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Employment Differentiation, Minimum Wages, and Firm Exit

Empleos diferenciados, salarios mínimos y cierre de empresas

Abstract

The economic literature acknowledges that labor markets can often be described by monopsonistic competition. In such a structure, employers have market power and in the long run, zero profits due to the free entry and exit of firms. This article builds a partial equilibrium model to analyze the role of minimum wages when employment is differentiated. It shows that first-best and second-best minimum wages can increase employment and improve efficiency by reducing market power, at the expense of firm exit, higher concentration among employers, and less employment variety. As such, this article can provide insights into the ambiguous effect of minimum wages on employment levels systematically found in the literature, and on the higher firm exit rates observed among new, small, and lower productivity firms.

Keywords: Employment differentiation, residual supply of labor, firm exit, minimum wage.

JEL Classification: D21, J21, J31.

Resumen

La literatura económica reconoce que, con frecuencia, los mercados laborales pueden describirse mediante la competencia monopsonista. En tal estructura, a largo plazo, las empresas tienen poder de mercado y cero ganancias económicas debido a la libre entrada y salida de firmas. Este artículo construye un modelo de equilibrio parcial para analizar el rol del salario mínimo cuando el empleo es diferenciado. Muestra que los salarios mínimos de primero y segundo mejor pueden aumentar el empleo y la eficiencia, al reducir el poder de mercado, a expensas del cierre de empresas, así como una mayor concentración entre los empleadores y una menor variedad de empleos. Como tal, este artículo puede aportar elementos para entender mejor las mayores tasas de cierre de firmas observadas entre las empresas nuevas, pequeñas y de menor productividad.

Palabras clave: Empleos diferenciados, oferta residual de trabajo, cierre de empresas, salario mínimo.

Clasificación JEL: D21, J21, J31.

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Introduction

This article builds a succinct model of the labor market focusing on monopsonistic competition, including horizontal employment differentiation, market power, and—in the long-run—free entry and exit of firms and zero profits. The model is used to make simulations and study market outcomes and policy options in terms of welfare, regarding for example first-best and second-best levels of the minimum wage.

The available empirical evidence is inconclusive regarding the impact of minimum wages on employment. The available empirical evidence also suggests that young and smaller firms have a higher probability of exit than older and larger firms. Although this article is theoretical, it provides insights that are compatible with the aforementioned empirical evidence.

The article starts with a summary of the existing literature on monopsonistic competition. It then outlines the basic assumptions used and the structure of the model, followed by a characterization and simulations of the short and the long-run equilibria in these settings. The model is subsequently used to analyze the impacts of the first-best and the second-best minimum wages in this context. The article ends with some conclusions.

I. Previous literature

The concept of monopsonistic competition has been used in the literature for several decades. Bhaskar et al. (2002) provided a good summary of the different developments around this market structure and argued that oligopsony and monopsonistic competition are the market structures that best describe labor markets in the real world.

Bhaskar et al. (1999) built a monopsonistic competition model in which workers have two different reservation wages (low and high)—with horizontally differentiated jobs à la Salop, transport costs, and free entry and exit of firms—and concluded that an increase in the minimum wage augments employment per firm, generates firm exit, and has ambiguous effects on industry employment. They also argued that if the minimum wage increases industry employment,

it increases welfare, and that if industry employment falls, the welfare effects are ambiguous.

Bhaskar (2003) et al. argued that when firms have high fixed costs, the minimum wage increases employment, as opposed to what occurs in more competitive labor markets, and that the welfare effect of a small minimum wage increase is unambiguously positive.

Empirically, Draca et al. (2011) found no evidence that reduced firm profitability due to the introduction of minimum wages leads to lower employment. They concluded that this result suggests that minimum wages redistribute quasi rents towards employees with low wages.

Card et al. (1994) used data from 410 fast food restaurants in New Jersey and eastern Pennsylvania to quantify the impact on employment of an increase in the minimum wage in New Jersey from \$4.25 to \$5.05. They also compared high-wage stores in New Jersey that were paying more than \$5.00 with low-wage stores. They found no evidence that the increase in the minimum wage affected the level of employment.

Dube et al. (2010) used U.S. data between 1990 and 2006 from contiguous counties and considered differences in state minimum wage policies. They found no employment effects from minimum wages in the short run and in the long run.

Belman et al. (2014) performed a meta-analysis and found some evidence that increases in the minimum wage lead to very small reductions in employment or employment hours.

Acar et al. (2019) used data from Turkey and found that a 25% increase in the real minimum wage led to a 12% increase in the rate of exit of firms from the formal economy and explained one third of the total fall in employment due to firm destruction, even if the remaining firms employ more workers. They also found that minimum wages hit firms with lower productivity and low profit margins harder in less concentrated markets.

