Excess Supply in the Spot Market for Labor*

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Abstract: A distinguishing feature of labor services is that they are immediately perishable. This paper explores the implications of immediate perishability for the market for homogenous labor services that are sold in a centralized exchange. The analysis sheds light on the nature of unemployment. The paper also explores implications for the role of labor cartels and firms in providing workers an alternative to selling their labor services on the spot market. Cartels can be Pareto superior to competition in the spot market because they organize labor to reduce excess supply.

Key Words: Unemployment, Matching function microfoundations, homogenous labor

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1. Introduction

Labor is the most important factor of production, and it appears to be plagued by excess supply in any country at any point in time. Unemployment in labor markets is typically attributed to mechanisms related to search theory, as exemplified by Diamond (1982), Mortensen (1982), and Pissarides (1985). As Pissarides (2000) notes in his summary of the theory's key insights, search theory attributes unemployment to mechanisms arising from heterogeneities and decentralized information:

> "The central idea . . . is that trade in the labor market is a decentralized economic activity. . . Trade in the labor market is a nontrivial economic activity because of the existence of heterogeneities, frictions, and imperfect information. If all workers were identical to each other and if all jobs were identical to each other, and if there was perfect information about their location, trade would be trivial."

In other words, standard search theory predicts full employment in markets featuring homogenous services traded in a central location. Yet many labor markets mimic these conditions and nonetheless feature excess supply. Valenzuela, Theodore, Melendez, and Gonzalez (2006) formally document the prevalence of unemployment in American day labor markets, where workers arrive in a central location to provide homogenous labor services. Similar conditions are readily observed for labor services in other markets, especially in developing countries.

The goal of this paper is to shed light on the nature of unemployment in centralized markets for homogenous labor services. In contrast to the circumstances highlighted by Pissarides, this paper examines the nature of unemployment in a centralized spot market for labor featuring homogenous workers, homogenous tasks, and perfect information. These features are common for markets of most commodities, including oil or wheat, for which markets clear. However, there is a distinct feature of labor services that prevents the labor market from functioning in the standard Walrasian fashion.

The primary feature that distinguishes the market for labor services from that of other commodities is that labor is immediately perishable. If, in any instant, labor is not put to use producing a storable good or employed in providing a service, then it is wasted as excess supply. Other commodities (e.g. oil), in contrast, have shelf lives such that if they are not consumed in any instant, the commodity remains available for future consumption.

The implications of perishability are best conveyed by comparing two separate spot markets, one for a storable commodity such as oil, and the other for a labor service such as haircuts. In each case, I assume that the market is open for a specific length of time (a day, without loss of generality), and that supply and demand for the commodity are common knowledge. Finally, since the products are homogenous, and since buyers can observe sellers' posted prices, prices will equalize across sellers.

In the market for oil, the rate of arrival of consumers is irrelevant. If, at any instant, there are no buyers, the oil remains for purchase in the next instant. Therefore, since the daily supply and demand curves are known by all sellers, each seller will simply sell oil at the price that results in clearing of the market in that day. This oil market functions as if a Walrasian auctioneer had organized the competitive equilibrium, and the equilibrium price and quantity are as predicted by the standard supply-and-demand analysis.

In the market for haircuts, the time of the buyer's purchase must precisely correspond to the time supplied by the seller due to the immediate perishability of barbers' labor. In the absence of contracts that specify the price at which each barber will provide haircuts to consumers in each instant, a sale of haircut services requires a buyer of haircut services to choose, in the instant, among the available sellers (barbers). If, at any point in time, the number of buyers at the market price is less than the number of sellers, excess supply will result in the form of labor supplied and perished.

Why would sellers of labor services remain at the market if they face the prospect of unemployment? Or why would the price not fall to induce more buyers for a given number of sellers, as it would in a standard supply-and-demand analysis of markets? Barbers' costs (due to forgone leisure or other opportunities) depend on time spent supplying labor to the market rather than from time actually providing haircuts. Therefore the relevant price to barbers is the price of their time, which is related to, but not equal to, the price of a haircut. A barber's decision to supply time to the labor market depends on his income from doing so. Income is a function of the market price of haircuts and the probability that a buyer purchases his labor service at each instant. Since barbers offer identical labor services, buyers will purchase a haircut from any barber with equal probability. Therefore the probability of a sale (and a barber's income) depends on the number of buyers relative to the number of sellers.

