

# Monopsony with nominal rigidities: an inverted Phillips Curve

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## Abstract

With nominal wage rigidities, it is crucial to distinguish whether wages are set by workers or firms – whether we have monopoly or monopsony power. This paper provides a model of monopsony power in the labour market and a monopsonistic Phillips Curve. If wages are set by firms who face nominal rigidities, and there is inflation, firms cannot adjust their wages fully. The real wage falls, and labour supply hence output decreases. This provides a Phillips Curve where the output gap is negatively correlated with wage inflation. In such a world monetary policy affects the intertemporal labour supply, while the Phillips Curve is a labour demand curve. Interest rate cuts reduce the labour supply instead of boosting demand: they are contractionary.

JEL codes: E24, E31, E52, J42

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## 1. Introduction

2 Policymakers have recently argued that monopsony is increasingly pervasive  
3 in the labour market.<sup>2</sup> With the fall in unionization and collective bargaining

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<sup>2</sup>Robinson (1933) originally defined monopsony as a *market situation in which there is only one buyer*, as opposed to monopoly with only one seller. More generally, it also encompasses any situation of imperfect competition where buyers dominate their input market, and face an elastic supply curve so that they can choose the price (or wage) that they offer. Firms with monopsony power can set lower wages than in a competitive market.

4 (documented for example in CEA (2016) or IMF (2017)), monopolistic unions  
5 are no longer a good description of the labour market. The increase in self-  
6 employment, flexible and part-time work – the so called *gig economy* – has made  
7 work more divisible and insecure (Haldane 2017). However, the consequence of  
8 these trends in labor market power for monetary policy is unclear. Is monopsony  
9 simply leading to lower wages? Or is there a more fundamental change? New  
10 Keynesian models assume that suppliers have market power and set their rates:  
11 the producer sets her own price, and/or the worker/union sets her own wage.  
12 What happens when wages are set by employers instead of employees, and  
13 they face nominal rigidities? In this paper, I argue that it not only affects the  
14 wage level, but also the Phillips Curve and monetary policy. Low interest rates  
15 become contractionary, instead of being expansionary.

#### 16 *Monopsony and the Phillips Curve*

17 The New Keynesian model with nominal wage rigidities usually assumes that  
18 wages are set by workers or unions having monopoly power. Individual workers  
19 or unions face a labor demand curve that is not perfectly elastic. They commit  
20 to a wage and are willing to work any amount at this wage. Hence the economy is  
21 (labour) demand-constrained. Here, I look instead at the effect of monopsonistic  
22 employers setting wages for their employees. Individual employers face an elastic  
23 labour supply curve : they have monopsony power. Since they commit to  
24 provide employment to anyone willing to work at the posted wage, the economy  
25 is now (labour) supply-constrained.<sup>3</sup>

26 In the NK wage monopoly model, firms' demand for labour is the result  
27 of an intertemporal Euler equation: if wages are higher today than tomorrow,  
28 or with high real rates, firms demand less labour today. Hence high interest  
29 rates reduce labour demand, while labour supply is fixed by nominal rigidities  
30 and doesn't react to the interest rate. On the other hand, if nominal rigidities  
31 apply to the demand side, labour demand no longer reacts to the interest rate,

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<sup>3</sup>With monopsony there is no notion of voluntary unemployment; instead there is voluntary job rationing: firms' labour demand is inefficiently low given the low real wage.

32 but the supply of labour does, with an Euler equation. If wages are higher  
33 today than tomorrow, or with high real rates, workers will work more today,  
34 and enjoy more leisure tomorrow: high interest rates are expansionary.<sup>4</sup> Since  
35 shocks to the natural or nominal rate of interest now affect the intertemporal  
36 supply equation, and not the intertemporal demand equation as before, they  
37 now qualify as *supply shocks* – instead of demand shocks.

