Trade under monopsonistic competition
Very preliminary - do not cite

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1 Introduction

It is a common observation that workers do not massively quit their employer if other employers raise their wages. Ashenfelter et al. (2010) and Manning (2003) report estimations of the firm’s labor supply elasticity from 2 to 4, which is too low to be consistent with the assumption that the labor market is perfectly competitive. Recently, Thisse and Toulemonde (2010) have developed a simple model of monopsonistic competition that builds on the workers heterogeneous perception of firms non wage attributes. It is consistent with the reported firm’s labor supply elasticity.

In this paper we explore how trade and firms location can be shaped by monopsonistic competition. We extend the Thisse and Toulemonde (2010) model to account for two countries, Home and Foreign. We simplify the model by assuming that firms’ production is sold under perfect competition. We assume that Home workers attach more weight to the non wage attributes of employers than Foreign workers do. As a consequence, Home firms are in a weaker position to extract a rent from their workers and they set higher wages than Foreign firms. Faced with higher labor costs in Home, more firms locate in Foreign. Hence, in contrast with Home workers, the Foreign workers who care more about the diversity of employers, find more employers in their country, but those firms offer lower wages.

Home firms have a low markup per worker because of high labor costs but they are also bigger than their Foreign counterparts because they are less numerous. Hence they earn a lower profit per worker but they succeed in covering their fixed costs by exploiting more workers than Foreign firms. In other words, the apparent productivity, i.e. the sales per worker, is higher in Home because the fixed costs are spread on more workers.

Under autarchy and free entry of firms, the product price is lower in Home than in Foreign because of the higher apparent productivity. Hence, trade opening puts a pressure on the demand for Home workers while it weakens the demand for Foreign workers. The opening raises Home wages and depresses Foreign wages. Faced with higher labor costs, some firms exit the Home market while other firms enter the Foreign market because of the lower costs. Opening has two opposite effects on the Home (Foreign) welfare: it raises (decreases) wages and it reduces (increases) the diversity of employers. We show that the net effect is positive for Home and negative for Foreign. Home firms become bigger in contrast with foreign firms. Hence, Home uses less resources in launching news firms and sells more output per worker: Home is an exporter of the good. We qualify our results to account for different preferences across countries about the produced good.

We also account for labor mobility across countries. In particular, we show that monopsonistic competition per se explains agglomeration of firms and workers if workers care more about the variety of job opportunities than about the location of jobs.

The paper proceeds as follows. In Section 2, we describe monopsonistic competition in a closed economy. In Section 3, we characterize the equilibrium
in the open economy with rigidity of workers’ location, while the subsequent section considers the case of workers’ mobility.

2 The closed economy

2.1 Technology

We consider an economy endowed with $L$ workers and one sector producing an homogeneous good. This good is produced under increasing returns by a continuum of $N$ firms. When firm $i \in [0, N]$ hires $\ell(i)$ workers, it supplies

$$q(i) = \ell(i) - f$$

units of the homogeneous good, $f$ being a fixed requirement of labor needed for the firm to operate.

2.2 Consumers and workers

Consumers’ preferences. Consumers share the same quasi-linear preferences:

$$U(x, h) = \alpha \ln x + h \quad \alpha > 0$$

where $x$ is the consumption of the produced good and $h$ is the consumption of an unproduced good. In this expression, $\alpha$ is a taste parameter that expresses the intensity of preferences for the produced good. The unproduced good is used as the numéraire and its supply $H$ is perfectly inelastic. A worker hired by firm $i$ earns a nominal wage $w(i)$ and has a budget constraint given by

$$px + h = Y(i) \equiv w(i) + \frac{H}{L} + \frac{1}{L} \int_0^N \pi(j) \, dj$$

where $p$ is the price of the produced good, $H$ the initial endowment of the unproduced good, $\pi(j)$ the profit made by firm $j$ (see below for more details), and $Y(i)$ the individual income (wage, share of the endowment of the unproduced good, share of total profits). A worker’s demand for the two goods are as follows:

$$x = \frac{\alpha}{p} \quad h = Y(i) - \alpha$$

where it is assumed that each worker has an initial endowment of the unproduced good sufficiently high to ensure a positive consumption of both goods. Therefore, the income level matters for the consumption of the unproduced good only, and thus the distribution of profits across workers is immaterial for the market outcome.

