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Adult and child labor markets with Nashian and Kantian firms

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Abstract

Purpose – This paper is a dedication to Professor Ngo Van Long who introduced the idea of Kant–Nash equilibrium. The author extends this analysis to the study of adult and child labor markets.

Design/methodology/approach – This is a game theoretic analysis of the market for adult and child workers when some firms behave in the neoclassical Nashian way and some firms follow a Kantian social norm.

Findings – The presence of Kantian firms in the output market in addition to Nashian lowers industry output and labor demand. This raises the possibility that Kantian behavior in the output market could lower wages sufficiently and increase the incidence of child labor. If firms engage in Kantian behavior in the labor market by not hiring child workers, adult wage rises but could lower child wage as children if they work can only work for Nashian firms. When labor demand is sufficiently high, more Kantians could raise adult wage above subsistence and eliminate child labor supply.

Originality/value – This is the first paper to apply Kant–Nash equilibrium to the labor market. The result that Kantian behavior could have an unintended negative spillover effect in other markets is new. The paper keeps alive the ideas of Professor Long, which hopefully will stimulate further work and build on his ideas.

Keywords Child labor, Kant–Nash equilibrium, Kantian norm

Paper type Research paper

1. Introduction

Professor Ngo Van Long, to whom this paper is dedicated, had produced, developed and propagated many scores of ideas in his academic career. Beginning with his first publication in 1973 as a graduate student at Australian National University, over the next half-century, he published eight books, over 200 academic papers and more of his papers will be published posthumously in the next few years. Professor Long was an economic theorist. His tool of choice was mathematics, but the topics he analyzed were all applied, of real-world significance, with policy relevance. His work encompassed resource and environmental economics, international trade and trade policy, economic growth and dynamic games and applied microeconomic theory topics including oligopolistic competition, vertical integration and mergers, on-the-job training, accumulation of specific human capital and brain drain.

Among his voluminous intellectual legacy are a series of more recent papers where he analyzed markets in which human behavior went beyond narrow self-interest and were motivated by morality and sense of duty. In this spirit, I extend Long's (2016) formulation of Kant–Nash equilibrium in oligopolistic output markets to labor markets with adult and child workers. The presence of Kantian firms in the output market alongside Nashian firms lowers industry output and thus reduces labor demand. When households only send children into the workforce when wage income falls below subsistence, we get the possibility that Kantian behavior in the output market could lower wages sufficiently and increase the incidence of child labor. However, if instead, firms follow a Kantian social norm in the labor market by not hiring child workers, adult

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wage rises but could lower child wage as children can now only work for Nashian firms. More Kantian firms could then increase profits for Nashian firms. When labor demand is sufficiently high, more Kantians could raise adult wage above subsistence and eliminate child labor supply.

Economic analysis typically begins with the assumption of individual rationality whereby agents act to pursue their own narrow self-interest taking as given the actions of others. While useful in many models of social interaction, this "Nashian" assumption has been subject to criticism for not always representing human behavior. Instead of choices driven by selfishness and cold calculation, human decisions often follow social norms irrespective of the choices' immediate effects on private payoffs. In some settings, social norms support cooperation among agents that is welfare enhancing for all agents. Smith (1759) argued that adherence to "duty" and other rules of behavior such as mutual help and cooperation are important foundations on which societies are built.

The subject of this paper and others is the Kant categorical imperative, an important social norm that seems to be the basis for decisions in many settings. The Kant categorical imperative states: "Act as if the maxim of your action were to become through your will a general natural law." Unlike the "hypothetical imperative" which is an action necessary to achieve some specific end, a "categorical imperative" is an action that should be taken regardless of the end (see (Russell, 1967)). As an example of Kantian behavior, Sen (1977) notes that people who play the Prisoners' Dilemma in laboratory experiments don't often behave according to the Nashian assumption by playing an unselfish strategy as if the person "has asked himself what type of preference he would like the other player to have, and on somewhat Kantian grounds has considered the case for himself having those preferences, or behaving as if he had them." Asking "why don't more people litter on the beach," Laffont (1975) argues that agents, in that Prisoners' Dilemma, following a Kantian social norm of not littering allows them to coordinate on an action without direct communication nor need for any external punishments for littering.