Bachman et al. (2017) used a semi-structural estimation of a dynamic monopsonistic competition model and found that the retail, hotel, restaurant,

and agricultural sectors were well described by monopsonistic competition, while other low-wage industries, such as food manufacturing, were not. Thus, the impacts of minimum wages may be heterogeneous across different industries.

In a more focused context, Luca et al. (2019) found that increasing the minimum wage by one dollar increased the likelihood of exit of a 3.5-star restaurant by 10 percent but had no significant effect on 5-star restaurants, reinforcing the idea that minimum wages affect lower productivity firms more than higher productivity firms.

Prieto et al. (2022) used U.S. Census Bureau data from the period 1978–2019 and found that approximately 75 to 83 % of new firms survived for one year or more; 62 to 73 % survived for two years or more; 52 to 64 % survived for three years or more; 46 to 58 % survived for four years or more; and 41 to 52 % survived for five years. They argued that their results for the first five years of a firm do not support the independence of risk of failure and firm age—or the increase in firm failure with firm age—but rather support the idea that the risk of firm exit decreases with age.

Bartelsman et al. (2003) used an OECD harmonized database for the United States, Germany, France, Italy, United Kingdom, Canada, Denmark, Finland, the Netherlands, and Portugal. Among others, they concluded that the exit of firms is concentrated in small firms; that entry and exit rates are fairly similar across countries; that around 20 % of firms in most industries enter and exit each year; that around 20 % to 40 % enter and exit in the first two years; and that approximately 40 to 50 % of firms survive beyond the seventh year.

This article builds a partial equilibrium model of employment differentiation to highlight as clearly as possible the basic concepts and insights that arise from such market structure, and to analyze efficiency, concentration, employment variety, and the role of economic policy. As is usually the case with this market structure, emphasis will be placed on applications related to labor markets.

II. A Model of Employment Differentiation

Given that this article addresses monopsonistic competition, its focus will be the labor market. Product markets will be assumed to be competitive and with a fixed price. This section of the article outlines the assumptions used, followed by the model structure. Then the short and the long-run equilibria will be discussed. The section will conclude with a summary of the results obtained.

A. Assumptions

In order to build a simple partial equilibrium model of monopsonistic competition, the following basic assumptions are made: i) there are many equally productive suppliers of labor (households); ii) there are many employers (n firms); and, iii) employment is horizontally differentiated by things other than skills, productivity, effort, and risk. For example, employment can be horizontally differentiated by location, or by the nature of the tasks expected in each job, all requiring similar levels of skills, productivity, effort, and risk.

The production functions and cost structures of all firms are identical. In the short run, there is a fixed number of firms. In the long run, there is free entry and exit of firms. If a firm produces and employs workers, the amount of capital per firm is fixed and positive in both the short and long run.

Given that this article focuses on the labor market, the output market is competitive and the price of the output produced by all firms is equal to 1 in both the short run and the long run. In addition, this model contains no transport costs.

B. Model Structure

Consider a labor market with wage (w); total hours worked (L); positive parameters a , b , c , d and n ; and the following linear market supply:

$$w = d + aL \quad (1)$$

The production function ($q_i(l_i, k)$) of any firm i as a function of the hours hired by each firm (l_i) and the fixed amount of capital k is:

$$q_i(l_i, k) = bl_i \quad (2)$$

The fixed cost associated with the fixed input k is c , and is positive as long as production is positive. In this article, the total revenue (TR_{NFCi}) and the average revenue (AR_{NFCi}) of firm i are expressed net of fixed costs (c). This makes it possible to focus on the revenue available to pay wages, simplifies the graphic representation of the model, and highlights the mirror symmetry of this model, with the standard textbook representations of monopolistic competition when referring to the goods and services markets.

Thus, there are identical total revenues (net of fixed costs) for all firms, as follows:

$$TR_{NFCi} = bl_i - c$$

The average revenue (net of fixed costs) from the labor hired is:

$$AR_{NFCi} = b - \frac{c}{l_i}$$

The marginal revenue (MR) from the labor hired for each firm is the marginal product:

$$MR_i = \frac{\partial TR_{NFCi}}{\partial l_i} = b$$

Definition: The residual labor supply of firm i is the market supply of labor (SS) minus the labor hired by all other firms (Σl_{-i}):

$$RSS_i = SS - \Sigma l_{-i}$$

Given the market supply, the labor supply can be written as:

$$L = \frac{w - d}{a}$$

In a symmetric equilibrium:

$$\frac{L}{n} = \frac{w - d}{na}$$

If

$$\frac{L}{n} = l_i$$

$$nal_i = w - d$$

Thus, the residual labor supply of firm i can be written as:

$$w = d + nal_i \quad (3)$$

C. The Short-Run Equilibrium

In the short run, the number of firms is fixed and equal to n . To find the labor hired by firm i in the short run, consider the profit maximization for firm i :

$$\Pi_i = bl_i - c - (d + nal_i)l_i \quad (4)$$

The first order condition for maximization is:

$$\frac{\partial \Pi_i}{\partial l_i} = b - d - 2anal_i = 0 \quad (5)$$

$$l_i = \frac{b - d}{2an} > 0$$

$$L = \frac{b - d}{2a} > 0 \quad (6)$$

Note that the market existence requires that $b > d$, since the marginal product must be greater than the intercept of the supply curve or else the market collapses.