Market Stability and Organization. Suppose that at a given price, income is sufficiently high to attract sellers to the market and the number of sellers is higher than the number of buyers (the market features unemployment). In the absence of an auctioneer who organizes the market, this price is unstable: Any seller who supplies time to the market will have an incentive to charge a slightly lower price in order to guarantee a sale in a given instant. Since all sellers have this incentive, the market price should be bid down until sellers' income is less than their outside option of market participation. At the low price, all sellers will want to leave the market in pursuit of their outside option. If all sellers leave, any seller will prefer supplying time to the market with a guaranteed sale.

It thus appears that markets for immediately perishable commodities are theoretically unstable. To approximate realistic markets for labor services, the models below assume that that the marketplace is organized by an auctioneer. For each price, sellers submit to the auctioneer a declaration of whether they will supply labor to the market given the demand at that price and given that other sellers will charge the same price. The equilibrium price is the lowest price that attracts sellers to the market.

Individual Producer-Consumer Matching. In the market for labor services, the time cost of consumption (or purchases) is equal to the time it takes a barber to cut a customer's hair. This time cost of consumption is due to the nature of haircut production which requires a single barber to match with a single consumer to produce a unit of haircut output. In other words, production is a Leontief technology over barbers and customers.

A Leontief matching technology is not unique to the market for haircuts. Consider, for example, the day laborer market. The market for day laborers is especially interesting because it is the component of the American labor market in which labor acts most like a commodity. Workers are paid a piece rate or per unit of time, rather than paid a salary; and labor inputs are nearly perfect substitutes. Yet in spite of these features which, ex ante, would lead one to expect the market for day laborers to clear, market clearing is rarely observed.[1]

Why don't day laborer wages fall until the market clears? One possibility, I suggest, is that output from day laborers is based on a Leontief technology between day laborers and their employers that arises from the time cost of hiring labor services. Specifically, the market for day

[1] According to Valenzuela, Theodore, Melendez, and Gonzalez (2006), the majority of day laborers spend six or seven full-time days a week seeking work, but far less time securing paid compensation.

laborers is a physical meeting place between hopeful laborers and employers. Each employer arrives at the market intending to bring workers to a work site for the day. Once an employer hires a day laborer, they form a relationship that is fixed until the end of the work day. In other words, at the beginning of the day, the day laborer demand curve is downward-sloping. But once hiring decisions have been made, demand is fixed at a given quantity at the agreed-upon price.

While there is little formal documentation of markets for other homogenous labor services, the analysis here may apply to a range of services, especially in developing countries. For example, certain city blocks of Istanbul are well-known to be full of kebab restaurants offering nearly identical meals for identical prices. Customers on these city blocks are typically greeted by restaurant owners and chefs pleading to be chosen to provide the labor service of cooking a kebab. Similar characteristics apply to markets for tourist massages in Indonesia and elsewhere. Indistinguishable services are offered for identical prices by people who may spend more time hoping to be matched with a buyer than they do actually providing a service.

A number of other papers, including Lagos (2000), Burdett, Shi, and Wright (2001), and Stevens (2007), offer microfoundations for alternative matching functions derived from different market structures. Lagos (2000) examines a model of location choice in which people buy taxi services to transport between locations given exogenous demand for transportation and exogenous prices. Burdett, Shi, and Wright (2001) derive prices and matching in a market with an exogenous number of buyers and sellers who meet in different locations. Stevens (2007) derives a matching function from an environment in which workers form a queue in the presence of costly job search and costly job recruitment.

In contrast to the environments in these papers, in the spot market matching environment specified below, the number of buyers and sellers is endogenous to the market price and there are no costs of job application or recruiting. One implication of endogenous market participation for both buyers and sellers is that the aggregate matching function in the spot market must be specified in terms of primitive parameters rather than simply in terms of the number of buyers and sellers. Finally, separations in the spot market for labor are directly related to the nature of the labor service itself, rather than the result of a random and exogenous job separation process

of unspecified nature. For example, a separation occurs in the spot market for haircut services because of the finite nature of a haircut.[2]

Definition of Unemployment. The analysis sheds light on the nature of unemployment and labor market participation. People who arrive at the market are considered labor market participants, and those who stay at home due to a sufficiently high reservation income are considered nonparticipants. Those who participate in the labor market are employed if, at any instant, they are being paid to provide a service. Those who are not providing a service at the labor market are unemployed. This view of unemployment is more nuanced than the view that guides official unemployment statistics. For example, someone who sits in front of a massage parlor all day in hopes of selling a massage service is officially considered to be employed when in reality, unemployment may be the prevailing experience of that worker.

