, after conditioning on industry-by-time fixed effects. That is, I run the regression

$$\Delta \log \left(\text{Employment}_{ist}\right) = \text{industry-time FE}_{it} + \sum_{q=2}^{4} \alpha_{qt} + \text{error}_{ist}.$$

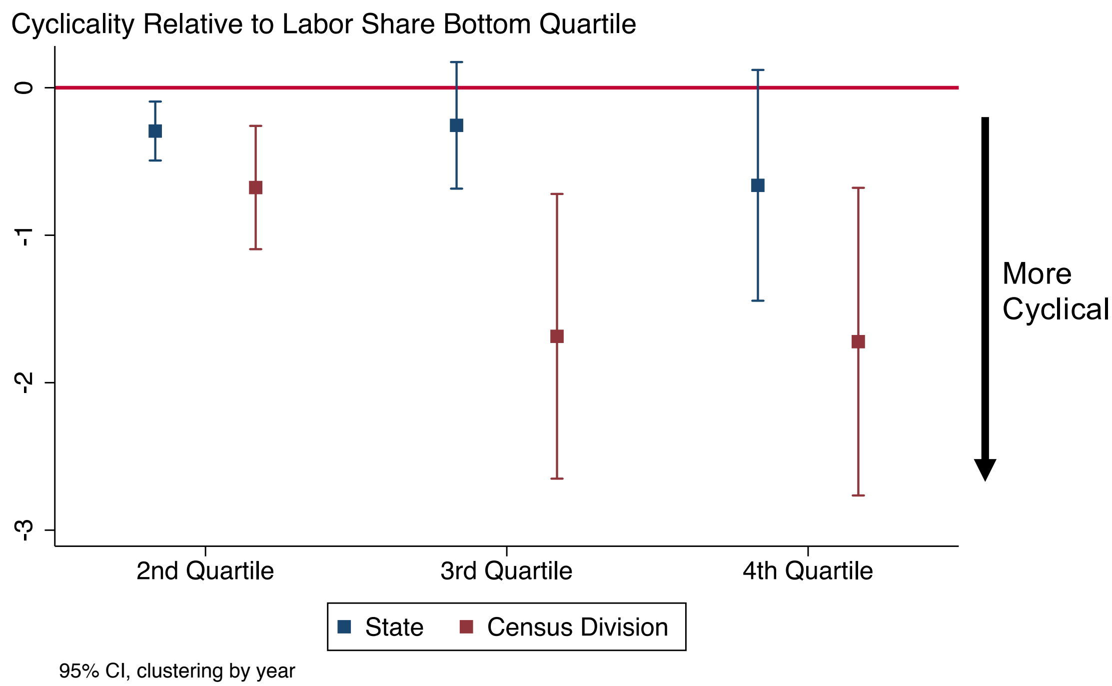
where the outcome variable is employment growth in industry i and state s in year t, and α_{qt} are a series of dummy variables for the second through fourth quartile of the labor share distribution. So, α_{4t} measures employment growth for labor markets in the top quartile of labor shares, relative to the bottom quartile, controlling for industry fixed effects. I then plot α_{4t}.

Figure 1 shows that high labor share markets are more cyclical, conditional on industry composition. The same pattern holds over every recession and expansion. High labor share markets contract by more over the Volcker recession, and expand more over the subsequent boom. They contract by more during the 1990s recession, and rise by more at the end of the 1990s. A similar pattern holds during the 2000s recession, the Great Recession, and the subsequent recovery.

I conduct several robustness exercises. First, I estimate regression equation (11) considering only tradeable industries. That is, I consider only labor markets in manufacturing, commodities, or agriculture. Labor markets in different regions, but the same tradeable industry, face similar product demand. So, by focussing on tradeables, we minimize the possibility that product demand may differ across labor markets. Differences in product demand, if they correlate with labor shares, could confound estimates of the effect of the labor share on cyclicality. Figure 5 reports the results. These results are similar to the baseline regression, and indeed somewhat larger. So, the confounding effect of different product demand does not seem important.