Workers’ heterogeneity. Each firm offers a wage and specific non-wage attributes to its workers. Workers are heterogeneous in their perception of the
non-wage attributes and free to choose the firm they want to work for. The indirect utility of a worker hired by firm $i$ is given by

$$V(i) = \alpha(\ln \alpha - 1) - \alpha \ln p + \frac{H}{L} + \frac{1}{L} \int_0^N \pi(j) \, dj + w(i) + \varepsilon(i)$$

The five first terms of the expression denote the indirect utility of consumption. The quality of the worker’s match with firm $i$ is given by the realization of the random variable $\varepsilon(i)$, which is known to the worker but unobservable by the firms. A worker chooses the firm that grants her with the highest indirect utility, that is, the hedonic wage given by

$$\max_i (w(i) + \varepsilon(i))$$

which depends on the wages set by firms and the levels of the worker’s match.\footnote{This approach bears some resemblance with Roback (1982) where workers choose their residence by combining wages and non-priced local amenities. The frameworks used in the two papers are very different, however.}

We assume that the random variables $\varepsilon(i)$ are independently and identically distributed according to the Gumbel distribution with zero mean.\footnote{Because the support of the Gumbel distribution that generates the logit is the real line, a worker’s highest hedonic wage could be negative. However, we may disregard this issue because each worker faces a continuum of firms.} This implies that the probability she chooses to work in firm $i$ is given by the continuous logit (McFadden, 1976; Ben-Akiva et al., 1985; Dagsvik, 2002):

$$P(i) = \frac{\exp \left( \frac{w(i)}{\nu} \right)}{\int_0^N \exp \left( \frac{w(j)}{\nu} \right) \, dj}$$

(4)

where $\nu$ stands for the standard-deviation of $\varepsilon(i)$ (up to the numerical factor $\pi/\sqrt{6}$). This modeling strategy allows us to account for a population of workers exhibiting heterogeneous tastes about firms/jobs since the probability that $\varepsilon(i) = \varepsilon(j)$ is zero. In (4), $\nu$ is an index that captures the diversity of preferences across workers who react differently to the same wage schedule. Alternatively, $\nu$ may be interpreted as an inverse measure of workers’ inter-firm mobility: a larger $\nu$ implies that a smaller share of workers is willing to change jobs in response to a wage cut.

As shown by Ben-Akiva et al. (1985), the expected hedonic wage is equal to

$$\nu \ln \int_0^N \exp \left( \frac{w(j)}{\nu} \right) \, dj.$$

Since the expected hedonic wage increases with the number of firms, workers’ heterogeneity translates into a preference for job variety. For instance, when wages are the same across firms, this expression becomes $w + \nu \ln N$, which increases at a decreasing rate with the number of firms.
2.3 Firms

In standard models of imperfect competition, firms use their monopoly power on the product market to cover their fixed costs, the input market being perfectly competitive. In this paper, firms operate under perfect competition on the product market. By contrast, the diversity of workers’ preferences about non-wage attributes endows firms with monopsony power on the labor market, which allows them to cover their fixed costs.

A firm $i$ setting wage $w(i)$ attracts

$$\ell(i) = LF(i)$$

(5)

workers, and thus the elasticity of firm $i$’s labor supply is

$$e(i) = \frac{w(i)}{\nu}$$

Clearly, the higher is the heterogeneity of workers, $\nu$, the less a firm’s labor supply is responsive to wages.

Substituting (1) for $q(i)$ yields the following expression for firm $i$’s profits:

$$\pi(i) = (p - w(i))\ell(i) - pf.$$  

(6)

The wage $w(i)$ is chosen by the firm. The market price, $p$, and the level of fixed costs, $pf$, are exogenous to the firm, but endogenously determined through market interactions. Firm $i$ chooses its wage $w(i)$ to maximize (6) subject to (5), which yields

$$w(i) = p - \nu$$

(7)

In words, firms facing an heterogeneous labor force are able to set wages lower than the marginal value product $p$. This is because workers do not massively quit an employer if another employer offers them a slightly higher wage. The higher the heterogeneity of workers, $\nu$, the lower the elasticity of a firm’s labor supply, hence the lower the equilibrium wage. The expression (7) also shows that the equilibrium wage responds to the market price.

2.4 Market equilibrium

In order to disentangle the various effects at work, it is both relevant and convenient to distinguish between what we call a short-run equilibrium, in which the number $N$ of firms is fixed, and a long-run equilibrium in which the number of firms is endogenously determined through free entry and exit.