The short-run equilibrium wage can be found by replacing the labor hired by a firm in its residual labor supply, as follows:

$$w = d + an \left[\frac{b - d}{2an} \right] \quad (7)$$

$$w = \frac{b + d}{2} > 0$$

The wage elasticity of (market and residual) labor supply can be expressed in terms of the model's parameters as:

$$\eta = \eta_i = \frac{\partial l_i}{\partial w} \frac{w}{l_i} = \frac{1}{an} \frac{\frac{b + d}{2}}{\frac{b - d}{2an}} \quad (8)$$

$$\eta = \eta_i = \frac{b + d}{b - d}$$

The markdown in the short run can be written as:

$$md = \frac{b - \left[\frac{b+d}{2}\right]}{b} \quad (9)$$

$$md = \frac{b-d}{2b} > 0$$

The market existence condition implies that there is always markdown, and thus inefficiency, in the short-run equilibrium.

The household (or worker) surplus (HS) can be estimated as:

$$HS = \frac{[w-d] * L}{2}$$

$$HS = \frac{\left[\left(\frac{b+d}{2}\right) - d\right] \left[\frac{(b-d)}{2a}\right]}{2} \quad (10)$$

$$HS = \frac{\left[\frac{b-d}{2}\right] \left[\frac{b-d}{2a}\right]}{2}$$

$$HS = \frac{(b-d)^2}{8a}$$

The profits for firm i (Π_i) in the long-run equilibrium can now be written in terms of the model's parameters as:

$$\Pi_i = (b-w)l_i - c$$

$$\Pi_i = \left[b - \left(\frac{b+d}{2}\right)\right] \left(\frac{b-d}{2an}\right) - c$$

$$\Pi_i = \left(\frac{b-d}{2}\right) \left(\frac{b-d}{2an}\right) - c$$

So:

$$\Pi_i = \frac{(b-d)^2}{4an} - c \quad (11)$$

Total profits in the industry can be expressed as:

$$\Pi = \frac{(b-d)^2}{4a} - cn \quad (12)$$

Social welfare (SW) can be estimated as the sum of the surplus of all the households plus the profits of the n firms:

$$SW = \frac{(b-d)^2}{8a} + \frac{(b-d)^2}{4a} - nc \quad (13)$$

$$SW = \frac{3(b-d)^2}{8a} - nc$$

Comparative statics results for the short run are summarized in Table 1.

Table 1. Comparative Statics in the Long Run Equilibrium

	↑a	↑b	↑c	↑d	↑n
l_i	↓	↑	—	↓	↓
L	↓	↑	—	↓	—
w	—	↑	—	↑	—
md	—	↑	—	↓	—
$\eta=\eta_i$	—	↓	—	↑	—
HS	↓	↑	—	↓	—
Π_i	↓	↑	↓	↓	↓
Π	↓	↑	↓	↓	↓
SW	↓	↑	↓	↓	↓

Source: Author.

As shown in Table 1, increases in the slope of the supply curve decrease employment per firm, total employment, household surplus, firm's profits, and social welfare. They have no effect on the wage rate, the mark-down, and the wage elasticity of (market and residual) labor supply.

Increases in productivity increase employment per firm, total employment, the wage rate, the markdown, household surplus, firm profits, and social welfare, and decrease the wage elasticity of (market and residual) labor supply.

As long as the market does not collapse due to lack of profitable firms, increases in the fixed cost decrease firm's profits and social welfare. However, they have no effect on employment per firm, total employment, the wage rate, the markdown, the wage elasticity of (market and residual) labor supply, and household surplus.

Increases in the intercept of the supply curve (reservation wage) increase the equilibrium wage rate and the wage elasticity of (market and residual) labor supply, while they decrease employment per firm, total employment, the markdown, firm profits, household surplus, and social welfare.

Consider the following simulations of this model in the short run as a mechanism to illustrate the way it operates. Any parameters can be used as long as the market existence condition holds.

In the short run, firms may have profits, losses (lower or equal to the fixed cost or else the firms close), or zero profits. The model can be graphed with the parameters and the results described in Table 2.

Table 2. Parameters and Results of the Simulations of the Model in the Short Run

Short Run Scenarios			
Parameter	$\Pi < 0$	$\Pi > 0$	$\Pi = 0$
a	0.00256	0.00256	0.00256
b	100	100	100
c	1000	1000	1000
d	20	20	20
n	1042	446	625
Result	$\Pi < 0$	$\Pi > 0$	$\Pi = 0$
w	60	60	60
L	15 625	15 625	15 625
l_i	15	35	25
md	0.4	0.4	0.4
HS	312 500	312 500	312 500
Π_i	-400	401	0
Π	-417 000	179 000	0
SW	-104 500	491 500	312 500

Source: Author’s results using ad-hoc values respecting the market existence condition.