Labor Cartels. Unemployment characterizes the spot market for labor when demand is low. Workers can overcome the unemployment problem by forming a labor cartel (or firm) to coordinate the times during which workers supply labor to the market. The cartel is Pareto efficient because it removes the inefficient slack in the economy without increasing the prices charged to consumers. Depending on demand parameters, a labor cartel may actually be associated with a lower price than the price that prevails in the absence of coordination.

Coase (1937) suggested that one of the reasons for suppliers to form a firm is to save on the transaction costs associated with writing contracts. While there are no explicit transaction costs in the hypothetical labor market, there are opportunity costs to workers' time supplied to the market. Thus the analysis suggests that one justification for the existence of firms and cooperatives is to save on the time cost of unemployment.

Additional Implications of Perishability. While the focus of the paper is on the market for homogenous labor services, other commodities, such as capital, feature immediately perishable service flows as well. While I do not formally explore the implications of perishability for different factor inputs and different market structures, the insights of the spot labor market analysis apply more broadly, and suggest that immediately perishable factor inputs will be unemployed if demand is sufficiently low.

[2] Similarly, buyers separate from sellers of restaurant meals based on the fact that meals are consumed in finite amounts; and consumers purchase massages for finite amounts of time, after which the buyer-seller relationship severs.

The remainder of the paper is organized as follows. Section 2 develops the basic intuition in a spot labor market with homogenous buyers and sellers. In this setup, sellers are either employed or unemployed at any instant. Section 3 introduces seller heterogeneity and derives conditions under which some workers choose not to participate in the spot labor market. Section 4 discusses the conditions under which workers will form a labor cartel and derives welfare implications. Section 5 concludes.

2. Model

This section presents a small open economy that consists of workers who allocate their time to home production (including leisure) and time selling labor services at a labor market. The labor market is a physical location in which willing workers meet with buyers of labor services. The demand for labor services is exogenously determined in the sense that the workers themselves do not purchase labor services at the market. Independence of demand simplifies the analysis and represents the fact discussed in Diamond (1982) that a worker's own market output is a small portion of his consumption.

There is a mass of N identical workers. Each worker has T units of time, which are allocated to home production, t^H, and market production, t^M. The time constraint can be written

$$T = t^H + t^M. \tag{1}$$

Each unit of time allocated to home production provides direct utility ϕ. Workers earn income I from spending time at the market, and this income is used to purchase a bundle of goods on the international market at a unit price. In this simple setup, home production is a perfect substitute for the market bundle, so indirect utility can be written

$$V = \phi t^H + I. \tag{2}$$

The time allocation is considered to be approximately a work day, so perfect substitutability between home production and market purchases represents the fact that consumers can either purchase daily necessities on the market or produce them at home.[3]

[3] The ability for workers to home produce or spend time at the market is analogous to the specification in Harris and Todaro (1970), in which individuals can either work in the agricultural sector or work in the city with some probability of unemployment (which results from a minimum wage in the city).

The Labor Market. The marketplace is a location in which buyers interact with sellers (workers) to purchase labor services. The provision of a unit of labor service requires τ units of time, where $\tau \in [0, T]$. In the barber analogy in the Introduction, τ is small relative to T, while in the market for day laborers it is large. In other labor markets, such as those for retail services, τ can be considered nearly instantaneous.

At each time t, there are S_t sellers at the market, where $S_t \in [0, N]$. Sellers' services are identical, and sellers have no market power. Buyers can observe sellers' posted prices, and if all sellers charge the market price, a buyer will approach any seller with equal probability. Denote the market price at time t by p_t. The number of buyers B_t is a function of the price of labor services:

$$B = \theta p^{-\epsilon}, \tag{3}$$

where θ is a demand shifter and ϵ is the price elasticity of demand. As we will see below, market outcomes are identical for any time $t \in [0, T]$, so equation (3) and subsequent equations omit time subscripts.

The probability that any worker sells his labor in the time interval τ is $P = \min\left\{\frac{B}{S}, 1\right\}$. If $B < S$, the worker's expected revenue is $p\frac{B}{S}$. If a worker is not matched with a buyer at a given point in time, he is considered unemployed in the time interval $[t, t + \tau]$.