2.4.1 The short-run equilibrium

In equilibrium, all firms set the same wage and attract the same number of workers, $\ell(i) = L/N$. The production volume available for consumption is equal to $L - Nf$, whereas demand is given by $\alpha L/p$. Market clearing implies

$$p = \frac{\alpha L}{L - Nf}.$$  

(8)
As expected, the price increases with $\alpha$ and with the fixed requirement $f$. Less expected, the market price increases with $N$, whereas entry typically leads to a lower market price in partial equilibrium models (Novshek, 1980; Salop, 1979). The reason for this difference in results is that these models disregard inputs’ markets. By contrast, our model highlights the fact that, through the fixed labor requirement, more labor is needed for a larger number of firms to operate. This general equilibrium effect reduces the produced good’s supply when more firms are active. Last, how the market price reacts to an increase in the size of the economy is the outcome of two opposing effects. On the one hand, an increase in the number of workers shifts upward the market demand for the produced good; on the other hand, it also shifts the supply ($L - Nf$) upward. Under constant returns ($f = 0$), both the supply and demand increase proportionally with $L$, which leaves the market price $p = \alpha$ unchanged. By contrast, when increasing returns prevail, the supply effect overweights the demand effect, thus leading to a lower market price.

Using (7) and $\ell(i) = L/N$, it is readily verified that individual profits are equal to

$$\pi(i) = -fp + \nu \frac{L}{N}$$

In this expression, the first term is the value of the fixed cost that must be covered by a firm operating under perfect competition. The second term is the profit margin earned per worker ($\nu$) times the firm’s workforce. Plugging (8) into this expression and summing profits across firms yields

$$\Pi = -fN \frac{\alpha L}{L - Nf} + \nu L$$

which decreases with $N$.

### 2.4.2 The long-run equilibrium

Profits earned from exploiting workers are washed out by free entry. In the long run, free entry implies that profits are zero. Profits are equal to zero when

$$N = \frac{\nu}{\alpha + \nu} \frac{L}{f}$$

Thus, the equilibrium number of firms increases with workers’ heterogeneity because a higher value of $\nu$ raises firms’ monopsony power and, therefore, their profits. Furthermore, $N$ decreases with $\alpha$ because a higher demand raises the market price, hence fixed costs, which deters entry.

During the entry process, both price and wage increase. When this process comes to an end, price and wage are given by

$$p = p_{AUT} \equiv \alpha + \nu$$
$$w = w_{AUT} \equiv p_{AUT} - \nu = \alpha$$

In the long run, a stronger monopsony power yields higher market prices which in turn raises wages, counteracting the direct negative effect of monopsony
on wages. Both prices and wages are independent from the market size $L$. Nevertheless, the expected hedonic wage, given by
\[
V_c \equiv \alpha + \nu \ln \left( \frac{\nu L}{\alpha + \nu f} \right)
\]
increases with $L$ because a bigger market is able to sustain a larger number of firms, thus widening the portfolio of jobs.

3 The open economy case

We consider two countries, Home and Foreign, where variables associated with Foreign are starred. The two countries are different in three dimensions: the size of the population, $L$ and $L^*$, the diversity of preferences across workers, $\nu$ and $\nu^*$, and the taste parameter, $\alpha$ and $\alpha^*$, for the produced good. Trade costs are zero, and thus this good is sold in both countries at the same price $p$.

3.1 Wages

For the same given price $p$, the maximization of firms’ profits yields the wages (see (7)):
\[
w = p - \nu \quad w^* = p - \nu^*
\]
Without loss of generality, suppose that Home workers are more homogeneous than Foreign workers, $\nu \leq \nu^*$. In other words, Home workers are more sensitive to nominal wages than Foreign workers. The monopsony power of Home firms is smaller than that of Foreign firms. As a consequence, Home firms set higher wages that are closer to the marginal revenue product than the Foreign wages.

Wages differ across countries, the product is homogeneous and there is no costs to restrain trade across countries. Nevertheless, not all firms set up in the low-wage country. Indeed, Home firms have a markup per worker that is lower than that of Foreign firms. However a Home firm attracts more workers than a Foreign firm precisely because it sets higher wages. The profit per worker is smaller in Home but firms are bigger and attract more workers, which compensate for the lower profit per worker.