As shown in Figure 1, with the parameters considered, if $n = 1042$ the typical firm will have short-run losses:

With the parameters considered, if $n = 446$ the typical firm will have short run profits, as shown in Figure 2.

With the parameters considered, if $n = 625$, the typical firm will have zero short-run profits, as shown in Figure 3.

In terms of the parameters of the proposed simulation, using equations 11 and 13, profits per firm and social welfare can be estimated as follows:

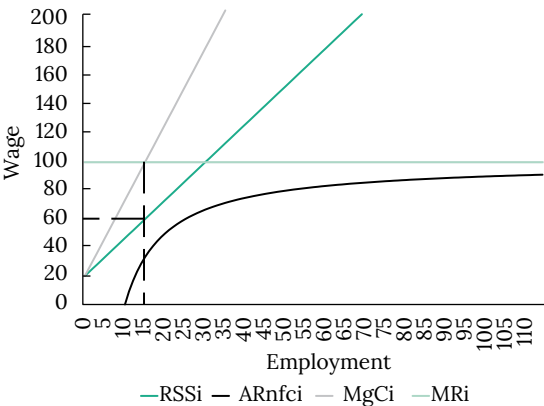


Figure 1. Short-Run Equilibrium with Losses

Source: Author’s calculations.

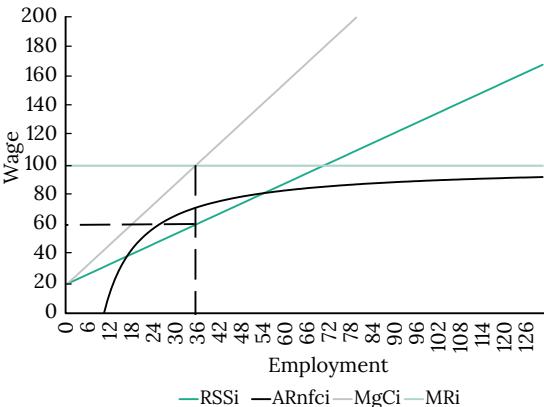


Figure 2. Short-Run Equilibrium with Positive Profits

Source: Author’s calculations.

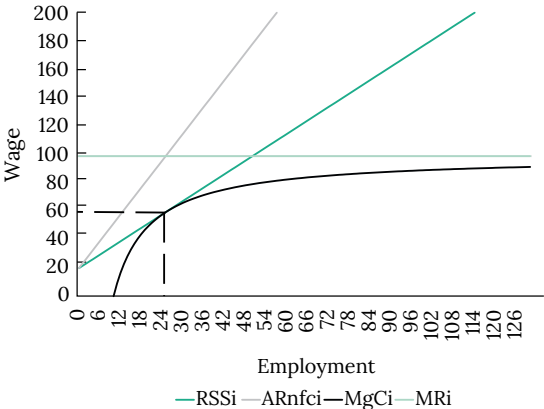


Figure 3. Short-Run Equilibrium with Zero Profits

Source: Author’s calculations.

For losses, consider $n=1402$:

$$\Pi_i = \frac{(100 - 20)^2}{4 * 0.00256 * 1\,042} - 1\,000 = -400$$

$$SW = \frac{3(100 - 20)^2}{8 * 0.00256} - 1042 * 1\,000 = -104\,500$$

For gains, consider $n=446$:

$$\Pi_i = \frac{(100 - 20)^2}{4 * 0.00256 * 446} - 1\,000 = 401$$

$$SW = \frac{3(100 - 20)^2}{8 * 0.00256} - 446 * 1\,000 = 491\,500$$

For zero profits, consider $n=625$:

$$\Pi_i = \frac{(100 - 20)^2}{4 * 0.00256 * 625} - 1\,000 = 0$$

$$SW = \frac{3(100 - 20)^2}{8 * 0.00256} - 625 * 1\,000 = 312\,500$$

Thus, in the short run, firms may have profits, losses (lower or equal to the fixed cost, otherwise the firms will close), or zero profits. Furthermore, at equilibrium there will be a markdown: the marginal cost will be higher than the unit labor cost. As such, the allocation of resources will be inefficient in the short run equilibrium.