### 38 *Related literature*

39 Monopsony (or oligopsony) has been studied both theoretically and empirically  
40 in the labour literature, as well as in other markets (see, among others,  
41 Manning 2003, Murray 1995 or more recently Morlacco 2019). Theoretical models  
42 of monopsony have usually relied on the Salop (1979) or Hotelling (1929)  
43 models of geographical differentiation, or on search frictions as in Burdett and  
44 Mortensen (1998). Recent papers of oligopsony in the labour market such as  
45 Berger et al. (2019) have relied instead on a model with a constant elasticity  
46 of substitution. Based on Horvath (2000), it is the mirror analog of CES monopolistic  
47 competition: workers have a taste for diversity and work in several  
48 firms/sectors<sup>5</sup>– as opposed to monopolistic competition as in Erceg et al. (2000)  
49 where firms have a taste for diversity and work with different worker types. A  
50 CES model is particularly tractable and suitable to study the interaction of  
51 monopsony and inflation, which is the key novel contribution of this paper.

52 This paper is also related to the recent literature looking at the growing  
53 role of very large and powerful firms. Eeckhout and de Loecker (2018), or Gutierrez  
54 and Philippon (2017) have documented an increase in monopoly power,  
55 where firms charge higher prices, and output is sub-optimally low. Policymakers  
56 such as CEA (2016) and IMF (2017) have highlighted the shift of bargaining

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<sup>4</sup>The usual NK model with price rigidities and flexible wages can also feature this intertemporal equation. It is however irrelevant, because nominal rigidities only apply to goods not labour, and the relevant Euler equation relates to the demand for goods.

<sup>5</sup>Horvath (2000) assumes that agents share their time across sectors while for me it is across firms. While most people work with only one employer in real life, this simplification can be rationalised with a discrete choice model, along the lines of Anderson et al (1987).

57 power from employees to employers, new features of the labour markets, and the  
58 resulting effect on weak wage growth but without looking at monopsony power  
59 specifically. Recent papers have looked at the link between monopsony power  
60 and weak wage growth. Azar et al. (2017) find a strong negative relationship  
61 between monopsony power and wages in the US. Looking at US manufacturing,  
62 Benmelech et al. (2018) document the same effect, though on a much smaller  
63 scale. Abel et al. (2018) find similar results to Benmelech et al. in the UK, for  
64 a larger firm sample.

65 Last, this paper is related to the debate on the shape of the Phillips Curve  
66 (Ball and Mazumder 2011, Blanchard 2016). It is also indirectly related to the  
67 reversal rate literature (Brunnermeier and Koby, 2018), where interest rates  
68 below a certain level become contractionary due to financial frictions, although  
69 the channel of contractionary low interest rates is different here.

70 The rest of the paper is organised as follows. Section 2 builds a model of  
71 monopsony, derives a monopsonistic Phillips Curve, interprets monetary policy  
72 in this setup and discusses the results. Section 3 concludes.

## 73 **2. The Phillips curve with monopsony**

74 In this section I build a model of monopsony power in the labour market,  
75 which allows me to write a monopsonistic Phillips Curve.

### 76 *2.1. Flexible steady state*

77 Let me first set up the model without nominal rigidities.

#### 78 *Households*

79 As in Horvath (2000), a worker allocates its time across different employers:  
80 there is a continuum of firms, indexed by  $i \in [0, 1]$ . By working  $L_i$  with each  
81 employer  $i$  (at a wage  $W_i$ ), the total wage received is  $\int_0^1 W_i L_i di$ . Disutility of

82 work depends on an *effective* labour  $L_t$ , which is a CES convex function of each  
 83 labour  $L_t(i)$  supplied to each firm  $i$ :<sup>6</sup>

$$L_t = \left[ \int_0^1 L_t(i)^{1+1/\eta} di \right]^{\frac{1}{1+1/\eta}}$$

84  $\eta = \frac{\partial \ln L_t}{\partial \ln W_t} |_{L,C}$  is the wage elasticity of labour supply.

85 The consumption good  $C_t$  is assumed to be homogeneous at a price  $P_t$ . The  
 86 representative households maximizes a separable utility function, subject to a  
 87 budget constraint:

$$\begin{aligned} & \max E_0 \sum_{t=0}^{+\infty} \beta^t [U(C_t) - V(L_t)] \\ \text{st.} \quad & P_t C_t + Q_t B_t = B_{t-1} + \int_0^1 W_t(i) L_t(i) di + \int_0^1 D_t(i) di \end{aligned}$$

88 From every firm  $i$ , the household receives a dividend  $D_t(i)$ , and a wage  
 89 compensation  $W_t(i)L_t(i)$  for supplying  $L_t(i)$  to firm  $i$ . New bonds  $B_t$  can be  
 90 bought or sold at price  $Q_t$ , the stochastic discount factor of the household.