Second, I ask whether heterogeneity or outliers are driving the estimates. I re-estimate β_4,

Figure 5: Tradeables: Cyclicality in High and Low Labor Share Markets



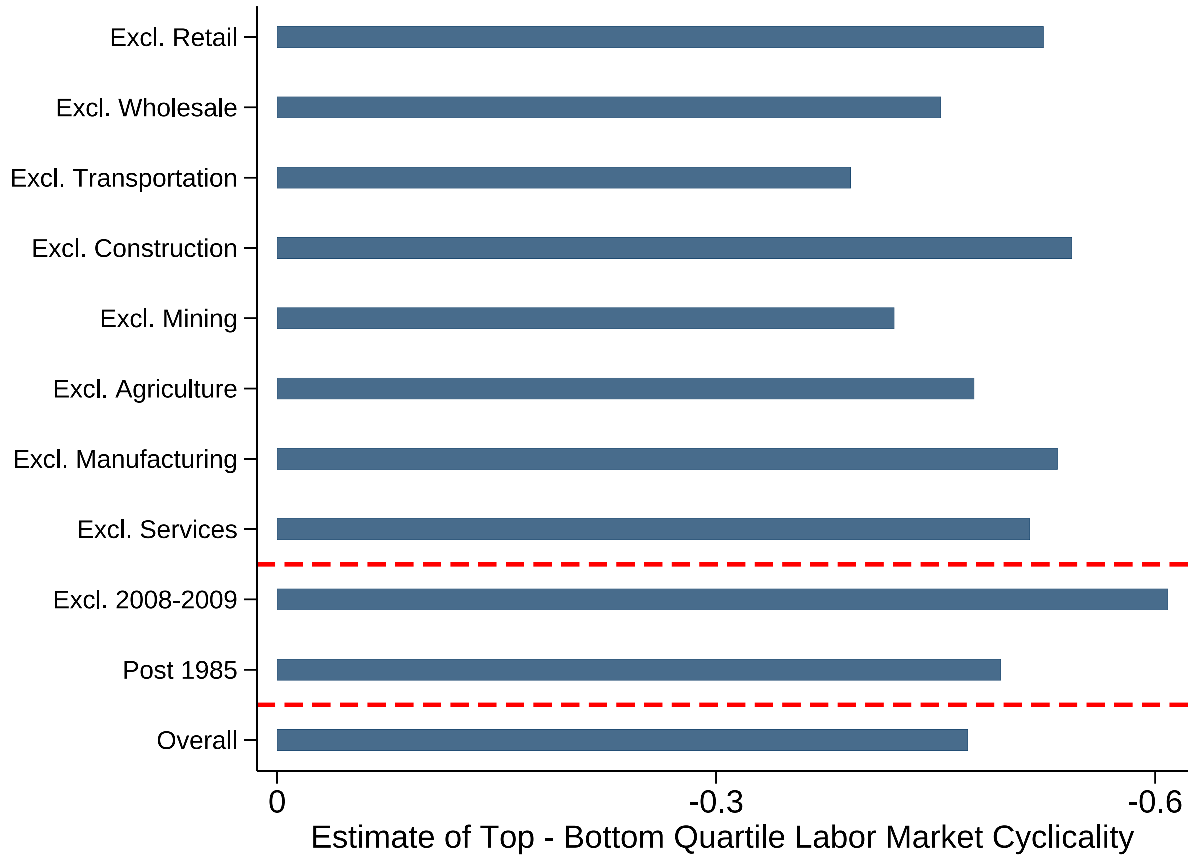
Notes: this figure plots estimates of β_2, β_3 and β_4 from estimates of regression equation (11) at either the state or census division level, with 95% confidence intervals. I restrict to tradeables: industries in manufacturing, agriculture or commodities. The outcome variable is annual industry-by-region employment growth at either the census division or the state level. The regressors are changes in aggregate unemployment, interacted with dummy variables for quartiles of the labor share distribution, for each labor market. A dummy variable for the bottom quartile is excluded. Point estimates of β_2, β_3 and β_4 are squares. Standard errors are clustered by time. The figure reports 95% confidence intervals.

the relative cyclicality of high labor share markets relative. I sequentially drop each industry sector. I also exclude the two largest recessions during the sample period, namely the 1982-4 Volcker Recession, and the Great Recession. Figure 6 shows the result. After dropping each of these periods, estimates of α_q change little.