D. The Long-Run Equilibrium

In the long run, free entry and exit of firms drives profits to zero:

$$\Pi_i = \frac{(b - d)^2}{4an} - c = 0$$

This makes it possible to quantify the number of firms and the employment per firm, in terms of the other parameters of the model:

$$n = \frac{(b - d)^2}{4ac} \quad (14)$$

$$l_i = \frac{b - d}{2a \left(\frac{(b - d)^2}{4ac} \right)}$$

$$l_i = \frac{2c}{(b - d)} \quad (15)$$

Other variables do not depend on the number of firms, so their values remain unchanged. For example, total employment is equal to:

$$L = nl_i = \frac{(b - d)^2}{4ac} \frac{2c}{(b - d)} = \frac{b - d}{2a} \quad (16)$$

The wages and the markdown in the long run can be written as in the short-run equilibrium:

$$w = \frac{b + d}{2} \quad (17)$$

$$md = \frac{b - d}{2b} \quad (18)$$

The wage elasticity of (market and residual) labor supply can be expressed in terms of the model's parameters, as in the short-run equilibrium:

$$\eta = \eta_i = \frac{b + d}{b - d} \quad (19)$$

In terms of social welfare in the long run, due to the free entry and exit of firms, the revenue of producers equals the opportunity cost of the inputs they use, and their economic profits are zero. The fixed cost affects the number of firms and employment per firm, but not the total employment. The surplus of all the households who supply work can be expressed as follows:

$$HS = SW = \frac{[w - d] * L}{2}$$

$$SW = \frac{\left[\left(\frac{b + d}{2} \right) - d \right] \left[\frac{(b - d)}{2a} \right]}{2}$$

$$SW = \frac{\left[\frac{b - d}{2} \right] \left[\frac{(b - d)}{2a} \right]}{2}$$

$$HS = SW = \frac{(b - d)^2}{8a} \quad (20)$$

Comparative statics of the results are summarized in Table 3.

As shown in Table 3, increases in the slope of the supply curve decrease the equilibrium number of firms, total employment, household surplus, and social welfare. They have no effect on the wage rate, the markdown, and the wage elasticity of the (market and residual) labor supply.

Increases in productivity increase the number of firms (employment variety), total employment, the wage rate, the markdown, and social welfare, and decrease employment per firm and the wage elasticity of the (market and residual) labor supply.

Table 3. Comparative Statics in the Long-Run Equilibrium

	↑a	↑b	↑c	↑d
n	↓	↑	↓	↓
l_i	—	↓	↑	↑
L	↓	↑	—	↓
w	—	↑	—	↑
md	—	↑	—	↓
$\eta = \eta_i$	—	↓	—	↑
$HS = SW$	↓	↑	—	↓

Source: Author.

As long as the market does not collapse due to lack of profitable firms, increases in the fixed cost decrease the equilibrium number of firms and increase employment per firm. However, they have no effect on total employment, the wage rate, the markdown, the wage elasticity of the (market and residual) labor supply, and social welfare.

Increases in the intercept of the supply curve (reservation wage) decrease the number of firms, total employment, the markdown and social welfare, but increase employment per firm, the wage rate, and the wage elasticity of the (market and residual) labor supply.

Any parameters can be used to simulate this model in the long run, as long as the market existence conditions are respected. For example, the model can be graphed with the parameters presented in Table 4 (as is the case in the short run with zero profits).

With the parameters considered, if $n=625$, the typical firm will have zero short and long-run profits, as shown in Figure 4:

Table 4. Parameters for the Simulations of the Model in the Long Run

Long Run	
Parameter	$\Pi = 0$
a	0.00256
b	100
c	1000
d	20
n	625
Result	$\Pi = 0$
w	60
L	15 625
l_i	25
md	0.4
HS	312 500
Π_i	0
Π	0
SW	312 500

Source: Author’s ad-hoc values respecting the market existence condition and zero profits in the long run.

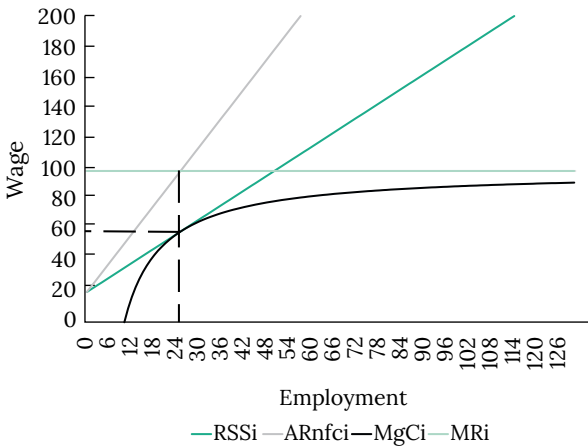


Figure 4. Long-Run Equilibrium with Free Entry and Exit of Firms

Source: Author’s calculations.

The social welfare shown in Table 4 can be estimated using equation 20, as:

$$SW = \frac{[100 - 20]^2}{8 * 0.00256}$$

$$SW = 6\,400 / 0.02048 = 312\,500$$

Thus, in the long run the allocation of resources will also be inefficient, since the marginal cost will be higher than the unit labor cost.

Note as well that this model could be used to study monopsony, oligopsony or monopsonistic competition in the short and long run, given that the number of firms at equilibrium depends on the values of the parameters of the model.