91 The Euler equation pins down the stochastic discount factor

$$Q_t = E_t \beta \frac{P_t}{P_{t+1}} \frac{U'(C_{t+1})}{U'(C_t)} \quad (1)$$

92 The first order condition for each  $L_t(i)$  brings

$$\frac{u'(C_t)}{P_t} W_t(i) = \left( \frac{L_t(i)}{L_t} \right)^{1/\eta} V'(L_t) \quad (2)$$

93 There is a substitution across jobs, and between leisure and consumption:

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<sup>6</sup>See Berger et al. (2019) for a discrete choice probabilistic microfoundation of this monopsony assumption, along the lines of Anderson et al (1987): workers have idiosyncratic preferences over different types of jobs and work for only one employer. As relative wages change, some workers fully substitute to a new occupation, creating imperfect aggregate substitutability. If preferences follow a Gumbel distribution, this results in CES.

94 **Property 1.** Write  $W_t$  the wage aggregate as

$$W_t = \left[ \int_0^1 W_t(i)^{1+\eta} di \right]^{\frac{1}{1+\eta}}$$

95 (1) As the worker takes prices and wages as given, the aggregate real wage is  
 96 equal to the marginal rate of substitution (MRS) of labour and consumption:

$$\frac{W_t}{P_t} = \frac{V'(L_t)}{U'(C_t)} = MRS_t \quad (3)$$

97 (2) Firm  $i$ 's relative labour supply is a function of its relative wage:

$$\frac{L_t(i)}{L_t} = \left( \frac{W_t(i)}{W_t} \right)^\eta \quad (4)$$

98 (3) Combining the  $MRS = \frac{W}{P}$  condition with the Euler equation of consump-  
 99 tion, one can write an intertemporal labour supply equation:

$$Q_t \frac{V'(L_t)}{W_t} = \beta E_t \frac{V'(L_{t+1})}{W_{t+1}} \quad (5)$$

100 In logs, with  $r^n = -\ln \beta$ , this writes  $v'(l_t) = (i_t - E_t \pi_{t+1}^w - r^n) + E_t v'(l_{t+1})$

101 At the optimum, the worker is indifferent between earning 1\$ tomorrow, or  
 102 earning  $Q_t$  today to buy a bond yielding 1\$ tomorrow. This intertemporal  
 103 labour supply equation doesn't exist when monopolistic workers set sticky wages  
 104 since they do not choose their labour supply. As explained in footnote 4 above,  
 105 this equation holds but it is irrelevant when wages are flexible.

106 *Firms*

107 Representative firm  $i$  takes prices as given, and has a production function  
 108  $Y_t(i) = F(L_t(i))$ . It maximizes its profits subject to the labour supply curve:

$$\max_{L_t(i), W_t(i)} P.F(L_t(i)) - W_t(i).L_t(i) \quad st. \quad \left( \frac{L_t(i)}{L_t} \right) = \left( \frac{W_t(i)}{W_t} \right)^\eta$$

109 The optimal wage is below the marginal product of labour (MPL):

$$W_t(i) = \frac{P_t \cdot F'(L_t(i))}{1 + 1/\eta} \quad \frac{W_t}{P_t} = \frac{MPL_t}{1 + 1/\eta}$$

110 With flexible prices and wages, the wage is equal to the MRS and is a markup  
 111 below the MPL. Hence this is not a state of voluntary unemployment where  
 112 workers work too little given the current wage. Instead, jobs are rationed and  
 113 firms hire too little, given the wage. Monopsonistic competition in the labour  
 114 market is similar to monopolistic competition in the goods market: the real  
 115 wage is below the marginal product of labour.