The Appendix carries out several additional robustness tests. I rerun regression (9) with different weighting schemes, and find the results are stable. I also rerun regression (9) with a trend measure of the labor share, extracted with an HP filter, to sweep away high frequency cyclical variation in labor shares. Again, the results change little. I study the response of state unemployment to identified labor demand shocks, from either oil prices or monetary policy. High labor share states are more sensitive to both oil and monetary shocks. Finally, I show that wage cyclicality does not differ across high or low labor share industries. Differing wage rigidity could be an alternative channel affecting cyclicality across labor markets. Given the result, this concern seems relatively minor.

I conduct a simple exercise to gauge magnitudes, and find the degree of comovement is

Figure 6: Robustness: Cyclicality in High and Low Labor Share Markets



Notes: this graph reports estimates of β_4 from regression equation (9). In order, I drop observations corresponding to industries in: the retail sector, the wholesale sector, transportation, construction, mining, agriculture, manufacturing and services. Then I exclude observations from either 2008 or 2009, and also drop observations from before 1985.

large. Consider two labor markets whose labor share differ by 8 percentage points.[32] I ask: given the estimate of β_4, how much does cyclicality differ across these labor markets? I find that in a labor market with an 8 pp lower labor share, when unemployment rises by 1 pp, log employment falls by 30% less. I use the estimate of β_4 from tradeables at the census division level, in Figure 5, for this calculation.

The Appendix presents some complementary worldwide evidence for dampening. I study the dataset of labor shares for OECD countries, constructed by Karabarbounis and Neiman (2013). I construct a measure of countries' unemployment volatility, as the standard deviation

[32] I choose 8 percentage points because it is the size of the peak-to-trough fall in the aggregate labor share (see the back-of-the-envelope exercise in subsection 2.4). I caution that this simple exercise cannot substitute for a careful mapping between regional and aggregate estimates. The measure of the labor share in aggregate data excludes depreciation and proprietors' income, but the regional measure includes both. So, I assume that within industries and across regions, the share of output going to depreciation or proprietors' income does not differ.

of their quarterly unemployment over five year rolling windows, using data on quarterly unemployment provided by the OECD. I show that countries with trend declines in their labor shares also have trend falls in unemployment volatility.

So, there is a comovement consistent with the theoretical result on dampening. Employment in low labor share markets is less sensitive to the business cycle. Moreover, variation in labor shares is driven by rents and the cost of capital, consistent with the theory. But the comovement may reflect omitted variables, instead of the dampening mechanism emphasized by the model. Regions might differ in workforce composition, state policy, or a host of other factors that affect cyclicality. So, in the next section, I try to identify variation in labor shares that is plausibly exogenous to other factors affecting regional cyclicality.

4 Identifying Labor Share Variation Using Statewide Reforms

The paper now identifies variation in the labor share with a difference-in-differences framework. I study the passage of two statewide reforms. These reforms isolate falls in the labor share due to either worker bargaining power or the cost of capital. The first reform is the passage of statewide right to work laws, which lowers unionization and hence worker bargaining power. The second reform is the passage of school finance reforms, which lower property taxes and hence the cost of capital. After the passage of both reforms, the labor share falls, and the sensitivity of state unemployment to aggregate business cycles also falls. There is dampening—if either rents or capital cause the labor share to change.

4.1 Difference in Differences Framework

I now explain how this paper identifies variation in the labor share, using a difference in differences framework. I explain the general difference-in-difference framework first. I then separately present regression results for each of the reforms.