3.2 Market equilibrium

The production available for consumption is given by $L + L^* - Nf - N^*f$, whereas demand is given by $\alpha (L + L^*) / p$. Market clearing implies
\[
p = \frac{\alpha (L + L^*)}{L + L^* - Nf - N^*f}
\]
which is a weighted average of the Home and Foreign autarchic prices where the weights are given by the production shares of each country, $(L - Nf) / (L - Nf + L^* - N^*f)$ and $(L^* - N^*f) / (L - Nf + L^* - N^*f)$. As in the closed economy, the price increases with the demand for the good, $\alpha$ and $\alpha^*$ and it decreases with the population, $L$ and $L^*$.
3.3 Entry

Under free entry and exit of firms, the profits of all firms are equal to zero. It is readily checked that the two zero-profit conditions imply:

\[ N = \frac{L\nu}{f} \frac{L + L^*}{L(\alpha + \nu) + L^*(\alpha^* + \nu^*)} \quad N^* = \frac{\nu^* L^*}{\nu L} \quad (10) \]

and

\[ p = \frac{L}{L + L^*} (\alpha + \nu) + \frac{L^*}{L + L^*} (\alpha^* + \nu^*) \quad (11) \]

Note that both countries supply the produced good since \( N \) and \( N^* \) are both positive. Everything else equal, an increase in the diversity of preferences in Home raises the monopsony power and the profitability of Home firms, which increases the number of Home firms. However, the total production available for consumption decreases with the number of firms. As a result, the price of the produced good goes up with \( \nu \).

Similarly, an increase in the diversity of preferences in Foreign raises the market price. It also increases the value of the fixed requirement, which reduces firms’ profits in Home. Consequently, \( N \) decreases with \( \nu^* \).

The price is a weighted average of the autarchic Home and Foreign prices, \( p_{\text{AUT}} \) and \( p^*_{\text{AUT}} \). The weights are given by the respective shares of population. For the sake of the argument, let us consider Home as the low price country under autarchy, \( p_{\text{AUT}} < p^*_{\text{AUT}} \iff \alpha + \nu < \alpha^* + \nu^* \). By opening its trade to a high price country, Home increases its price, which raises the value of the fixed requirement and reduces entry at Home. Indeed, it is readily checked that

\[ p > p_{\text{AUT}} \iff p_{\text{AUT}} < p^*_{\text{AUT}} \iff N < N_{\text{AUT}} \]

An increase in the Foreign population leaves the Foreign autarchic price unchanged but raises the relative Foreign production. Under trade opening, the international price increases because the weight associated with the high foreign price increases. In turn, this raises the value of the fixed requirement at Home and reduces the profitability of Home firms. The number of Home firms decreases with the size of the Foreign population.

For the same reason, the number of Home firms increases with the size of the Home population if Home is the low price country. Even if Home is the high price country, the increase in the size of the Home population raises the number of Home firms because firms are now able to hire and exploit more workers.

3.4 Expected hedonic wage

It is readily checked that the wages are

\[ w = w_{\text{AUT}} + \frac{L^*}{L + L^*} (p^*_{\text{AUT}} - p_{\text{AUT}}) \]

Thus, the opening to trade raises the wages of all workers from the low price country, i.e. from the country where the demand parameter \( \alpha \) and the diversity
of preferences of workers, \( \nu \), are the lowest. On the one hand, if both countries have the same taste for the consumed good \( (\alpha = \alpha^*) \), the workers in the country with the lowest diversity of preferences gain from the opening to trade at the expense of the workers from the other country. On the other hand, if all workers share the same dispersion parameters, \( (\nu = \nu^*) \), workers with the lowest taste for the produced good are the only one to gain from the opening to trade.

A country with a high mobility is more likely to gain from the opening to trade in terms of nominal wages. However high labor costs reduce the number of firms and the diversity of employers. What is the net effect of the opening on the welfare? The expected hedonic wage is

\[ V = w + \ln N \]

\[ = w_{AUT} + \frac{L^*}{L + L^*} \left( p_{AUT}^* - p_{AUT} \right) + \nu \ln \left( \frac{L_L}{p_{AUT}^* L + p_{AUT}^* L^*} \right) \]

(12)

To track the effect of the opening to trade on the expected hedonic wage, it suffices to check how \( V \) changes with \( L^* \). It is readily checked that \( V \) increases with \( L^* \) if and only if \( p_{AUT}^* > p_{AUT} \). Thus all workers living in the low price country gain from the opening to trade whereas those living in the high price country lose from the opening. The positive effect that the opening has on nominal wages more than compensate the lower number of firms.