Building on these writings, Roemer (2010) formally developed the idea of a Kantian equilibrium in games. A player following Kantian social norm when faced with a decision would consider whether deviating from a proposed equilibrium strategy would make her better off when *all other* individuals deviate like she does. Note that the Kantian player here is rational in the sense that she is maximizing *her own* payoff, but unlike the Nashian, she is comparing the current outcome to one where all other players did as she does. In the example above, the Kantian equilibrium of no litter can be supported because a Kantian player would compare her payoff when no one litters to her payoff when everyone litters. The Kantian norm allows society to coordinate and support a better outcome. The question arises as to how such a norm introduced and sustained. Roemer (2010) notes parents typically teach their children the Kantian norm. Similarly, Long (2020b) argued that parents have incentive to provide moral education to their children and that through moral education individuals receive a warm glow from adhering to the Kantian norm thus sustaining it. Relatedly, White (2015) notes that the Kantian norm of *duty* within family relationships supports altruism and resource allocation within the household. The adherence to Kantian norm within the household by parents could by example support the moral education of children, which would then propagate the norm. Relatedly, Benchekroun and Long (2008) develop a model in which the decision of selfish agents to perform "duties" is conditioned on the "stock of cooperation" in society. When the build-up of this stock of cooperation is sufficiently large, the free-riding problem is overcome.

The fact that the presence of the Kantian norm might require interventions such as moral education or additions to social capital introduces the possibility of multiple equilibria or the presence of heterogenous agents. That is, it is possible that Kantians and Nashians coexist in the same game. In a series of papers, Professor Long introduced the idea of Kant–Nash equilibrium. Long (2016) analyzed oligopolistic firms that were both Kantian and Nashian. Long (2020a) studied the tragedy of the commons when some agents were Kantian and some Nashian. Long (2022) explored the effects of tax credits for charitable donations when some taxpayers behaved like Nashians and others were Kantian. Grafton, Kompas and Long (2017) considered Kant–Nash equilibrium in the context of climate change mitigation.

For this paper, Long (2016) provides a natural starting point to study how Kantian behavior can affect the labor market. Kant–Nash equilibrium with quantity-setting firms in the output market spills over into the labor market by affecting labor demand. To study adult and child labor markets, we invoke the assumptions on household labor supply decisions found in Basu and Van (1998). Adults supply labor inelastically, but parents only send children to work if the *adult* wage falls below subsistence level. This assumption, essentially that child leisure is a luxury good, gives the effective labor supply curve a backward bending shape. As more firms are Kantians, industry output falls, labor demand falls and adult wage falls. Beyond a critical number of Kantian firms, adult wage falls below subsistence and children enter the work force. Consequently, Kantian behavior in the output market has the unintended effect of increasing the incidence of child labor.

I extend beyond Long (2016) to analyze the case where the Kantian norm applies directly in the labor market. When Kantian firms choose not to hire child labor, the implications are more complicated. Adult wage could rise because of the increase in demand for adult labor and if it rises enough, could eliminate child labor. But if adult wage does not rise enough, children could still work but now child wages will be lower because of less demand for child labor. The effect on household welfare depends on the relative changes in adult and child labor demand. Interestingly, as with the case of Kantian behavior in the output market, the presence of Kantian firms increases profit for Nashian firms.

The next section extends Long (2016) analysis of the output market with Kantian and Nashian firms to the labor market with adult and child workers. In section 3, I derive the Kant–Nash equilibrium when some firms in the labor market follow the Kantian norm of not hiring child workers. Section 4 concludes.

2. Kantians and Nashians in the output market

There are m firms each producing an amount y_i of a homogenous good using the same production technology. The firms supply a market represented by inverse demand function $P(Q) = B - Q$ where B is an exogenous market size parameter and Q is total industry output, $Q = \sum_i^m y_i$. Each firm hires l_i units of labor in a competitive labor market at wage w to produce the output with a concave technology $y_i = \sqrt{2l}$. The cost function associated with each firm i is thus $C(y_i) = wl = \frac{w}{2}y_i^2$.

Suppose the firms compete by setting quantities in a Cournot oligopoly but that there are two types of firms. Assume that a number n of these firms make decisions in the usual Nashian way. Each firm maximizes its own profit taking as given the output levels of all the other firms. There are also k firms that behave in a Kantian sense, $n + k = m$. In this paper, we consider the case of *exclusive* Kantian firms (see Long (2016)) where each Kantian firm takes the payoffs of the non-Kantian (Nashian) firms as given when making decisions.

Definition 1. An **exclusive Kant–Nash equilibrium** is an output vector:

$$\mathbf{y} = (y_1^N, y_2^N, \ldots, y_n^N, y_{n+1}^K, \ldots, y_{n+k}^K)$$

such that.

(1) *No* ***Nashian*** *firm j can gain by deviating from y_j^N assuming all other firms maintain their EKNE output levels; and*

(2) *No* ***Kantian*** *firm i can increase its profit by applying a scaling factor $\lambda > 0$ to the output vector $(y_{n+1}^K, \ldots, y_{n+k}^K)$ of all Kantian firms. That is,*

$$1 \in \underset{\lambda}{\operatorname{argmax}} \pi_i \left(y_1^N, \ldots, y_n^N, \lambda y_{n+1}^K, \ldots, \lambda y_{n+k}^K\right)$$

Recall that in an exclusive Kant–Nash equilibrium, the exclusive Kantian firms only apply the Kantian norm to the community of Kantian firms. This is why the λ scaling parameter only multiplies the outputs of the k Kantian firms.