The first stage regression studies the effect of a reform on the labor share. The regression is

$$\text{labor share}_{ist} = \alpha_{is} + \gamma_t + \beta_{\text{First Stage}}\text{reform}_{st} + \text{controls}_{ist} + \varepsilon_{ist}. \tag{12}$$

labor share$_{ist}$ is the labor share in a region and industry. α_{is} is an industry-by-state fixed effect. γ_t is a time effect. reform$_{st}$ is a dummy variable, equal to 1, if the reform has been passed in the state. The coefficient of interest is $\beta_{\text{First Stage}}$. $\beta_{\text{First Stage}}$ estimates the fall in the labor share after the passage of the reform. For example, suppose that Oklahoma passes a right to work law. $\beta_{\text{First Stage}}$ measures the subsequent fall in the Oklahoma's labor share. This regression clusters standard errors by state, following the recommendation of Bertrand, Duflo, and Mullainathan

(2004), and weights by mean value added in each region-industry. The regression only includes years with an Economic Census (i.e. in five year increments starting from 1977). So, the sample period is 1977-2012.[33]

I now discuss the identification assumption. Equation (12) is a standard panel difference-in-difference regression with multiple treatments and periods. The identification assumption is that trends in labor shares would be the same in all states, absent the passage of reforms. This assumption is "parallel trends", as in the standard difference-in-difference setup. Then $\beta_{\text{First Stage}}$ identifies the fall in the labor share due to the reform. For example, absent the passage of its right to work law, Oklahoma should have a similar trend in its labor share to other states. This assumption is not directly testable. Nevertheless, two robustness tests can provide comfort. First, if the identification assumption is correct, the addition of controls such as state specific linear trends or industry-by-time fixed effects should not alter the estimates. These controls deal with other factors affecting states' labor shares, such as secular trends, or common industry shocks across states. Second, there should be no pre-trend in states' labor shares before the law is passed.

The reduced form regression studies the effect of the reform on the cyclicality of state level unemployment. The reduced form regression is

$$\begin{aligned}\Delta_{t+2,t-2}\log\left(\text{employment}_{ist}\right) = {} & \alpha_{is} + \gamma_t + \text{controls}_{ist} + \varepsilon_{ist} \\ & + \left(\delta_{is} + \beta_{\text{Reduced form}}\text{reform}_{st}\right) \times \Delta_{t+2,t-2}U_t. \end{aligned} \tag{13}$$

The outcome variable is employment growth over five year intervals at the industry-state level. $\Delta_{t+2,t-2}U_t$ is the change in unemployment over five year intervals. α_{is} is an industry-by-state fixed effect. γ_t is a time fixed effect. δ_{is} is an industry-state specific loading on aggregate unemployment. reform_{st} is a dummy variable equal to 1 if a reform has been passed in the state. The regression weights by mean employment in each region-industry and clusters standard errors at the state level. The regression studies longer, five-year differences, to gain greater power than using single year differences, similarly to Mian, Sufi, and Verner (2017). The regression is low powered because we are studying how an interaction term, $\text{reform}_{st} \times \Delta_{t+2,t-2}U_t$, changes after the passage of the reform. As in the first stage regression, I include only years with an Economic Census.

In the reduced form regression, the coefficient of interest is $\beta_{\text{Reduced Form}}$. If the identification assumption is valid, then $\beta_{\text{Reduced Form}}$ identifies the effect of the reform on the cyclicality of state level employment. Suppose that $\beta_{\text{Reduced Form}}$ is negative. Then after the reform

[33] The BEA applies smoothers to region-industry labor shares between census years. So, higher frequency dynamics are hard to interpret in a difference-in-difference framework.

passes, employment growth at state-by-industry level becomes less sensitive to changes in aggregate unemployment. For example, suppose that Oklahoma passes a right to work law. Then if $\beta_{\text{Reduced Form}}$ is negative, Oklahoma's employment subsequently responds by less to changes in aggregate unemployment.

Here, the identification assumption is that the sensitivity of regional employment to aggregate unemployment would have similar trends, across different states, in the absence of the reform. Our regression controls for time invariant industry and state specific factors affecting cyclicality in a given state.

This framework naturally connects to the dampening predicted by theory. Suppose that a statewide reform—affecting either rents or the cost of capital—lowers the labor share. Then state-by-industry employment should become less sensitive to changes in aggregate unemployment.