III. The Role of the Minimum Wage

Now, consider the role of minimum wages (w_{MIN}) in the long run. In order to generate a change in the allocation of resources with an increase in the level of employment and output, a minimum wage must be above the monopsonistic competition wage at the long-run equilibrium and be equal to or less than the labor productivity b . So:

$$\frac{b + d}{2} < w_{MIN} \leq b$$

This article focuses on the first-best minimum wage and the second-best minimum wage, defined as follows:

Definition: The first-best minimum wage is the minimum wage that maximizes social welfare.

In this model, social welfare is maximized where the wage is equal to the marginal product (as under perfect competition), there is no markdown, and the allocation of resources is efficient. However, in this model such welfare maximization requires the use of subsidies, as explained later on.

Definition: The second-best minimum wage is the wage that does not maximize social welfare, but is the best available option for policymakers.

In this model, the second-best minimum wage is lower than the marginal product of labor (there is markdown and thus, inefficiency) but maximizes social welfare without making use of subsidies.

E. The First-Best Minimum Wage

The first-best minimum wage would replicate the competitive wage, so the minimum wage would be equal to the marginal product of labor:

$$w_{MINFB} = b$$

And the equilibrium level of employment would be:

$$L = \frac{b - d}{a}$$

There would be only one firm in the market, due to the prevalence of increasing returns to scale for any level of production. In this case, the other results in the long-run equilibrium in terms of the parameters of the model can be described as:

$$n = 1 \quad (22)$$

$$l_1 = L = \frac{b - d}{a} \quad (23)$$

$$md = 0 \quad (24)$$

$$\eta = \eta_i \rightarrow \infty \quad (25)$$

$$\Pi_i = \frac{(b - b)^2}{4a} - c = -c \quad (26)$$

$$HS = \frac{[b - d] * L}{2}$$

$$HS = \frac{(b - d)}{2} * \frac{(b - d)}{a}$$

$$HS = \frac{(b - d)^2}{2a} \quad (27)$$

$$SW = \frac{(b - d)^2}{2a} - c \quad (28)$$

With the first-best minimum wage, the sole remaining firm loses the fixed cost. Thus, the government must subsidize that firm to cover the fixed cost. The subsidy is not distortionary because the fixed cost does not affect quantities or prices. It is merely a transfer from the government to the firm, and household surplus is at a maximum.

Generating the resources to pay the subsidy may be distortionary, but since the analysis here is partial equilibrium, it can be assumed that the subsidy is financed with a welfare-improving Pigouvian tax.

Nevertheless, subsidizing a monopsony, as in this case, may not be feasible for fiscal or political reasons, and that justifies considering the second-best minimum wage in the next sub-section.

Comparative statics of the results are summarized in Table 5.

Table 5. Comparative Statics with the First-Best Minimum Wage

	↑a	↑b	↑c	↑d
$l_i = L$	↓	↑	—	↓
$\Pi_i = \Pi$	—	—	↓	—
HS	↓	↑	—	↓
SW	↓	↑	↓	↓

Source: Author.

Increases in the intercept and slope of the supply of labor reduce employment per firm, total employment, household surplus, and social welfare. Increases in productivity increase employment per firm, total employment, household surplus, and social welfare. Provided that the government subsidizes the fixed cost, increases in the fixed cost reduce the firm's profits and social welfare, but have no effects on employment per firm, total employment, and household surplus.

To illustrate the first-best minimum-wage, the model can be graphed by using the parameters shown in Table 6.

Table 6. Parameters for the Simulations of the First-Best Minimum Wage in the Long Run

Long Run	
Parameter	$\Pi=0$
a	0.00256
w_{FBMW}	100
c	1000
d	20
n	1
w	100

(Continued)

Long Run	
Subsidy	1000
Result	$\Pi=0$
L	31250
l_i	31250
md	0
HS	1 250 000
Π_i	-1000
Π	-1000
SW	1 249 000

Source: Author's ad-hoc values respecting the market existence condition and zero profits in the long run.

Due to the scales involved, a stylized representation of the first-best minimum wage equilibrium is shown in Figure 5.

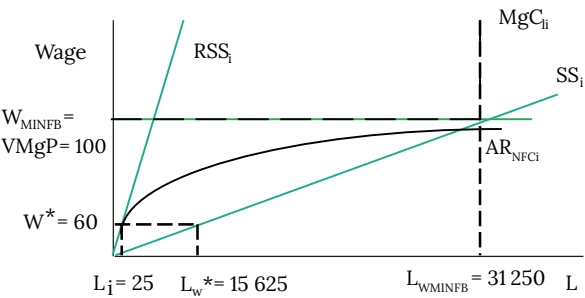


Figure 5. First-Best Minimum Wage Equilibrium in the Long Run

Source: Author's calculations, stylized graph due to scales involved.