2.1 All Nashian firms

When all firms are Nashian, $k = 0$, we obtain the usual Cournot Nash equilibrium. Each firm's output is defined by first-order condition:

$$P'(Q)y_j + P(Q) = wy_j$$

$$y_j = \frac{B - Q}{1 + w}.$$

Industry output is $Q = my_i$:

$$Q^N(0, m) = \frac{mB}{1 + w + m}. \tag{1}$$

To obtain the industry demand for labor, we compute the labor demand for each firm and aggregate to the industry level. Each firm's output is

$$y_j(0, m) = \frac{B}{1 + w + m}.$$

Industry Labor Demand:

$$L^N(w; 0, m) = ml_N^{jd} = m\frac{y_j^2}{2}.$$

$$L^N(w; 0, m) = \frac{m}{2}\left(\frac{B}{1 + w + m}\right)^2. \tag{2}$$

2.2 All Kantian firms

Now consider the other extreme when all firms are Kantian, $k = m$. Each firm's output is defined by:

$$\begin{aligned}
\frac{d}{d\lambda}\left(P(\lambda Q)\lambda y_i - \frac{w}{2}(\lambda y_i)^2\right) &= 0 \,\text{at}\, \lambda = 1 \\
P'(\lambda Q)Q\lambda y_i + P(\lambda Q)y_i - w\lambda y_i^2 &= 0 \,\text{at}\, \lambda = 1 \\
P'(Q)Qy_i + P(Q)y_i &= wy_i^2.
\end{aligned}$$

$$y_i = \frac{1}{w}(B - 2Q).$$

Industry output $Q = my_i$ is:

$$Q^K(m,m) = \frac{mB}{w+2m}. \tag{3}$$

Note that output when all firms are Kantian is the same as that if all m firms had merged (or colluded) and made decisions as a joint monopolist. Since $m > 1$ the level of output is lower than the all-Nashian level given in equation (1). Each firm's output is

$$y_i(m,m) = \frac{B}{w+2m}.$$

Since the all-Kantian level of output is the same as that of one monopolist producing for the entire market, welfare as measured by consumer surplus is lower than in the all-Nash case.

Proposition 1. Since $m > 1$ industry output when all firms are Kantian is lower than when all firms are Nashian. See equations (1 and 3).

Industry Labor Demand is:

$$L^K(w;0,m) = ml^N_{jd} = m\frac{y_j^2}{2}.$$

$$L^K(w;0,m) = \frac{m}{2}\left(\frac{B}{w+2m}\right)^2. \tag{4}$$

Proposition 2. Since $m > 1$ *labor when all firms are Kantian is lower than when all firms are Nashian. See equations 4*

2.3 Coexistence of Kantian and Nashian firms

We now consider the case when $0 < k < m$, some firms are Nashian and some firms are Kantian. Each of the $n = m - k$ Nashian firms choose output to maximize its own profit taking as given the output levels of the other $m - 1$ firms. The first order condition defining output is:

$$P'(Q_E)y^N_{jE} + P(Q_E) = wy^N_{jE}$$

where $Q_E = ny^N_{jE} + ky^K_{jE}, y^N_{jE}$ is the level of output of a Nashian firm and y^K_{jE} the level of out of a Kantian firm.

$$-y^N_{jE} + B - ny^N_{jE} - ky^K_{iE} = wy^N_{jE}. \tag{5}$$

Output of each of the k Kantian firms is defined by:

$$\begin{aligned}
\frac{d}{d\lambda}\left(P\left(ny^N_{jE} + ky^K_{iE}\right)\lambda y^K_{iE} - \frac{w}{2}(\lambda^K_{iE})^2\right) &= 0 \text{ at } \lambda = 1 \\
k\left(y^K_{iE}\right)^2\lambda P'(Q_E) + P(Q_E)y^K_{iE} &= w\lambda\left(y^K_{iE}\right)^2 \text{ at } \lambda = 1 \\
k\left(y^K_{iE}\right)^2 P'(Q_E) + P(Q_E)y^K_{iE} &= w\left(y^K_{iE}\right)^2
\end{aligned}$$

$$-k\left(y^K_{iE}\right) + B - ny^N_{jE} - ky^K_{iE} = wy^K_{iE}. \tag{6}$$

We can write equations (5 and 6) as the system:

$$\begin{pmatrix} w+n+1 & k \\ n & w+2k \end{pmatrix} \begin{pmatrix} y_{jE}^{N} \\ y_{iE}^{K} \end{pmatrix} = \begin{pmatrix} B \\ B \end{pmatrix} \tag{7}$$

