Abstinence from Child Labor and Profit Seeking

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Abstract. Some firms voluntarily abstain from using child labor, presumably in response to concerns about the welfare of overseas child workers. These firms do not, however, support banning the imports of competitors' products manufactured with child labor. As an explanation of this seemingly contradictory behavior, I consider a setting in which two firms engage in Bertrand competition for consumers who vary in the value they place on goods made without child labor. When the firms differentiate themselves according to their labor input, both enjoy greater profits. If imports using child labor are banned, this reduces the profits of both firms. Similar results can also arise in a many firm setting. If charitable donations to education foundations raise the cost of child labor, this too can arise as a purely profit-seeking activity by adult labor firms. Thus, while the adult-labor firms engage in seemingly altruistic behavior, they may do so not out of regard for children but rather for their own profits.

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1. Introduction

The Fair Labor Association (FLA) was founded in 1999 by member corporations to monitor their overseas labor practices. A major concern for the group is the use of overseas child labor by firms that are either based in or sell products in the United States. The International Labor Organization (2001) estimates that over 250 million children work worldwide. While some estimates suggest that 70 percent of these children are employed in agriculture, this still implies that some 75 million children are employed in industry (Ashagrie, 1998). In an effort to reduce child labor, the FLA's *Workplace Code of Conduct* (1999) states that its members shall not employ anyone "younger than 15 (or 14 where the law of the country of manufacture allows) or younger than the age for completing compulsory education in the country of manufacture where such age is higher than 15". Many FLA members such as Reebok International, Nike, and Levi-Strauss also contribute to overseas child welfare programs. For example, in 1997, Reebok promised $1 million in assistance to Pakistani education programs which benefit regions in which child labor is particularly widespread (Department of Labor, 1997). Furthermore, these same firms seek to distance themselves from business partners who use child labor. Reebok makes this abundantly clear in its Human Rights Production Standards (1999), where it flat out states that "Reebok will not work with business partners that use child labor".

This concern for the welfare of child labor is also an impetus for government policy. One of the starkest proposals to combat overseas child labor is Senate Bill 1551, the Child Labor Deterrence Act (or the Harkin Bill). First introduced by Senator Tom Harkin (D-Iowa) in 1992, this bill bans U.S. imports of goods produced by children under fifteen. While this bill has failed repeatedly, more tempered versions have succeeded. One example is the 1997 Sanders Amendment of the Trade Act of 1930, which extended the ban on importation of products made with "forced or indentured labor" to include products made with "forced or indentured child labor". Another is the recently approved Harkin Child Labor Amendment which made the elimination of only the "worst forms of child labor" a major goal of future U.S. trade

negotiations.[1,2] One reason for the continued failure of the Harkin Bill banning imports using any type of

child labor is that it has faced opposition by adult labor firms as well as the overseas child labor-using

firms. For example, the Oriental Rug Importers Association, Inc. (ORIA) proclaims on its website that it

"is absolutely opposed to the use of illegal child labor and, accordingly, our members have taken

affirmative steps to avoid the procurement of carpets made with illegal child labor" (ORIA, 2002). At the

same time, it also boasts that the organization's lobbying efforts "successfully opposed the Harkin

Legislation".[3] Similarly, although it was formed after the earliest incarnations of the Harkin Bill, the

FLA has remained curiously silent on the Harkin Bill and its offshoots.

       This silence is surprising on two counts. First, since these firms presumably abstain from the use

of child labor out of a belief that child labor is detrimental to the employees (an issue that is by no means

resolved as discussed in Basu, 1999), one would expect them to favor such a proposal for altruistic

reasons. Second, since these firms compete against the low-cost child labor firms, such a ban would

eliminate their low-cost competitors. While there is little solid data on how many imports are produced

with child labor, anecdotal evidence suggests that a significant part of child labor in developing countries

is devoted towards exports to developed nations. For example, of the rugs hand-knotted in Bangladesh,

an industry that traditionally uses child workers, approximately 60 percent of the output is bound for U.S.

markets (Collingsworth, 1997). Thus, a ban on child labor imports would presumably also benefit these

firms' bottom lines, a boon noted by Basu (1999) among others. Despite this, adult labor-using firms

either withhold support or actively fight proposed bans on child labor. Krueger (1997) even finds

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[1] It is worth noting that of the twenty-four detention orders placed against child slavery products
between 1991 and 2001, only six of these actually resulted in a ban (Sanders, 2001).