Market Organization and Buyer-Seller Matching. If $B < S$ at a given market price at any time, an individual seller will have an incentive to charge a lower price $p^* = p - \delta$, for some $\delta > 0$, to guarantee a sale and income $p^* > p\frac{B}{S}$. If each seller undercuts other sellers, the market price will continue to fall (within the instant) until income from market participation is too low to attract any sellers. But if all sellers leave the market, an individual seller will have an incentive to travel to the market as the sole service provider.

Thus a market lacking any organization will also lack dynamic stability. Therefore, the market is assumed to be organized by an auctioneer who finds the lowest price such that (a) the market will feature sellers all selling their services at that price, and (b) there is no excess demand. In other words, the market price is the lowest price such that, if undercutting is prohibited, sellers would supply time to the labor market rather than to home production.

To determine the market price, each seller submits to the auctioneer a bid stating whether he will participate if (a) other sellers will charge the same price, and (b) the total number of buyers is $B = \theta p^{-\epsilon}$. Once the market price is determined, the auctioneer randomly assigns buyers to sellers, guaranteeing that expected market income for any seller is $p\frac{B}{S}$.

Labor Force Participation. A worker must choose between home production and supplying time to the market. Transportation between home and market is costless. At any time t, the value of supplying time to the market until period $t + \tau$ is

$$V^W(t,\tau) = \left(\int_t^{t+\tau} p\frac{B}{S}ds\right) + \max\{V^W(t+\tau,\tau), V^H(t+\tau,\tau)\}. \tag{4}$$

The value of working at home is

$$V^H(t,\tau) = \phi\tau + \max\{V^W(t+\tau,\tau), V^H(t+\tau,\tau)\}.$$

Note that the continuation value of home and market work are identical due to the fact that the value of home and market time during an inverval τ is independent of t. Thus a worker will make the same choice for all $t \in [0,T]$.

PROPOSITION 1: If the worker is at the market at time t, he will stay until time T (the end of the day). If the worker chooses to travel to the market, he leaves at the beginning of the day ($t = 0$) and does not home produce.

PROOF: $V^W(t,\tau) - V^H(t,\tau) = \left(p\frac{B}{s} - \phi\right)\tau$. Therefore, if $p\frac{B}{s} > \phi$ then $V^W(t,\tau) > V^H(t,\tau)\ \forall t \in [0,T]$. Q.E.D.

The value of traveling to the marketplace is

$$V^W = Tp\frac{B}{S}, \tag{5}$$

while the value of staying home is $V^H = T\phi$.

Workers will supply time and labor to the market if and only if $V^W \geq V^H$, which is equivalent to

$$p\frac{B}{S} \geq \phi. \tag{6}$$

In this simple setup, all workers are identical, and either all workers travel to the marketplace or all stay at home. Equation (6) implies that the price of labor must satisfy

$$p \geq \frac{S}{B}\phi \tag{7}$$

to induce workers to arrive. Given the competitive nature of the labor market, the price of labor services will be bid down until (7) holds with equality whenever $B < S$.

Equilibrium. Since all workers are identical, all will arrive at the market if condition (7) is satisfied, which implies that $S = N$. The equilibrium must be analyzed separately under two conditions. First if the equilibrium price is such that the number of buyers is less than the number of sellers, then the equilibrium price can be obtained by substituting the buyer's demand function (3) into (7). Otherwise the equilibrium price will equalize the number of buyers and sellers when demand is sufficiently high.

$$p = \begin{cases} \left(N\frac{\phi}{\theta}\right)^{\frac{1}{1-\epsilon}} & for\ B < N. \\ \left(\frac{\theta}{N}\right)^{\frac{1}{\epsilon}} & for\ \ B = N. \end{cases} \tag{8}$$

Note that if demand is inelastic, $\epsilon < 1$, the price is decreasing in the level of demand θ when $B < N$. This is because higher demand increases the probability that a worker sells his labor, increasing the value to the worker of time spent at the market for a given market price and reducing the price required to cover the worker's opportunity cost of home production.

Given the price, the total number of buyers in each instant is obtained by substituting in equation (8) for the price in $B = \theta p^{-\epsilon}$ when $B < N$.

$$B = \theta^{\frac{1}{1-\epsilon}}[N\ \phi]^{-\frac{\epsilon}{1-\epsilon}}. \tag{9}$$

The total amount of time that workers spend at the market but not working is

$$t^U = T\left(1 - \frac{B}{N}\right), \tag{10}$$

which is considered unemployment.