from which we can solve for the output levels of the Nashian and Kantian firms respectively:

$$y_{jE}^{N}(k,m) = \frac{B(w+k)}{(w+1)(w+2k)+(m-k)(w+k)},$$

$$y_{jE}^{K}(k,m) = \frac{B(w+1)}{(w+1)(w+2k)+(m-k)(w+k)}.$$

By inspection, $y_{jE}^{N}(k,m) > y_{jE}^{K}(k,m)$ when $k > 1$ and the two levels are equal when $k = 1$. That is, a Kantian firm when there is only one Kantian firm is effectively Nashian. Industry output is:

$$Q^{KN}(k,m) = m\left(\frac{m-k}{m} y_{jE}^{N}(k,m) + \frac{k}{m} y_{iE}^{K}(k,m)\right).$$

Since $y_{jE}^{N}(k,m) > y_{jE}^{K}(k,m)$ for $k > 1$ and industry output is m times the weighted average of the outputs of the two types of firms, it follows that:

$$Q^{K}(m,m) < Q^{KN}(k,m) < Q^{N}(0,m)$$

for $1 < k < m$.

Labor demand can be derived similarly:

$$\begin{aligned} L^{d}(w;k,m) &= m\left(\frac{m-k}{m} l_{j}^{Nd}(k,m) + \frac{k}{m} l_{i}^{Kd}(k,m)\right) \\ &= m\left(\frac{m-k}{m}\frac{y_{jE}^{N}(k,m)^{2}}{2} + \frac{k}{m}\frac{y_{iE}^{K}(k,m)^{2}}{2}\right). \end{aligned}$$

Since $y_{jE}^{N}(k,m) > y_{jE}^{K}(k,m)$ for $k > 1$, it follows that:

$$L^{K}(m,m) < L^{d}(w;k,m) < L^{N}(0,m).$$

The depiction of labor demand over the range of $k \in [0, m]$ is shown in Figure 1.

Proposition 3. When more firms behave as Kantians in the output market, output falls and labor demand decreases.

2.4 Labor supply and equilibrium

To determine equilibrium in the labor market, we describe the household labor supply decisions. Suppose there are H households, each with one adult and one child. For simplicity, assume adults and children are substitutes in production and equally productive in the industry being analyzed. The results would not change if we assumed children and adults are substitutes but children were less productive than adults. In that case, the two types of labor would be substitutes but with a scaling factor. The unit of labor would be 'adult-equivalent' units. Since results don't change, we make the simplifying assumption that the scaling factor

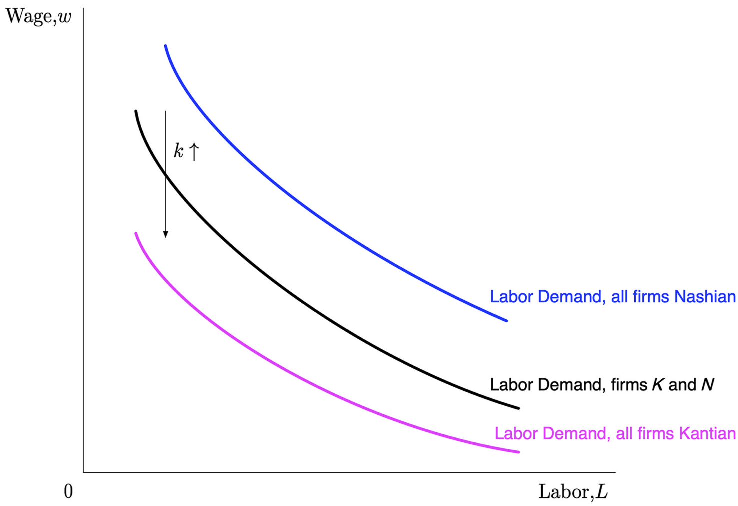

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Figure 1.
Labor demand with Kantian and Nashian firms in the output market

is 1. Results would change of course if child and adult labor were complementary. But since we have in mind the market for less-skilled workers, the assumption of the labor types being substitutes is more appropriate.

While adults supply labor inelastically, children only work if the adult wage falls below some subsistence level, s. This "Luxury Axiom" introduced by Basu and Van (1998) gives the effective labor supply curve shown in Figure 2. When wages are above subsistence level s, only adults work and supply is the vertical segment at quantity H. When wage falls below s, both adults and children are in the labor force and supply is inelastic at level $2H$.

Proposition 4. If labor demand is sufficiently high (e.g. labor is very productive, the market is sufficiently large), such that labor demand when all firms are Kantian intersect adult-labor-only supply at wage $w > s$, children do not work and the number of Kantians versus Nashian firms in the market only affect wages paid to adults.