116 *2.2. Sticky wages*

Let me assume that the firm faces a Calvo fairy when setting its wage: only a fraction  $(1 - \theta)$  of firms can reset their wage in each period. The wage is set to maximize the discounted profits subject to the labour supply curve:

$$\begin{aligned} \max_{W_t^*(i)} \mathbb{E}_t \sum_{k=0}^{+\infty} (\theta\beta)^k \frac{u'(C_{t+k})}{P_{t+k}} [P_{t+k}F(L_{t+k}(i)) - W_t^*(i)L_{t+k}(i)] \quad (6) \\ \text{st. } \left( \frac{L_{t+k}(i)}{L_{t+k}} \right) = \left( \frac{W_t^*(i)}{W_{t+k}} \right)^\eta \end{aligned}$$

117 Around a zero-inflation steady state, the FOC provides a Phillips Curve:<sup>7</sup>

**Property 2 (Calvo monopsonistic Phillips Curve).**

$$\pi_t^w = \frac{(1 - \beta\theta)(1 - \theta)}{\theta} \left( \frac{-1}{1 + \alpha\eta} \right) (mrs_t - mpl_t) + \beta\mathbb{E}_t[\pi_{t+1}^w] \quad (7)$$

118  $\alpha = \frac{-LF''(L)}{F'(L)}$  is the elasticity of the production function and  $\frac{(1-\beta\theta)(1-\theta)}{\theta}$  comes  
 119 from the Calvo modeling.  $mrs_t$  and  $mpl_t$  are the log deviations of the MRS  
 120 and MPL at  $t$ , hence  $(mrs_t - mpl_t)$  is a measure of real economic activity.  
 121 Monopsony only plays a role through  $\eta$  and the negative sign.

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<sup>7</sup>The log approximation of the optimal Calvo wage (dropping the markup) is  $w_t^* = (1 - \beta\theta) \sum_{k=0}^{+\infty} (\beta\theta)^k [p_t + mpl_{t+k|t}]$ . If  $mpl = -\alpha l$ ,  $mpl_{t+k|t} = mpl_{t+k} + \alpha\eta(w_{t+k} - w_t^*)$ . Using the fact that  $mrs = w - p$ , and standard algebra, the Phillips Curve can be derived.

122 I compare this monopsony model with a baseline NK monopoly model with  
123 wage stickiness but flexible prices based on Erceg et al. (2000).<sup>8</sup> In the normal  
124 wage Phillips Curve with monopoly power,<sup>9</sup> wages are set by employees. With  
125 a positive labour demand shock, the nominal wage cannot increase, so employ-  
126 ment increases above potential. This leads to positive wage inflation to close  
127 this positive employment gap. Hence the positive inflation-employment gap cor-  
128 relation. On the other hand, when wages are set by monopsonistic employers, a  
129 positive labour supply shock increases employment above potential, as the rigid  
130 wage does not fall. This leads to wage deflation to close this employment gap.

### 131 2.3. Supply, demand and monetary policy

132 It is useful to write the model in terms of labour supply and demand de-  
133 pending on wage inflation, to compare it with the usual wage monopoly model.

134 In the monopoly wage model, the  $\frac{W}{P} = MPL$  condition for firms brings  
135  $(\pi_{t+1}^w - \pi_{t+1}^p) = (mpl_{t+1} - mpl_t)$ . Combined with the Euler equation of con-  
136 sumption, it yields the firms' intertemporal labour demand equation:<sup>10</sup>

$$[u'(c_t) + mpl_t] = (i_t - E_t \pi_{t+1}^w - r_t^n) + E_t [u'(c_{t+1}) + mpl_{t+1}] \quad (8)$$

137  $r_t^n$  is the (possibly time varying) natural interest rate. With a Taylor rule  
138  $i_t = \phi \pi_t^w$ , then – for given expectations of future variables – this provides a  
139 negative demand relationship between wage inflation and labour. It is then

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<sup>8</sup>Most models with sticky wages also feature sticky prices. However I assume flexible prices to make the two models most comparable. When firms with goods monopoly power and labour monopsony power face nominal rigidities in both markets, output depends on a *difference* of the price and wage inflation, instead of an average as in EHL (see Denery, 2020).