Model Implications. In the basic setup above, all workers travel to the market and are therefore part of the work force. Unemployment is an inevitable feature of the model whenever the number of buyers in any instant is less than the number of sellers. If so, the instantaneous employment rate is equal to

$$E = \left(\frac{N\phi^{\epsilon}}{\theta}\right)^{\frac{1}{\epsilon-1}}, \tag{11}$$

And the unemployment rate is

$$U = 1 - E.$$

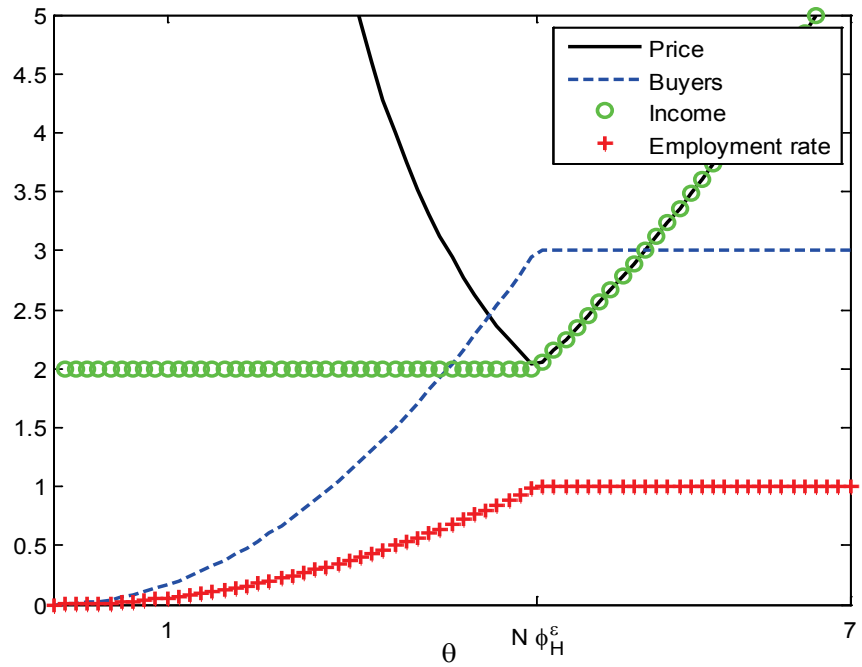
Inelastic Demand. When demand is inelastic, the price and the unemployment rate are falling in the demand parameter θ. This is due to a thick market effect whereby higher demand increases the matching probability between buyers and sellers, reducing the time cost of labor service provision for each unit of output.

PROPOSITION: When demand is inelastic ($\epsilon < 1$), unemployment is positive if and only if $\theta < N\phi^{\epsilon}$.

PROOF: The ratio of buyers to sellers is $\frac{B}{N} = \theta^{-\frac{1}{\epsilon-1}}\phi^{\frac{\epsilon}{\epsilon-1}}N^{\frac{1}{\epsilon-1}}. = \left(\frac{N}{\theta}\phi^{\epsilon}\right)^{\frac{1}{\epsilon-1}}$. If $\epsilon < 1$, $\left(\frac{N}{\theta}\phi^{\epsilon}\right)^{\frac{1}{\epsilon-1}} < 1 \quad \Leftrightarrow \theta < N\phi^{\epsilon}$. Q.E.D.

Figure 1 shows how market outcomes vary with θ when $\epsilon = 0.5,\ N = 3$, and $\phi = 2$. For low values of θ, the market features unemployment because the number of buyers is less than the number of sellers. As θ approaches $N\phi^{\epsilon}$, the demand curve shifts out, increasing the probability that a seller is matched with a buyer. Since the probality of a sale increases, the price decreases to maintain expected income equal to sellers' reservation income ϕ. When $\theta = N\phi^{\epsilon}$, the lowest price that will induce workers to supply time to the market yields demand equal to the number of buyers. Thus sellers match with buyers with probability 1. For $\theta \geq N\phi^{\epsilon}$, the price increases in θ to ensure that there is no excess demand. In other words, when demand is sufficiently high, the market operates as would a standard Walrasian market, and sellers' income is increasing in demand and the market price.

Figure 1: Effect of an Increase in the Demand Parameter θ on Market Outcomes when Demand is Inelastic.



Elastic Demand. The market under elastic demand does not share the interesting features of the market with inelastic demand (unemployment and thick market effects). Instead, the spot market for labor yields the same market outcome as would occur under the standard supply-and-demand analysis that applies when the market is organized by a Walrasian Auctioneer. The resulting market-clearing price satisfies $N = \theta p^{-\epsilon}$.