Proposition 5. If labor demand is sufficiently low, (e.g. labor productivity is very low, the market is very small) such that labor demand when all firms are Nashian intersect the adult-and children-labor supply segment at wage $w < s$, all children work and the number of Kantians versus Nashian firms in the market only affect the wage paid to adults and children.

Proposition 6. If the labor demand for at some intermediate level (e.g. labor productivity is at some medium range, the market is very neither small nor large) such that the equilibrium wage when all firms are Nashian is above the subsistence level, $w^* > s$, but when all firms are Kantian, the equilibrium wage is below subsistence, $w^* < s$, then introducing more Kantian firms into the output market reduces adult wage and could drive children into the labor force.

In Figure 2, we show the family of Kant–Nash labor demand curves for some intermediate level of labor demand. As drawn in Figure 2, when all firms in the market behave as Nashians,

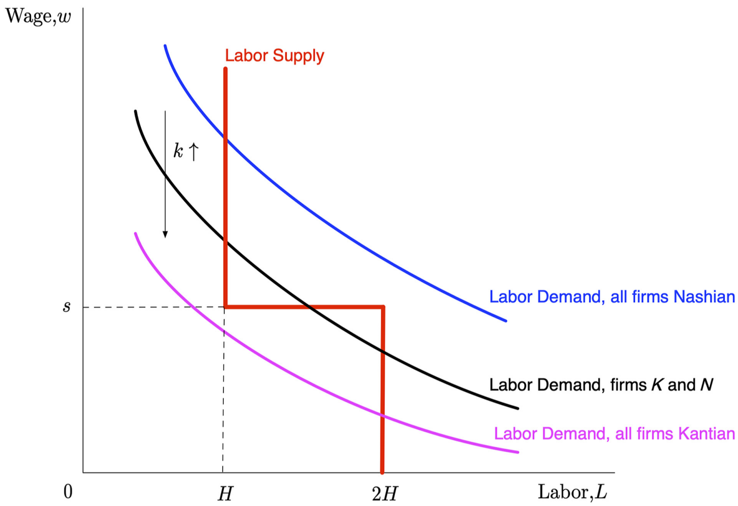

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Figure 2. Labor market equilibrium with Kantian and Nashian firms in the output market

labor demand is sufficiently high to support an equilibrium wage $w^* > s$. As more firms are Kantians, industry output falls and labor demand falls. Beyond a critical number k Kantian firms, adult wage falls below subsistence and children enter the work force driving wage even lower. In this case, Kantian behavior has the unintended consequence of driving children into the labor force. Note that in all cases described above, more Kantian firms in the output market have the effect of lowering wage because of lower output reducing the demand for labor.

Note that the assumption of inelastic adult labor supply is not crucial for these results. It is the "Luxury Axion," the assumption that children work when adult wage falls below subsistence and do not work otherwise that makes the effective labor supply curve (child plus adult) backward bending which gives rise to the possibility of multiple equilibria.

3. Kantian norm in the labor market

Recall the Kantian categorical imperative: "Act as if the maxim of your action were to become, through your will, universal law." Suppose that a firm follows this norm in the labor market by NOT hiring child labor. There are $k \in (0, m)$ Kantian firms in the labor market and $m - k$ Nashian firms do hire children in the labor market. For the following discussion, assume all firms behave as Nashians in the output market.

3.1 Labor demand is high

Figure 3 shows total labor demand when all firms are Nashian in the labor market for the market conditions corresponding to high, medium and low labor demand.

Proposition 7. If labor demand is sufficiently high (e.g. labor is very productive, the market is sufficiently large), the Kantian norm in the labor market has no effect on the labor market since both Nashian and Kantian firms only hire adult workers.

Define w^E as the wage when all firms are Nashian in the labor market and $L^d(w^E) = 2H$. If labor demand is sufficiently high such that $w^E > s$, then no children work in equilibrium. The

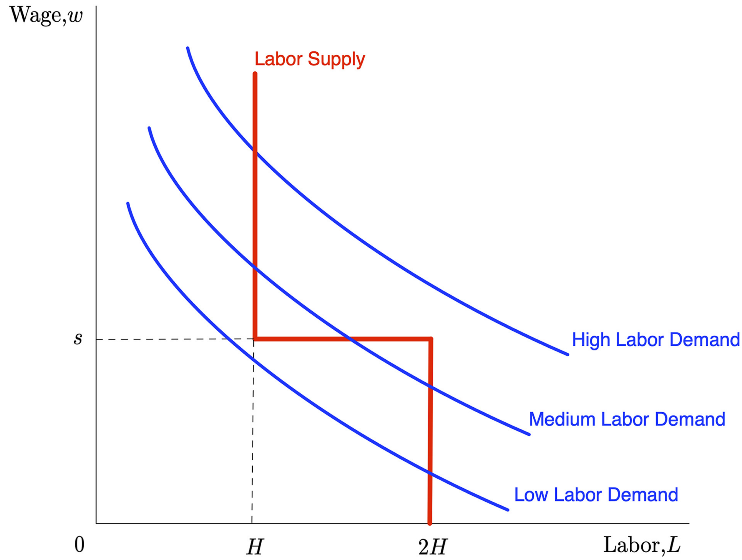

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Figure 3.
Labor demand when all firms are Nashian in the labor market