<sup>9</sup>The normal NK model with sticky wages and flexible prices typically displays employers with a taste for diversity among worker types, with an elasticity of substitution  $\epsilon$ . With  $\phi$  the disutility curvature, the Calvo wage monopoly Phillips Curve can be written

$$\pi_t = \frac{(1-\beta\theta)(1-\theta)}{\theta} \left( \frac{1}{1+\phi\epsilon} \right) (mrs_t - mpl_t) + \beta E[\pi_{t+1}]$$

<sup>10</sup>The typical price NK model features 3 equations: the price PC, the Euler equation of consumption, and a Taylor rule as a function of price inflation. In the wage monopoly model, we have 4 equations: the wage PC, a wage inflation Taylor rule, the Euler equation of consumption, and the condition  $W/P = MPL$ . Eq (8) combines these last two for simplicity.

140 combined with the upward-sloping labour supply PC with wage inflation and  
 141 labour  $\pi_t^w = \beta E_t \pi_{t+1}^w + \lambda(mrs_t - mpl_t)$

142 On the other hand, in the monopsony wage model, the Phillips Curve is  
 143 a demand curve in terms of labour and wage inflation. The corresponding  
 144 intertemporal labour supply curve is eq. (5), which in logs becomes<sup>11</sup>

$$v'(l_t) = (i_t - E_t \pi_{t+1}^w - r_t^n) + E_t v'(l_{t+1}) \quad (9)$$

145 With a Taylor rule  $i_t = \phi \pi_t^w$ ,<sup>12</sup> this provides a positive supply relationship  
 146 between wage inflation and labour – for given expectations of future variables.  
 147 It is then combined with the downward-sloping monopsony PC, which is the  
 148 firms' labour demand equation:  $\pi_t^w = \beta E_t \pi_{t+1}^w - \lambda(mrs_t - mpl_t)$ .

149 In what follows, I assume the following Taylor rule:  $i = \phi_\pi^w \pi^w$ . The difference  
 150 between the wage monopoly and monopsony models is displayed in figure 1,  
 151 and does not depend *qualitatively* on the specific calibration of the two models.  
 152 Under monopoly the Phillips Curve (PC) is a supply curve combined with an  
 153 intertemporal demand curve (D), while under monopsony it is a demand curve  
 154 combined with an intertemporal supply curve (S).<sup>13</sup>

### 155 *Interest rate shocks*

156 Under monopoly, a drop in the policy rate (or an increase in the natural  
 157 interest rate) raises demand. Output increases above its potential, the positive  
 158 output gap raises wage inflation. Conversely, under monopsony, impatience  
 159 lowers the labour supply today relative to tomorrow. With a negative output  
 160 gap, inflation increases and raises the nominal and real rates.

<sup>11</sup>Under monopsony we have 4 equations: the wage PC, a wage inflation Taylor rule, the Euler equation of consumption, and  $W/P = MRS$ . Eq (9) combines these last two.

<sup>12</sup>Under monopsony, with a Taylor rule  $i = \phi_y y + \phi_\pi^w \pi^w$ , the analog of the Bullard and Mitra (2002) condition becomes  $\phi_\pi^w - \frac{1-\beta}{\kappa} \phi_y > 1$ . Hence the rule is unchanged if  $\phi_y = 0$ .

<sup>13</sup>Denote  $\sigma = -CU''(C)/U'(C)$ ,  $\alpha = -LF''(L)/F'(L)$  and  $\phi = LV''(L)/V'(L)$ . In the monopoly case, the monopoly PC and labour demand equation write, respectively:  $\pi_t^w = \beta E_t \pi_{t+1}^w + \lambda(\sigma(1-\alpha) + \phi + \alpha)l_t$  and  $(\sigma(1-\alpha) + \alpha)(l_t - E_t l_{t+1}) = -(i_t - E_t \pi_{t+1}^w - r_t^n)$ . In the monopsony case, the monopsony PC and labour supply equation write, respectively:  $\pi_t^w = \beta E_t \pi_{t+1}^w - \tilde{\lambda}(\sigma(1-\alpha) + \phi + \alpha)l_t$  and  $\phi(l_t - E_t l_{t+1}) = (i_t - E_t \pi_{t+1}^w - r_t^n)$ .