PROPOSITION: When demand is elastic ($\epsilon > 1$), the market price will always equate the number of buyers with the number of sellers.

PROOF (by contradiction): Suppose there exists a market price p such that $B < S$. Then expected income is $p\frac{B}{S} = p^{1-\epsilon}\frac{\theta}{S}$, which is decreasing in the market price. Lower prices yield higher incomes because the income-increasing effect of more buyers outweighs the income-decreasing effect of a lower price per sale. Thus at any price p such that $B < S$, each seller will prefer a market price $p^* < p$. But the existence of such a price p^* violates the assumption on market organization that the price p is the lowest market price that will induce sellers to supply time to the market. Q.E.D.

3. Elastic Supply

In the above setup, all workers are identical and therefore all either stay at home or supply labor to the market. In reality, workers are likely to have different costs of market participation even if they provide identical labor services. Here I extend the model to permit heterogeneity in the value of workers' reservation income. Specifically, I assume that agents are one of two types: high opportunity cost of labor market participation and low opportunity cost of market participation. As we will see, under this extension some workers will not participate in the labor market.

Model. The economy consists of N potential workers. L of the workers have a low value of home production, ϕ_L, and H of the workers have a high value of home production, ϕ_H. The indirect utility of worker of type $j \in \{L, H\}$ can be written

$$V_j = t_{H,j}\phi_j + I_j,$$

where I_j is the income of type j. As in the baseline model above, the number of any buyers in the time interval $\tau \in [0, T]$ is $B = \theta p^{-\epsilon}$.

To streamline the analysis, I assume throughout that demand is inelastic ($\epsilon < 1$). For low levels of demand, high types prefer home production to market participation and are considered out of the labor force. Low type workers who arrive at the market but are not matched with buyers are unemployed.

PROPOSITION : When $\theta < N\phi_H^{\epsilon}$, Only low-type workers supply labor to the market. The employment ratio is

$$E = \left(\frac{\theta}{L\phi_L^{\epsilon}}\right)^{\frac{1}{1-\epsilon}}.$$

PROOF: If market income is sufficiently high to attract the high types to the market, low type workers can profitably set a lower price and capture a larger share of demand. To see this, note that the high type workers will supply time to the market if and only if their market income exceeds their opportunity cost, which is equivalent to

$$p\frac{B}{S} \geq \phi_H. \tag{12}$$

If condition (12) holds, then the equilibrium price can be derived by substituting in $B = \theta p^{-\epsilon}$ and rearranging:

$$p^* = \left(\frac{\phi_H N}{\theta}\right)^{\frac{1}{1-\epsilon}}. \tag{13}$$

where the number of sellers is equal to N. If the market price is given by Equation (13), then the income of each worker is $p\frac{B}{N} = \phi_H$. But if the price is given by (13), a low-type worker can post a price slightly lower than p^* and provide a labor service with certainty, in which case that worker's income is given by the posted price. Let the low-type worker's posted price be $p' = p^* - \delta$ for some $\delta > 0$. Then it is profitable to post a lower price p' if and only if $p^* > \phi_H + \delta$. By substituting in (13) for p^* and rearranging, this condition can be written as

$$p^* = \left(\frac{\phi_H N}{\theta}\right)^{\frac{1}{1-\epsilon}} > \phi_H + \delta \Rightarrow \frac{\phi_H N}{\theta} > \phi_H^{1-\epsilon} \Rightarrow$$

$$\theta < N\phi_H^{\epsilon}. \tag{14}$$

Q.E.D.

Since a low-type worker can profitably post a price below the threshold price required to attract high-type workers to the market, all low-type workers will post a price below p^* and high-type workers will choose to home produce rather than to supply labor to the market. Then the model reduces to the baseline model above, in which case the number of potential workers is the number of low-type agents, L. The low-type agents bid down the price until it yields the threshold income required to attract low-type agents to the market,

$$p = \left(\frac{\phi_L L}{\theta}\right)^{\frac{1}{1-\epsilon}}.$$

The equilibrium income of market participants is $p\frac{B}{L} = \phi_L$, and the employment rate is

$$\frac{B}{L} = \left(\frac{\theta}{L\phi_L^{\epsilon}}\right)^{\frac{1}{1-\epsilon}}. \tag{15}$$

Unemployment is $1 - \frac{B}{L}$.