The social welfare shown in Table 6 can be estimated using equation 28, as:

$$SW = \frac{[100 - 20]^2}{0.00512} - 1\,000$$
$$SW = 1\,249\,000$$

Thus, compared to the long-run market equilibrium, with the first-best minimum wage, total employment increases from 15 625 hours hired (625 firms employing 25 units of labor) to 31 250 hours hired (by one firm). The allocation of resources is efficient (there is no mark-down) but there is firm exit; the market concentration of employers increases; the variety of employment available falls; and the losses of the remaining firm are equal to its fixed cost. If the government wants the firm

to operate in the long run, it must subsidize its fixed cost. However, as previously explained, such subsidy is merely a transfer and is non-distortionary, given that the fixed costs do not alter prices and/or quantities.

F. The Second-Best Minimum Wage

Subsidizing a monopsony may not be feasible for different reasons, for example, because of fiscal and/or political considerations. The second-best minimum wage would be determined where the market supply is equal to the average revenue of a typical firm:

$$d + aL = b + \frac{c}{L} = AR_{NFCI}$$

$$aL - (b - d) = -\frac{c}{L}$$

$$aL^2 - (b - d)L = -c$$

$$aL^2 - (b - d)L + c = 0$$

There are two roots. Considering the root with the highest level of employment, since welfare is being maximized without using subsidies:

$$L = \frac{b - d + \sqrt{(b - d)^2 - 4ac}}{2a} \quad 29$$

$$w_{SBMW} = d + a \left[\frac{b - d + \sqrt{(b - d)^2 - 4ac}}{2a} \right]$$

$$w_{SBMW} = \frac{b + d + \sqrt{(b - d)^2 - 4ac}}{2} \quad (30)$$

$$n = 1$$

$$md = b - \frac{b + d + \sqrt{(b - d)^2 - 4ac}}{2} \quad (31)$$

$$md = \frac{b - d - \sqrt{(b - d)^2 - 4ac}}{2} \quad (32)$$

$$\Pi_i = \Pi = 0 \quad (33)$$

$$HS = SW = \frac{\left[\frac{b + d + \sqrt{(b - d)^2 - 4ac}}{2} - d \right] \left[\frac{b - d + \sqrt{(b - d)^2 - 4ac}}{2a} \right]}{2}$$

$$SW = \frac{\left[\frac{b - d + \sqrt{(b - d)^2 - 4ac}}{2} \right] \left[\frac{b - d + \sqrt{(b - d)^2 - 4ac}}{2a} \right]}{2}$$

$$HS = SW = \frac{[b - d + \sqrt{(b - d)^2 - 4ac}]^2}{8a} \quad (34)$$

Comparative statics of the results are summarized in Table 7.

Table 7. Comparative Statics with the Second-Best Minimum Wage

	↑a	↑b	↑c	↑d
$l_i = L$	↓	↑	↓	↓
$HS = SW$	↓	↑	↓	↓

Source: Author.

Increases in the intercept, the slope of the supply of labor, and the fixed cost reduce employment per firm, total employment, household surplus, and social welfare. Increases in productivity increase employment per firm, total employment, household surplus, and social welfare.

The second-best minimum wage can be graphed in this model with the parameters shown in Table 8.

Table 8. Parameters for the Simulations of the Second-Best Minimum Wage in the Long Run

Long Run	
Parameter	$\Pi=0$
a	0.00256
SBMW	99.9679
c	1000
d	20
n	1
Result	$\Pi=0$
L	31237
l_i	31237
md	0.0001605
HS	1 248 999.80
Π_i	0
Π	0

(Continued)

Long Run	
SW	1 248 999.80

Source: Author's ad-hoc values respecting the market existence condition and zero profits in the long run.

Again, due to the scales involved, a stylized representation of the second-best minimum wage equilibrium is shown in Figure 6:

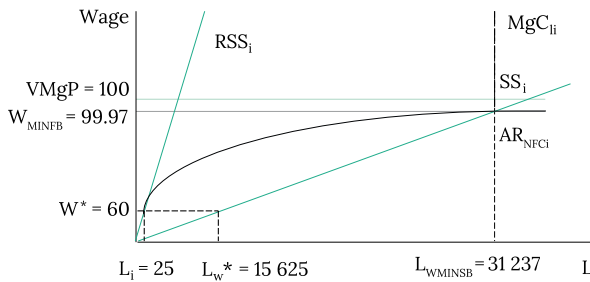


Figure 6. Second-Best Minimum Wage Equilibrium in the Long Run

Source: Author's calculations, stylized graph due to the scales involved.

Thus, compared to the long-run market equilibrium, with the second-best minimum wage, total employment increases from 15 625 hours hired (625 firms employing 25 units of labor) to 31 237 hours hired (by one firm) and the allocation of resources is more efficient than the equilibrium with no minimum wage, because the firm is now a price taker and the markdown is smaller. Furthermore, there is no need to subsidize the remaining employer, since it has zero profits. However, in this case, the allocation is not perfectly efficient and there is firm exit, which implies that the market concentration of employers increases and the variety of employment available is reduced.