### 3.5 Exports

The difference between the Home production and consumption defines the Home exports. It is readily checked that these exports are equal to

\[ X = \frac{LL^* (\alpha^* \nu^* - \alpha \nu)}{L (\alpha + \nu) + L^* (\alpha^* + \nu^*)} \]

which is positive if and only if \( \alpha^* \nu^* > \alpha \nu \).

Assume that \( \alpha = \alpha^* \) and \( \nu < \nu^* \). Then, Home is an exporter of the produced good despite it is also the high wage country. The low-wage country, Foreign, exports the non-produced good. Because wages are higher in Home, firms are bigger in order to cover their fixed costs. Hence, fewer resources are wasted in fixed requirements at Home, which allows the country to produce more than its consumption. The opposite holds in Foreign: wages are lower, which promotes entry of more small firms. Hence, more resources are wasted in fixed costs and the country is not able to produce its whole consumption. In other words, the marginal productivity is the same in both countries but the average productivity is higher in Home. The lower is the dispersion parameter in Home and the higher is the dispersion parameter in Foreign, the larger are the Home exports. Of course, Home exports less of the produced good if its own consumers demand high quantities of the produced good and if Foreign consumers demand low quantities of the product.
4 Economic geography

Until now we have assumed that workers were immobile. We now relax this assumption. We consider the simpler case where all workers have the same value of the dispersion parameter across firms, $\nu = \nu^*$.\(^3\) We denote the total number of workers $L$. We assume that workers have heterogeneous preferences not only about the employers but also about the country in which they locate. A worker first chooses a country to live and to work and then she chooses an employer among the firms located in her country.

The indirect utility of a worker living in the home country and employed in firm $i$ is given by

$$U(i) = \alpha \ln \alpha - \alpha \ln p + w(i) + \varepsilon(i) + \xi$$

where the realization of the random variable $\xi$ is the perception of the attribute of the Home country by a worker. A worker chooses the country that grants her with the highest expected indirect utility. Under the assumption that the random variables $\xi$ are independently and identically distributed according to the Gumbel distribution with zero mean, the probability that a worker chooses to live in the home country is given by the logit

$$P = \frac{\exp \left[ \frac{V}{\mu} \right]}{\exp \left[ \frac{V}{\mu} \right] + \exp \left[ \frac{V^*}{\mu} \right]}$$

where $\mu$ stands for the standard-deviation of $\xi$ (up to the numerical factor $\pi/\sqrt{6}$). This parameter is an index capturing the diversity of preferences on countries across workers. A large value of $\mu$ implies that some workers are strongly attracted by one of the two countries and would require high wages and a large number of firms to move to the other country. When $\mu = 0$, workers move instantaneously to the country that grants them the highest indirect utility. Hence, $\mu$ can also be interpreted as a parameter that denotes the mobility cost across countries.

Under $\nu = \nu^*$, the indirect utility can be written as

$$V = \frac{\alpha L + \alpha^* L^*}{L + L^*} + \nu \ln \left( \frac{L \nu}{L \left( \alpha + \nu \right) + L^* \left( \alpha^* + \nu \right)} \right)$$

and

$$P = \frac{1}{1 + \left( \frac{L - L^*}{\mu} \right)^\frac{\xi}{\mu}}$$

Workers move to home until $L = P L$ or until all workers are located in the same country. In other words $L$ (de)increases if $L < (>) P L$. It is readily checked that

$$L < P L \iff \left( \frac{L - L^*}{L} \right)^{\frac{\xi}{\mu} - 1} < 1$$

\(^3\)Considering $\nu \neq \nu^*$ would force us to consider which workers locate in which country.
For $\nu > \mu$, the left-hand-side of the inequality is smaller than 1 for any $L > \mathcal{L}/2$; it is larger than one for any $L > \mathcal{L}/2$. Hence workers agglomerate in one country ($L = \mathcal{L}$ or $L = 0$) if $\nu > \mu$. Otherwise, each country counts fifty percent of the workers, $L = \mathcal{L}/2$.

The condition $\nu > \mu$ means that the diversity of preferences across employers is more important than the diversity of preferences across countries. Because $\mu$ is low, the mobility cost is low and workers move where they find the best job opportunities, that is, they agglomerate in one country. Under $\nu < \mu$, the mobility cost is high and workers accept to sacrifice job opportunities to live in their preferred location.

References