Equation (15) demonstrates that unemployment is decreasing in the demand parameter θ. Figures 2 and 3 shows how market outcomes depend on θ under the following parameterization:

$$N = 3, \qquad L = 2.5, \qquad \phi_L = 1.8, \qquad \phi_H = 2, \qquad \epsilon = 0.5.$$

At low values of demand, an increase in θ reduces unemployment among the low-type workers without affecting labor force participation. As in the baseline model, the price falls due to a thicker market that permits expected income to remain equal to reservation income at a lower price. The market is saturated with buyers when $\theta = L\phi_L^{\epsilon}$. The standard supply-and-demand analysis applies until θ reaches $N\phi_H^{\epsilon}$ (indicated by the tick mark on the x-axis), at which point market income is sufficiently high to attract high-type participants. The equilibrium price jumps down due to the influx of workers but increases thereafter.

Figure 3 shows that the employment (unemployment) rate is increasing (decreasing) in θ for all values of θ. Labor market participation jumps when θ reaches the necessary threshold to induce high-type workers to supply time to the market.

Figure 2: Effect of an Increase in the Demand Parameter θ on Prices, Quantities, and Incomes.

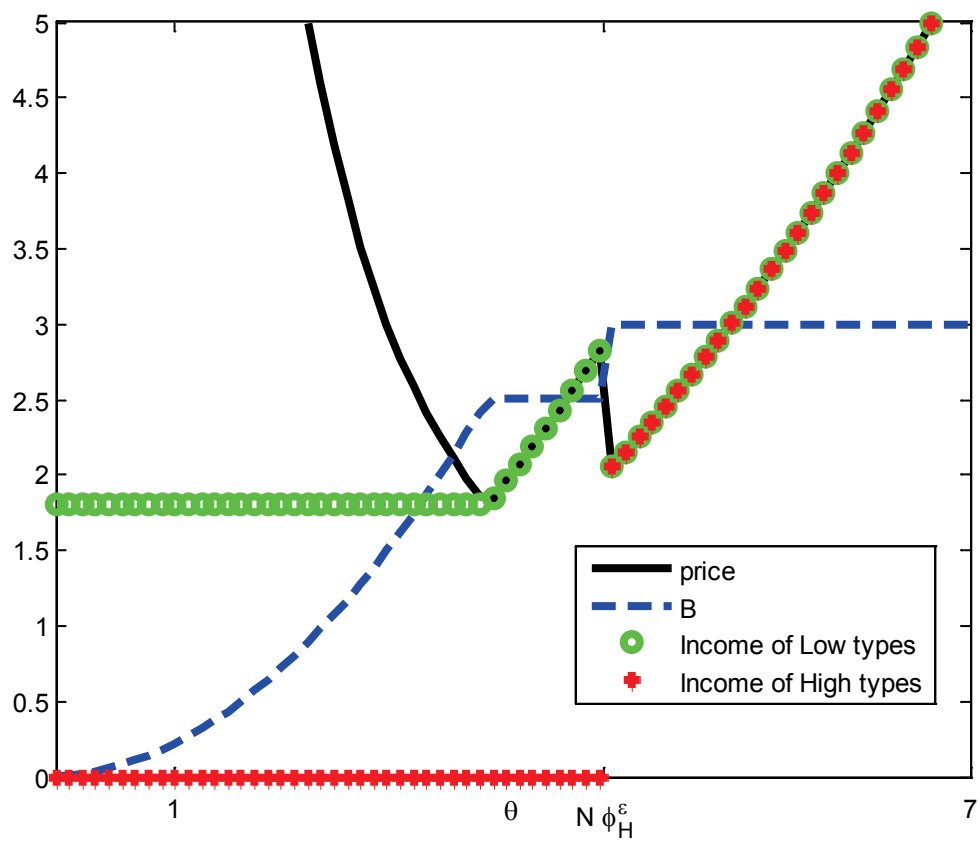
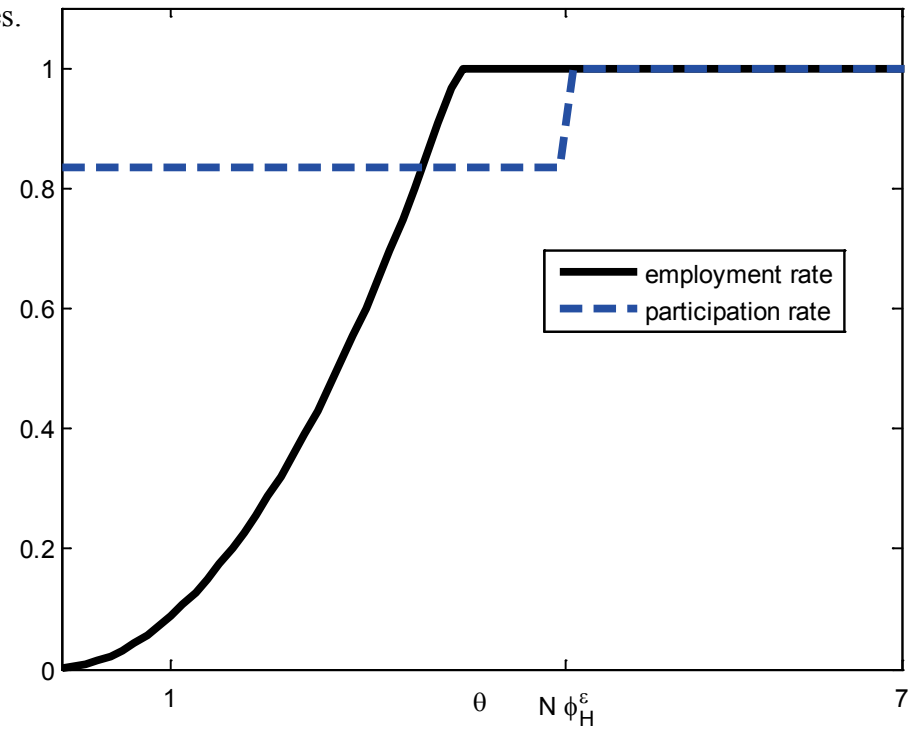