Social welfare with the second-best minimum-wage as shown in Table 8, can be estimated using equation 34, as follows:

$$HS = SW = \frac{[b - d + \sqrt{(b - d)^2 - 4ac}]^2}{8a}$$

$$SW = \frac{[100 - 20 + \sqrt{(100 - 20)^2 - 4 * 0.00256 * 1\,000}]^2}{8 * 0.00256}$$

$$SW = \frac{[80 + \sqrt{(6\,400 - 10.24)}]^2}{0.02048}$$

$$SW = \frac{25\,579.5159}{0.02048}$$

$$HS = SW = 1\,248\,999.80$$

With these first and second-best minimum wages, there is no unemployment in this model, since the focus here is on the effects of these policies on efficiency, employment, employer concentration, employment differentiation, and firm exit. If the minimum wage is higher than the first-best minimum wage, there is no employment, no output, and there is a welfare loss in this model.

IV. Summary of the Results Obtained

The results obtained in this article, in terms of the parameters of the model proposed, can be used to characterize the equilibria for the different scenarios analyzed and are summarized in Table 9.

It is also important to keep in mind that minimum wages above the monopsonistic competition wage and up to the perfect competition wage improve welfare and the level of employment, as shown in the results presented in Table 9 and as found in the simulation calculations. Welfare and employment are maximized with the first-best minimum wage, while the second-best minimum wage generates more employment and more welfare than the monopolistic competition equilibrium. However, these increases in welfare come at the expense of firm exit, less variety of employment, and more employment concentration.

It is also important to consider that unemployment increases once the minimum wage is higher than the perfect competition wage, as is the case in this article, and in such case the impacts on welfare, employment and unemployment require an analysis that goes beyond the model considered in this article.

Table 9. Summary of the Results Obtained

	Short-Run	Long-Run	FBMW	SBMW
n	n	$\frac{(b-d)^2}{4ac}$	1	1
l_i	$\frac{b-d}{2an}$	$\frac{2c}{(b-d)}$	$\frac{b-d}{a}$	$\frac{b-d+\sqrt{(b-d)^2-4ac}}{2a}$
L	$\frac{b-d}{2a}$	$\frac{b-d}{2a}$	$\frac{b-d}{a}$	$\frac{b-d+\sqrt{(b-d)^2-4ac}}{2a}$
w	$\frac{b+d}{2}$	$\frac{b+d}{2}$	b	$\frac{b+d+\sqrt{(b-d)^2-4ac}}{2}$
md	$\frac{b-d}{2b}$	$\frac{b-d}{2b}$	0	$\frac{b-d-\sqrt{(b-d)^2-4ac}}{2}$
$\eta = \eta_i$	$\frac{b+d}{b-d}$	$\frac{b+d}{b-d}$	$\rightarrow \infty$	$\rightarrow \infty$
Π_i	$\frac{(b-d)^2}{4an} - c$	0	-c	0
HS	$\frac{(b-d)^2}{8a}$	$\frac{(b-d)^2}{8a}$	$\frac{(b-d)^2}{2a}$	$\frac{[b-d+\sqrt{(b-d)^2-4ac}]^2}{8a}$
SW	$\frac{3(b-d)^2}{8a} - nc$	$\frac{(b-d)^2}{8a}$	$\frac{(b-d)^2}{2a} - c$	$\frac{[b-d+\sqrt{(b-d)^2-4ac}]^2}{8a}$

Source: Author.

V. Conclusions

Differentiated employment generates a markdown and, thus, an inefficient allocation of resources in the short and long run. Free entry and exit of firms ensure that all firms have zero economic profits in the long run.

Given the assumptions of the model proposed in this article, *ceteris paribus*, social welfare has been shown to be consistently higher the greater the productivity of labor and the lower the fixed costs and the opportunity cost of workers, in terms of the intercept and the slope of the labor supply.

The first-best minimum wage maximizes employment and efficiency by removing the firms' market power and their markdown, but there is exit of firms, which implies that the market concentration of employers increases, the variety of available

employment falls, and the remaining employer must be subsidized to cover its fixed costs.

The second-best minimum wage also increases employment and efficiency with regards to the monopsonistic competition equilibrium, by reducing the firms market power. In addition, it does not require subsidies for the remaining employer. But it does not maximize employment nor efficiency, since the marginal product of labor is higher than the second-best minimum wage. There is also exit of firms, which implies that the market concentration of employers increases and the variety of available employment falls.

This article provides insights into the trade-offs that can occur between the level of minimum wages, the level of employment, the higher firm exit rates observed among small, new, and low productivity firms, the concentration of employers, and the variety of employment.

Note that the minimum wages analyzed in this article do not generate unemployment, as would be the case with minimum wages above the first-best minimum wage. For wages above the perfect competition level and their impacts on unemployment, employment, and welfare, the existing literature on such scenarios should be consulted.

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