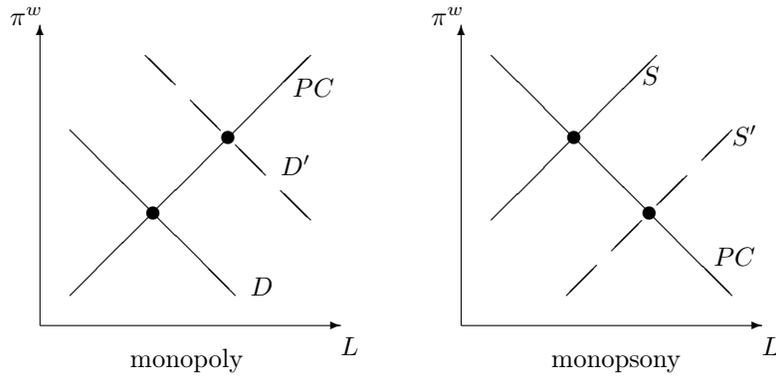


Figure 1: The monopoly vs. monopsony models. Under monopoly the PC is a supply curve, while it is a demand curve under monopsony. The dashed lines show the effect of a decrease in the policy rate  $i$ , or an increase in  $r^n$ .

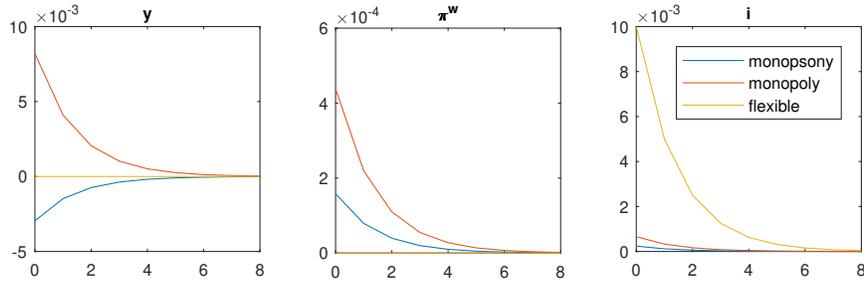


Figure 2: Response of  $(y, \pi^w, i)$  to an impatience shock

161 Figure 2 shows that qualitatively, inflation and interest rates increase in  
 162 both models (though the magnitude depends on calibration). As the real in-  
 163 terest rate doesn't increase enough to match the increased impatience, output  
 164 increases under monopoly but falls under monopsony. Crucially with monop-  
 165 sony, impatience shocks are no longer positive demand shocks, but negative  
 166 supply shocks, as they apply to the intertemporal *supply* curve now.

### 167 3. Conclusion

168 This paper first introduced a model of monopolistic competition with a con-  
 169 stant elasticity of substitution (CES) between jobs similar to Horvath (2000).  
 170 While the monopolistic competition model features imperfect substitution of  
 171 employers between workers or worker types – a love of variety – monopsonistic

172 competition features imperfect substitutability of workers across different em-  
173 ployers or job types. Workers prefer to work for different employers as it brings  
174 a lower disutility than working for one sole employer.

175       Having introduced this model of monopsony, it is easy to build a New Key-  
176 nesian model with wages set by monopsonistic employers. The difference with  
177 the classical monopoly Phillips Curve is that the output-inflation correlation  
178 becomes negative. Since interest rate shocks affect the intertemporal labour  
179 supply curve instead of the consumption demand curve, these interest shocks  
180 have the opposite effect of the normal monopoly case. An interest rate drop  
181 reduces the labour supply and is contractionary.

182       Looking at heterogeneity is an obvious avenue for future research. Employ-  
183 ers have monopsony power in some sectors while others still show employee  
184 monopoly power. Studying mega firms with both monopoly power over their  
185 consumers and monopsony power over their employees is another promising path  
186 that I explore in Dennery (2020): output then depends on a difference between  
187 price and wage inflation. Last, shifting the bargaining power – and wage rigidi-  
188 ties – from workers to firms would also add realism: the slope of the Phillips  
189 Curve would now depend on both sides’ relative bargaining power.

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