Figure 3: Effect of an Increase in the Demand Parameter θ on Employment and Participation Rates.



4. Labor Cartels

In the spot market for labor services, suppliers provide homogenous services and have no market power. Yet the market outcome is not efficient due to excess supply. Each worker would be better off if everyone coordinated to ensure that at any instant, each worker is either providing a service or exercising his outside option (e.g. home production). This section examines the circumstances under which coordination in the form of a labor cartel is sustainable. The labor cartel operates as a firm in which each worker is also shareholder. The cartel sets the price of services *and* the work schedules of laborers so that there is no excess supply in the market.

Consider the baseline model from Section 2 with homogenous workers and certain demand. If workers were to coordinate and form a cartel, the marketplace would operate as if a single monopolist were providing services to the buyers. The cartel would set prices to maximize revenue, subject to the constraints that sellers' utility from coordination must equal or exceed their utility from deviating from the cartel. As shown below, the effect of the cartel is not to restrict supply. Rather, the cartel organizes workers to remove excess slack in the economy.

PROPOSITION: In a one-time game with homogenous workers, coordination is sustainable if and only if the price charged by the firm equals the instantaneous value of home production.

PROOF: A cartel that maximizes the welfare of its members will choose a market price such there is no excess capacity (workers are either at home or employed at the market). In this case, a worker's instantaneous income equals the price. If this price exceeds the value of home production, any worker will benefit by traveling to the market, undermining the cartel's ability to equate the number of workers with the number of buyers. If the price is less than the value of home production, no worker will travel to the market. Thus the cartel's optimal price must equal the value of home production. Q.E.D.

Note that when demand is inelastic and θ is sufficiently low, the value of home production is less than the price that is obtained when workers do not coordinate (see Figure 1). Thus the cartel price actually increases output relative to the price under competition. To see that the cartel price is sustainable, note that instantaneous income is the same as the value of home production. Therefore, workers are indifferent between participating in the market and working at any instant, and in each instant they receive indirect utility equal to $\phi\tau$. Indirect utility over the course of the day equals

$$V = T\phi,$$

which is the same as utility under competition in the baseline model.

Buyers are better off when workers are organized as a cartel because they pay a lower price and purchase more labor services. This counterintuitive result is due to the fact that a cartel removes sellers' time cost of unemployment inherent in the competitive spot market, permitting sellers to charge a lower price and earn the same income per unit of time spent at the market.

5. Conclusion

This paper builds a theory of unemployment based on the observation that labor services are immediately perishable. The theoretical spot market for homogenous labor services features unemployment when demand is sufficiently low because labor services cannot be stored and thus some workers fail to match with buyers at any point in time. The theoretical market explored above is relevant to real-world markets for homogenous services sold in a central location. Such

markets include day labor markets as well as markets for a range of services in developing countries.

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