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Aggregate demand externalities and labor supply decisions: Worker discouragement and market inefficiency

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Abstract

When monopolistic firms price using markups over worker productivity, low productivity workers may not enter the labor market because the wage may be too low. In the presence of aggregate demand spillovers, a profits tax used to subsidize discouraged workers (an earned income tax credit) can actually be Pareto improving and raise profits. © 1997 Elsevier Science S.A.

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Typically, when analysing labor market problems, economists have focused mainly on unemployment. This is because it is generally recognized that unemployment may represent both a serious distributional problem as well as inefficiency in the utilization of resources. In contrast, both economists and policy makers have tended to look at only the distributional consequences of worker discouragement, often regarding those who do not participate as lazy and market outcomes as efficient. Whereas we find the distributional aspects to be of great importance, distribution is not the main focus of this paper. We believe that there is a relation between low wages and worker discouragement. In our paper, we show that people may choose not to work because of a market failure in which the wage is too low.

When output markets are characterized by market power, prices are determined as markups over marginal cost, distorting the real wage which workers use to make entry decisions. This may lead to inefficiency. In the model we consider, monopolists can pay as little to workers as the real wage determined by a low-productivity competitive fringe without fear of fringe entry. This may leave some workers discouraged who, if the wage were higher, would otherwise work. The model is characterized by efficient or inefficient equilibria depending upon parameter values. When low productivity workers do not enter, it may still be profitable to firms if their real wages could be raised to a level high enough to induce entry. However, the private market has no hope of moving to a

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Pareto efficient equilibrium because such coordination is infeasible given the combination of product market monopolies and competitive labor markets. Nevertheless, government can subsidize low-productivity labor, financed via a profits tax. Such a tax/subsidy can actually increase after tax profits and potentially improve the welfare of all.

1. Consumer side

There are three types of agents: high productivity (type one) workers, low productivity (type two) workers and investors. Workers receive all their income from labor and investors all their income from profits. High and low productivity worker utility functions are assumed identical. A continuum of produced commodities and leisure all enter into worker utility functions. The goods are indexed along the unit interval. Each good enters symmetrically into the utility function. In addition, disutility from labor, $G(\bar{L}-l)$ enters additively into the utility function with $(\partial G(\bar{L}-l))/\partial l<0, \bar{L}$ being the maximum time allocated to work. Labor choice is discrete: the utility of leisure when no labor is supplied is $G(\bar{L})=G_L$ and when all of labor is supplied, leisure is normalized so that $G(0)=0$. The two types of workers have exogenously given differences in productivity uniformly across sectors. A type two worker will work $\bar{a}$ hours, where $\bar{a}>1$, to produce the same output as type one workers. So, specifying the worker's maximization problem, we have:

$$W(G(l), \vec{X}_i) = e^{\int_0^1 \ln(X_i)\, di} + G(\bar{L}-l) \quad \text{where } l \in \{0, \bar{L}\},$$

$$\text{subject to: } w\frac{l}{\theta} \geq \int_0^1 p_i X_i \, di\,,\ \theta = 1 \text{ for type 1 labor; } \theta = \bar{a} \text{ for type 2 labor.} \tag{1}$$

Investors are assumed not to supply labor. The investor maximization problem assuming no trading of stocks, then, is:

$$C(\vec{X}) = e^{\int_0^1 \ln(X_i)\, di},$$

$$\text{subject to } \int_0^1 \alpha_i^j \pi_i \, di \leq \int_0^1 p_i X_i \, di \text{ where } \alpha_i^j \, di \text{ is the } j^{\text{th}} \text{ investor's share in firm i's profits.} \tag{2}$$

There is a continuum of workers of measure N, indexed from 0 to N on the real line and a continuum of investors indexed from 0 to 1. N is assumed to be relatively large to the measure of the set of industries, and we assume that workers must specialize with many workers in each industry. We shall denote by β the fraction of workers who are of high productivity type and by $1-\beta$ the fraction who are of low productivity type.

2. Producer side

Each sector has a monopolist with access to an increasing returns to scale technology characterized by low marginal costs. Type one workers will be able to produce ε units of a good in one labor-hour with increasing returns technology and 1 unit with CRS technology ($\varepsilon>1$). The increasing returns are characterized by a fixed cost, F and a constant marginal cost. There is also a competitive fringe with access to the constant returns technology. Labor is assumed to be the only factor of production. The nominal wage is determined competitively, and shall be denoted by w. Monopolists limit price to keep the competitive fringe out, maintaining the same price. The difference between the constant returns determined price and increasing returns marginal costs is the profit margin per unit of output charged by monopolists allocated to payment of the fixed cost and profits.