4.2 Reform #1: Right to Work Laws

I now turn to the first statewide reform, the passage of right to work laws (Farber, 1984). These reforms, by design, lower workers' bargaining power. I find that the reforms lower the labor share and reduce the sensitivity of states' employment to aggregate business cycles.

4.2.1 Institutional Background

Right to work laws allow workers in a unionized workplace to opt out of paying membership fees to a union, even if workers benefit from the unions' actions. So, right to work laws weaken union power. Right to work laws tend to be passed for political reasons, by anti-union politicians, to reduce the bargaining power of labor. See Feigenbaum, Hertel-Fernandez, and Williamson (2018) for an extensive discussion.

A large number of states had right to work laws prior to 1976, particularly in the South of the United States.[34] During 1976 to 2012, five states passed right to work laws, namely: Idaho (1985), Indiana (2012), Michigan (2012), Oklahoma (2001) and Texas (1993).

Through the lens of the model, right to work laws lower worker bargaining power. So, these laws should lower the labor share by raising the rent share, and then lead to dampening.[35]

The identification assumption is that, as right to work laws passed, there were no other trends affecting states' sensitivity to aggregate business cycles. This assumption is debatable:

[34] Specifically: Alabama, Arizona, Arkansas, Florida, Georgia, Iowa, Kansas, Louisiana, Mississippi, Nebraska, Nevada, North Carolina, North Dakota, South Carolina, South Dakota, Tennessee, Utah, Virginia and Wyoming.

[35] Unions create additional effects on labor markets, such as increasing firms' severance costs. The Appendix outlines an extension of the baseline model with severance costs. Greater severance costs should raise the labor share and lead to dampening, in line with the baseline result.

after all, anti-union politicians may pass other legislation at the same time as right-to-work laws. Still, I do not find tell-tale signs of an identification assumption violation, such as pre-trends.

4.2.2 First Stage Regression with Right to Work Laws

I show that the passage of right to work laws lower labor shares. I estimate the first stage regression equation (12) with right to work laws as the state level reform. Table 3 reports estimates of $\beta_{\text{First stage}}$. The first column shows that the passage of a right to work law lowers state labor shares by 2.8 percentage points. The fall is statistically significant. The second column introduces linear trends, for each industry-state, and finds similar results, both in significance and in magnitude. So, the result is robust to trends in labor shares, at the industry-by-state level. The third column introduces industry-by-time fixed effects, to absorb common time varying industry shocks. The same result holds, in magnitude and significance. Recall that the peak-to-trough fall in the aggregate labor share was between 3 and 6 percentage points. So, a fall in the labor share of 2 percentage points is quite large.

I provide evidence in favor of the identification assumption. The fourth column tests for pre-trends. I add a single lead of the dummy variable for whether a right to work law has passed. If the lead of the dummy is significant, a violation of the identification assumption is likely. State labor shares will have been trending in treated states, in advance of the law having been passed, implying a violation of the parallel trends assumption. However, column (4) of Table 3 shows that the lead coefficient is not significant. Still, contemporaneous policy changes could also affect both labor shares and cyclicality and may complicate the interpretation of the results, depending on the nature of these policy changes.[36]

So, taking stock of the results, the first stage shows that a proxy for declining worker bargaining power lowers the labor share. We have identified variation in the labor share, of the same kind emphasized by our model. We can now investigate the prediction of the model. If the labor share falls, due to lower worker bargaining power, the model predicts dampening. Regional employment should become less sensitive to aggregate business cycles. I now investigate this prediction.

4.2.3 Reduced Form Regression with Right to Work Laws

Now I show that the passage of right to work laws lowers the sensitivity of regional employment to aggregate business cycles. I estimate the reduced form regression equation (13) with right to

[36] If these other contemporaneous policies only affect unemployment dynamics by changing the labor share, the identification strategy remains valid.

work laws as the state level reform. Table 4 reports the results, by estimating $\beta_{\text{Reduced Form}}$. The first row and column shows that $\beta_{\text{Reduced Form}}$ is positive and statistically significant. In the aftermath of a right to work law, state employment contracts by less as aggregate unemployment rises. The second column adds industry-by-time fixed effects, to absorb common, time varying industry shocks. The same result holds: $\beta_{\text{Reduced Form}}$ is positive and significant. So, there is evidence of dampening.