switching of a Nashian firm to Kantian firms in the labor market has no effect on the labor market since there is no supply of child labor in the market anyway. Only adults work. And since Kantian firms and Nashian firms produce the same output, there is no effect on wage when more firms become Kantians. The equilibrium wage, w^*, is defined by labor market clearing:

$$L^d\left(w^*\right) = \frac{k}{2}\left(\frac{B}{1+w^*+m}\right)^2 + \frac{m-k}{2}\left(\frac{B}{1+w^*+m}\right)^2 = H.$$

3.2 Labor demand is low

Now suppose the demand for labor is low.

Proposition 8. If labor demand is sufficiently low (e.g. labor productivity is very low, the market is small), when the number of Kantian firms are few, Kantian firms hire only adults, and Nashian firms hire both adults and children, all at the same equilibrium wage.

Define w^{AA} as the wage when no firms are Kantian in the labor market and $L^d(w^{AA}) = H$. If labor demand is very low such that wage $w^{AA} < s$, that is, the highest possible equilibrium adult wage would still mean children need to work. The all-Nashian equilibrium wage w^E in this case is defined by

$$\frac{m}{2}\left(\frac{B}{1+w^E+m}\right)^2 = 2H.$$

When $k > 0$ firms are Kantian, if labor demand from the Kantian firms does not exceed the supply of available adults H,

$$\frac{k}{2}\left(\frac{B}{1+w^E+m}\right)^2 \leq H, \tag{8}$$

then the equilibrium wage is defined by

$$L^d\left(w^*\right) = \frac{k}{2}\left(\frac{B}{1+w^*+m}\right)^2 + \frac{m-k}{2}\left(\frac{B}{1+w^*+m}\right)^2 = 2H.$$

Kantian firms can hire adults at w^* and Nashian firms can hire adult and child labor at the same wage, $w^K = w^N = w^*$. Combining this equilibrium condition with inequality 8 yields the condition on the maximum number of Kantian firms in the labor market to be $k \leq \frac{m}{2}$. This case of few Kantians is depicted in Figure 4.

Proposition 9. If labor demand is sufficiently low (e.g. labor productivity is very low, the market is small), when the number of Kantian firms are numerous, Kantian firms hire only adults and Nashian firms hire only children. Adult wage is higher than child wage in this Kant–Nash equilibrium.

When $k > \frac{m}{2}$, then $\frac{k}{2}\left(\frac{B}{1+w^E+m}\right)^2 > H$, then there will be excess demand for adult labor at w^E. Adult wage will rise. If w^A, defined by $kl^K(w^A) = H$, is less than s, then adult wage rises but is still below subsistence so children are still working. Now there is excess supply of child labor for the Nashian firms at w^E so child wage falls with increasing k, $s > w^A > w^E > w^C$. The effect of additional Kantians in the labor market is to push adult wage higher and child wage lower. This effect is shown in Figure 5.

For the case of low labor demand, the Kant–Nash labor market equilibria for different values of k are summarized in Figure 6.

3.3 Intermediate level of labor demand

Now suppose the demand for labor is at some intermediate level.

Proposition 10. If labor demand at an intermediate level that when there are no firms are Kantian in the labor market, two equilibria exist, at wage $w^* > s$ where only adults work defined as $L^d(w^*) = H$, and $w^{**} < s$ where both adults and children work defined as $L^d(w^{**}) = 2H$.

(1) *If the labor market begins at the no child labor equilibrium, then more Kantians in the labor market has no observable effect since Kantians and Nashians only hire adult workers and children do not work.*

(2) *If the labor market begins at the child labor equilibrium, if there are few Kantians in the labor market, wage is not affected and children continue to work.*

(3) *If the labor market begins at the child labor equilibrium, if there are many Kantians in the labor market, adult labor is not enough to meet demand from Kantian firms. Adult wage rises and child wage falls. If adult wage rises above subsistence, then children leave the labor force. If adult wage rises but not above subsistence, then children continue to work but for lower wage.*

When there are $k \in \left(0, \frac{m}{2}\right)$ Kantian firms, labor demand from the Kantian firms does not exceed the supply of available adults H, Kantian firms can hire adults at w^* and Nashian firms can hire adult and child labor at the same wage, $w^K = w^N = w^*$. When $k > \frac{m}{2}$, then