The firm faces the following problem:

$$\max_{l_1, l_2} p(Q, Y)\left[\varepsilon\left(l_1 + \frac{l_2}{\bar{a}}\right) - F\right] - wl_1 - w_2 l_2 \text{ where } Q = \varepsilon\left(l_1 + \frac{l_2}{\bar{a}}\right) - F$$

$$\text{subject to the competitive fringe constraint: } p(Q, Y) \leq w, \tag{3}$$

where $p(Q, Y)$ is the inverse demand function facing the firm. We can express the wage rate as a uniform wage per unit of worker effort because effort is completely substitutable across worker types. Since the labor market is competitive, there is no way to sustain a wage in the private market with type two workers paid anything except $1/\bar{a}$ times the hourly wage which type one workers receive. With unit-elastic demand, the monopolist would want to charge as high a price as possible; however, the competitive bounds the price at w.

3. Private market equilibria

We will now characterize equilibrium in each case. By an equilibrium, we mean an uncountable vector of prices and quantities of each type of labor hired by each firm, $(\vec{p}, w_2, \vec{l}_1, \vec{l}_2)$ such that at these prices and allocations of types one and two labor, each worker, investor and firm maximizes their utilities and profits subject to their respective constraints (Eqs. (1)–(3)).

Given that type 1 workers receive $w\bar{L}$ as income if they choose to work, whereas type 2 workers receive $w(\bar{L})/\bar{a}$, the firm is indifferent between which types of labor it hires. Since welfare consequences do not depend on the equilibrium distribution of worker types across firms, we will only consider symmetric equilibria. As we have argued above, the unit-elastic demand and the competitive-fringe determined bound on the price fixes p at w. Since the nominal wage is the numeraire, we shall normalize $w = 1$.

The interesting cases to look at are ones in which at the competitive fringe determined real wage, the type one workers will always be willing to enter the labor market which is true when $\bar{L} \geq G_L$. In the two types of equilibria we will consider, firms will always pay the fixed costs needed for monopoly power. This condition will be met if $(\varepsilon - 1)(\beta N\bar{L}) > F$. Given the two above mentioned conditions, the types of equilibria are determined by type two labor market entry decisions. If $(\bar{L})/\bar{a} \geq G_L$, then type two labor will enter; in this case firm profits will be:

$$\pi_j = (\varepsilon - 1)\left(\beta N\bar{L} + (1 - \beta)\frac{\bar{L}}{\bar{a}}\right) - F = m\left(\beta N\bar{L} + (1 - \beta)\frac{\bar{L}}{\bar{a}}\right) - F . \tag{4}$$

Type two workers do not enter when $G_L < (\bar{L})/\bar{a}$. In this case, profits will be

$$\Pi = m(\beta N\bar{L}) - F\,. \tag{5}$$

4. Pareto improving government policy

When type two workers do not enter the labor market, there still may be room for a Pareto improving wage subsidy. In such cases, it would be infeasible for a decentralized economy to provide a subsidy to workers above the competitive-fringe determined wage. Given any nominal wage, $\bar{w}$, firms will set price equal to $\bar{w}$. Therefore, any attempt of firms to coordinate on a higher wage would simply lead to a higher price level, and would not lead to type-two workers entering the labor market. A government wage subsidy, on the other hand, can actually provide a higher real income and help induce labor entry.

Certainly, it must always be efficient when both types of workers enter the labor market without the use of government policy. However, it is not necessarily the case that when workers do not enter, it is efficient. A sufficient condition for government policy to be Pareto improving is that a wage subsidy (financed via a profits tax) which is just large enough to induce type 2 worker entry raises after tax profits. In this case, workers will be made neither better nor worse off and after tax profits will be higher.

Proposition. *There exists a-improving government policy that induces low productivity worker entry, when disutility from labor is greater than the market wage, but less than the marginal product in the increasing returns sector:* $(\bar{L})/\bar{a} < G_L < \varepsilon(\bar{L})/\bar{a}$.