The Appendix carries out several robustness tests, to look for heterogeneity or outliers. I sequentially drop each industry sector and each state that passes a right to work law during the sample period, from the regression. I find the results unchanged. I also drop each time period from the regression and do not find that the results differ.

One important concern is that the passage of right to work laws might affect wage rigidity—I also investigate this issue in the Appendix. Bargaining power of unions might cause workers' wages to become more rigid. Then, as unionization reduces, workers wages might become more flexible. This force would dampen employment fluctuations, through a different mechanism than that emphasized in this paper. But I find limited evidence for such patterns.

Taken together, we can interpret the reduced form and first stage results in terms of the dampening result predicted by the model. The first stage results show that right to work laws lower labor shares. Given the nature of right to work laws, which lower worker bargaining power, the fall in the labor share likely reflects rising rents going to firms. The reduced form results show that right to work laws reduce the sensitivity of regional employment to aggregate business cycles. Taken together, the results show that falls in the labor share, due to declining worker bargaining power and rising rents, dampen fluctuations in employment. So, we have identified evidence of the dampening prediction made by the model, in regional data.

4.3 Reform #2: School Financing Reforms

To be added.

5 Conclusion

After the 1980s, the share of output paid to workers—often termed the labor share—fell in the United States and worldwide. Increases in both the capital and rent share seem to have contributed to the falling labor share. But with existing data, measuring their relative importance is hard.

This paper asks how the falling labor share affects unemployment fluctuations. Though the *causes* of the falling labor share are manifold, the *consequences* may be more straightforward.

I argue that the falling labor share should dampen unemployment fluctuations—if either rents or capital caused the fall. I make two contributions. First, the paper studies a canonical labor search model, which I augment with sunk capital. When the labor share falls, due to either capital or rents, unemployment responds less to labor demand shocks. Second, I present some evidence of dampening. The paper documents a comovement consistent with the theory: employment in high labor share markets is more sensitive to aggregate business cycles. Then I study the passage of two statewide reforms, which identify changes in the labor share due to either rents or capital. After the passage of both reforms, the labor share falls, and the sensitivity of state unemployment to aggregate business cycles also falls.

Another important explanation for the falling labor share is reallocation from high to low labor share firms.[37] In companion work, Hazell and Patterson (2020) link the arguments in this paper to firm level theory and data.

[37]Important contributions include Autor et al. (2017), Hartman-Glaser et al. (2017), Kehrig and Vincent (2018) and Gouin-Bonenfant (2018).

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6 Tables

Table 1: Correlates of Region-Industry Labor Shares

Dependent Variable:	Annual Region-Industry Labor Share	
Right to Work Law	-0.0180**	-0.0178**
	(0.00633)	(0.00651)
2nd Quartile of Property Taxes	0.0342***	0.0307***
	(0.00608)	(0.00644)
3rd Quartile of Property Taxes	0.0573***	0.0476***
	(0.0116)	(0.0121)
4th Quartile of Property Taxes	0.107***	0.0894***
	(0.0180)	(0.0173)
2nd Quartile of Minimum Wages	0.0245**	0.0240**
	(0.00758)	(0.00781)
3rd Quartile of Minimum Wages	0.0341*	0.0322*
	(0.0139)	(0.0141)
4th Quartile of Minimum Wages	0.0259	0.0230
	(0.0174)	(0.0172)
N	25739	25739
Industry Effect	Y	Y
Industry-Time Effect	N	Y
r2_within	0.125	0.114

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: the outcome variable of this regression is state-by-quarter labor shares. The regressors are a dummy for whether the state had a right to work law, dummies for four quartiles of the annual minimum wage distribution, and dummies for four quartiles of the property tax rate distribution. The time period is 1976 to 2017. Labor shares are from the Bureau of Economic Analysis' Regional Economic Accounts. Standard errors are clustered by state. One, two and three asterisks represent significance at the 5, 1 and 0.1 percent level.