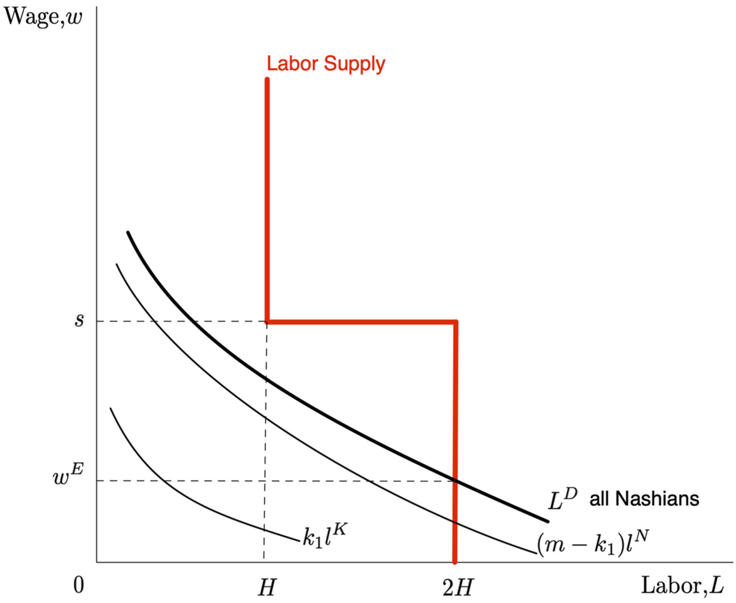

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Figure 4.
Labor demand when all firms are Nashian in the labor market

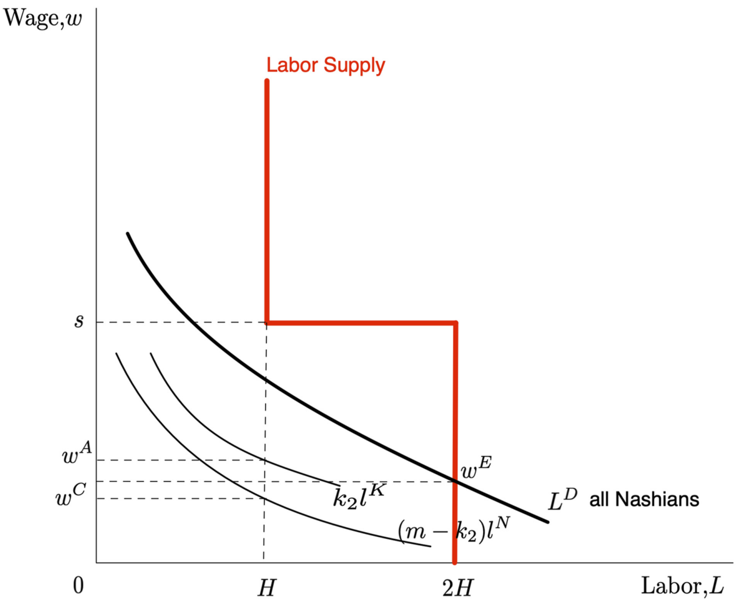

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Figure 5.
Labor demand when all firms are Nashian in the labor market

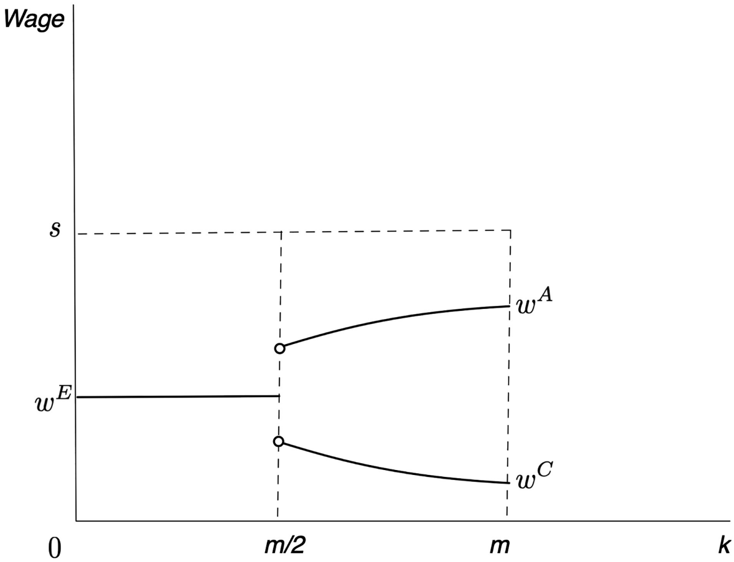

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Figure 6. Kant–Nash labor market equilibrium wages when labor demand is low