Proof. We want to show that the difference between the 'tax' and 'private' equilibrium profits is positive:

$$\Pi_T - \Pi_P = (1-\tau)\left[m\left(\beta N\bar{L} + (1-\beta)\frac{\bar{L}}{\bar{a}}\right) - F\right] - [m(\beta N\bar{L}) - F]\,.$$

Since the total government expenditure on subsidy, s, needed is just enough to induce type two workers to enter the labor market, it is true that:

$$S = \left(G_L - \frac{\bar{L}}{\bar{a}}\right)(1-\beta)N = \tau\left[m\left(\beta N\bar{L} + (1-\beta)N\frac{\bar{L}}{\bar{a}}\right) - F\right] \Rightarrow$$

$$(1-\tau)\left[m\left(\beta N\bar{L} + (1-\beta)N\frac{\bar{L}}{\bar{a}}\right) - F\right] = m\left(\beta N\bar{L} + (1-\beta)N\frac{\bar{L}}{\bar{a}}\right) - F - S \Rightarrow$$

$$\Pi_T - \Pi_P = (\varepsilon - 1)\left(\beta N\bar{L} + (1-\beta)\frac{\bar{L}}{\bar{a}}\right) - F - \left(G_L - \frac{\bar{L}}{\bar{a}}\right)(1-\beta)N$$

$$- [(\varepsilon - 1)(\beta N\bar{L}) - F] \Rightarrow \ \varepsilon\frac{\bar{L}}{\bar{a}} - G_L > 0 \text{ QED}\,.$$

This condition on existence of a Pareto improving wage subsidy is exactly what is expected. It is Pareto improving when the value added to production of type 2 workers is greater than the amount necessary to induce type two workers into the market.

Note that the private market could potentially induce type 2 labor entry when it is efficient using two separate mechanisms. Firms may be able to achieve efficiency by coordinating on a high real wage. However, in a decentralized economy, due to the fact that the firms are monopolists in their own market but small in terms of their impact on the price level, they will always choose the same optimal profit margin over the nominal wage making any such coordination infeasible. Similarly, efficiency may be obtained by coordinated relative wage discrimination; this may be achieved either via nominal wage discrimination or price discrimination. In fact, there are ranges of parameter values where efficiency dictates that, in equilibrium, real wages can not be proportional to worker productivity. Firms, however, have no individual incentives to offer lower prices to type 2 workers in the setting of a decentralized market economy. Nominal wage discrimination also is infeasible in such cases because it is associated with excess demand for one type of labor and excess supply for the other; arbitrage prevents an efficient wage schedule.

5. Conclusion

In this model, we have demonstrated that in an economy with increasing returns to scale where the real wage is not equated with the marginal product, aggregate demand externalities can lead to an inefficiently large number of discouraged workers. This represents a failure of both the first and second welfare theorems. Equilibria can be inefficient and it is possible to improve the distribution of income at the same time that everyone's income is weakly increased.

In this model, demand acts like a public good. Each firm would be willing to pay anything up to the differential between the profit margin and the wage costs of production of an additional good in order to see an extra unit of that good demanded. Since worker preferences are uniform over all commodities, it is impossible for a firm to pay only for an increase in its own product demand. Given that any individual firm would only be willing to compensate a worker for demanding extra units of its own good, demand takes on the character of a public good and is underprovided for in equilibrium.

The argument presented here generalizes beyond the particular price setting mechanism. Competitive fringe pricing is a tractable way to illustrate that there may be aggregate demand effects from not paying workers their marginal productivities. Moreover, market power is sufficient though not necessary for such inefficiency to occur. Many of these results generalize to any production system where the marginal product of labor is greater than the disutility of labor which is in turn greater than the competitively determined wage.[1] A monopsonist with perfect ability to discriminate between types of labor would price discriminate in its wage offerings, using two different proft margins for the different types of labor. This is actually what government allows through policy. The effective after tax profit margins over the two types of labor are different.

Given barriers to entry, as modeled here through limiting the access to increasing returns technology, firms are able to extract a rent. Our contention is that this leads to price-setting behavior where the real wage is suboptimally low. The private market has no way to make any type of efficiency gains given this situation. At any rate, the relevance of marginal productivity for

[1]We have worked out examples with Marshallian externalities, Dixit–Stiglitz Production, CRS firms with market power, and Cournot oligopoly models with non-Cobb–Douglas preferences as well as with contestable markets. These examples are available upon request.

determining the wage rate of all workers in the real world has to be seriously questioned, not the least because as demonstrated here, market outcomes and policy prescriptions may be radically different in such a world.

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