Table 2: Cyclicality of High and Low Labor Share Region-Industry Markets

Dependent Variable:	Annual industry-by-region employment growth	
	State level	Census division level
$\Delta\text{Unemployment}_t \times I\left(\text{labor share}_{is,t-1} \in \text{quartile}_2\right)$	-0.299**	-0.475**
	(0.0946)	(0.166)
$\Delta\text{Unemployment}_t \times I\left(\text{labor share}_{is,t-1} \in \text{quartile}_3\right)$	-0.289*	-0.425
	(0.124)	(0.237)
$\Delta\text{Unemployment}_t \times I\left(\text{labor share}_{is,t-1} \in \text{quartile}_4\right)$	-0.472*	-0.626*
	(0.188)	(0.280)
Industry-time fixed effect	Y	Y
N	25365	25365

Notes: the outcome variable is annual industry-by-region employment growth at either the census division or the state level. The regressors are changes in aggregate unemployment, interacted with dummy variables for quartiles of the labor share distribution, for each labor market. A dummy variable for the bottom quartile is excluded. The regression is weighted by average employment in each labor market. Standard errors are clustered by time. The time period is 1976-2017. Employment is from the Quarterly Census of Employment and Wages. Labor shares are compensation / (compensation + gross operating surplus) from the Bureau of Economic Analysis' Regional Economic Accounts. One, two and three asterisks represent significance at the 5, 1 and 0.1 percent level.

Table 3: First Stage: Right to Work Laws Lower Labor Shares

Dependent Variable:	State-by-industry labor share			
Right to Work Law$_{st}$ = 1	-0.0276***	-0.0245***	-0.0187***	-0.0180*
	(0.00378)	(0.00402)	(0.00414)	(0.00784)
Right to Work Law$_{s,t+5}$ = 1				-0.00393
				(0.00972)
Year Effect	Y	Y	Y	Y
Industry-Region Effect	Y	Y	Y	Y
Industry-Region Linear Trend	N	Y	N	N
Industry-Time Effect	N	N	Y	N
N	3240	3240	3240	2837

Notes: the outcome variable is region-by-industry labor shares, measured from the Bureau of Economic Analysis' Regional Economic Accounts. The regressor is a dummy variable for whether a right to work law has been passed at time t in state s. The regression is weighted by mean value added in each region-industry. Standard errors are clustered by state. The sample is in Census years only, in five year increments starting from 1977, through to 2012 inclusive. One, two and three asterisks indicate significance at the 5, 1, and 0.1 percent level.

Table 4: Reduced Form: Right to Work Laws Lower Cyclicality of Regional Employment

	Region-Industry Employment Growth			
Right to Work Law$_{st}$ = 1×	1.252**	4.543*	1.009*	4.197*
$\Delta_{t+2,t-2}$Aggregate Unemployment$_t$	(0.385)	(1.963)	(0.449)	(1.996)
Industry-state effects	Y	Y	Y	Y
Industry-state trends	N	Y	N	Y
Industry-time effects	N	N	Y	Y
N	2716	2716	2716	2716

Notes: the outcome variable is growth in region-industry employment over five years, from the Quarterly Census of Employment and Wages. I study the regression equation

$$\begin{aligned}\Delta_{t+2,t-2}\log\left(\text{employment}_{ist}\right) &= \alpha_{is}+\gamma_t+\text{controls}_{ist}+\varepsilon_{ist}\\ &\quad+\left(\delta_{is}+\beta_{\text{Reduced form}}\text{reform}_{st}\right)\times\Delta_{t+2,t-2}U_t\end{aligned}$$

as in the main text. reform$_{st}$ is an indicator for whether a right to work law has been passed in the state. The regression is weighted by mean employment in each region-industry. Standard errors are clustered by state. I control for pre-trends, by adding in the control reform$_{s,t+5}\times\Delta_{t+2,t-2}U_t$. The sample is in Census years only, in five year increments starting from 1977, through to 2012 inclusive. One, two and three asterisks indicate significance at the 5, 1, and 0.1 percent level.