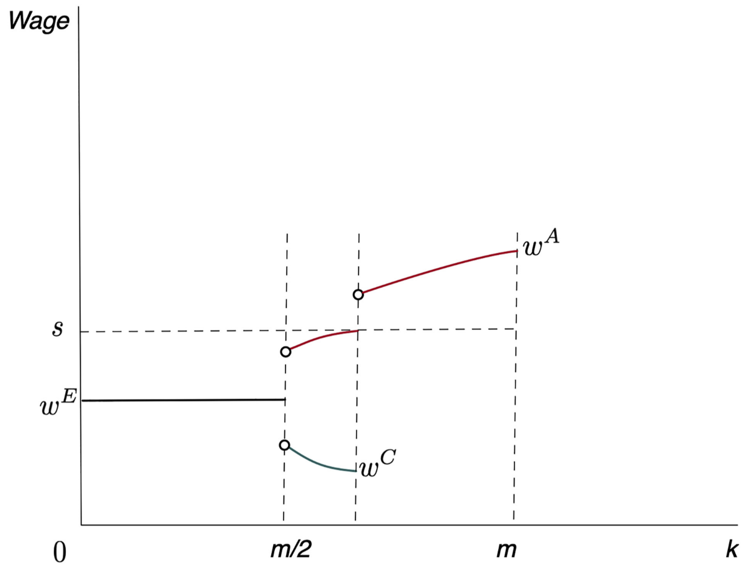
$\frac{k}{2}\left(\frac{B}{1+w^E+m}\right)^2 > H$, then there will be excess demand for adult labor at w^E. Adult wage will rise. If w^A, defined by $kl^K(w^A) = H$, is less than s, then adult wage rises but is still below subsistence so children are still working. Now there is excess supply of child labor for the Nashian firms at w^E so child wage falls with increasing k, $s > w^A > w^E > w^C$.

If $k \in \left(\frac{m}{2}, m\right]$ increases beyond a level such that $w^A > s$, then the wage paid by Kantian firms exceeds subsistence and children no longer work. The Nashian firms must now hire adults which increases the adult wage above w^A. More Kantians in the labor market can raise adult wage and beyond a certain threshold, can eliminate child labor. Kant–Nash labor market equilibria for intermediate levels of labor demand for different values of k are summarized in Figure 7.

In summary, the presence of Kantian firms in the labor market does increase the adult wage which if it rises sufficiently above subsistence, would induce households to remove children from the labor force. However, when labor demand is too low, and adult wage does not rise above subsistence, then children will still have to work but now face lower demand since Kantian firms do not hire children. In this case, child wage falls. If labor demand is sufficiently high and adult wage rises sufficiently with more Kantian firms, then children will no longer work. This latter situation would be compatible with the Kantian norm of not hiring children.

4. Concluding remarks

I extend Long's (2016) analysis of quantity setting firms in the output market with Nashian and Kantian firms to the labor market for adult and child laborers. Adherence to the Kantian norm in the output market could increase child labor because of lower industry output and thus lower labor demand and wages. If firms follow a Kantian norm in the labor market of not hiring child workers, adult wage rises but could lower child wage as children, if they work,



Source(s): Figure by author

Figure 7.
Kant–Nash labor market equilibrium wages when labor demand is at an intermediate level

can only work for Nashian firms. If labor demand is sufficiently low, adult wage does not rise enough to eliminate child labor. But when labor demand is sufficiently high, more Kantians could raise adult wage above subsistence and eliminate child labor supply.

The results in this paper introduce the possibility that agents following a Kantian norm in one market might have negative spillover effects in other markets. This is a result that was not present in previous papers that only analyzed one market in isolation. Similarly, Kantian behavior in the child labor market though of course can never increase the incidence of child work, but it could lower wages for child workers which might lower household welfare. Interestingly, the presence of Kantian firms increases profits for Nashian firms. A further extension could consider two types of households, Kantian and Nashian. In the case of an intermediate level of labor demand where multiple equilibria exist, a Kantian norm in which parents do not send children to work could increase adult wage sufficiently to send to labor market to the equilibrium without child labor.

This paper adds to the literature of Kant–Nash equilibrium introduced by Professor Ngo Van Long. More can be done in this area where there are multiple types of labor in the same labor market. For example, preference for immigrant versus native labor or discrimination across different labor types. Professor Long's contributions in many other areas will likewise generate new work in the years ahead.

Professor Milton Friedman who was awarded the Nobel Prize for his work in monetary economics among many other topics wrote that: "When crisis occurs, the actions that are taken depend on the ideas that are lying around." He believed this to be the importance of the academic economist: to develop ideas and to keep them alive and available until the time that they are needed. Professor Ngo Van Long has left behind a treasure trove of ideas. It is our hope that they will be kept alive by the next generations of researchers and inspire new ideas from them until the time that they are will be needed.

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