[2] The worst forms of child labor only covers child slavery, child pornography, trafficking in
children, and the use of children in hazardous occupations (Harkin, 2002). Dessy and Pallage (2002) and
Swinnerton and Rogers (2002) discuss the effect of banning the worst kinds of child labor on children.

[3] The specific locations of these quotes are respectively http://www.oria.org/policy1.htm and
http://www.oria.org/membership.htm.

empirical evidence of this resistance by examining the voting records of congressional representatives on the early versions of the Child Labor Deterrence Act. Surprisingly, he finds that the representatives of low-skill districts are least likely to vote in favor of the Harkin Bill even though their constituents are most likely to be in competition against the low-wage foreign child workers. Similarly, the Canadian Labor Congress's (CLC) Mike Desautels has stated that the CLC would not support banning Canadian imports of child labor products (Yanz and Jeffcott, 1998).

In this paper, I resolve this apparent contradiction by showing that the use of adult labor can arise not from concern for child workers, but rather from simple profit-seeking. If some consumers prefer products made without child labor, adult labor firms can differentiate themselves by their production methods. Thus, even though products may have identical physical attributes, by segmenting the market along this dimension, firms engaging in price competition can earn greater profits. Since this "production differentiation" can benefit all firms, neither the adult nor the child labor firms would seek to have it eliminated. In interviews, Harkin himself has suggested production differentiation as a reason for firms to abstain from child labor. For example, in a 1997 interview, he notes that firms "are now starting to use [child labor-free production] as a marketing tool. They are actually using it in advertising and in marketing to say that our clothes or our products… are not made with child labor" (Israeli Embassy Publications, 1997, pg. 3). He believes that this strategy will be successful because "polls all indicate that the vast majority of consumers would purchase and would spend that something extra if they knew that the product was not made with child labor" (ibid.). Even if one doubts that the vast majority of consumers are willing to do so, the continued existence of such products demonstrates that at least some consumers are willing to pay more for child labor-free products. To get an idea of how many consumers may have preferences based on production methods, consider Haq (1996), who reports that a poll of American consumers found that 84 percent would be willing to pay an additional $1 for a $20 garment if it were made without sweatshop labor. Similarly, so-called "fair trade" cocoa which is made without child labor or destructive environmental processes sells for as much as 30 percent more than standard

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cocoa (Pellizzari, 2002). With this in mind, it is reasonable to suppose that some portion of consumers would be willing to pay more for goods made without child labor.

Within this production differentiation framework, it is also possible to attribute charitable donations by adult labor firms to profit seeking. If donations serve to improve schooling (or at least increase the mandatory length of it), this can increase the cost of child labor and increase the adult labor firm's profits. Similarly, we might expect that adult labor firms would support a tariff against child-labor products even if they do not support a full ban. This is an interesting insight when considering that although the ban of the Harkin Bill has repeatedly failed, there has been some success at making preferential trade relations contingent upon labor issues including the use of child labor. In the U.S., the Trade and Development Act of 2000 sought to deny normal trade relations to countries that fail to meet and effectively enforce the ILO Convention 182 which bans the "worst forms of child labor". This idea has been pushed even further by using the Generalized System of Preferences (GSP) to revoke normal trade relations for developing countries that are not making satisfactory efforts to correct poor labor standards. Similarly, the European Union introduced labor standards into its GSP in 1998.[4] This argument was also used by Rodrik (1995) who suggests that if a nation on the whole views poor overseas labor standards as serious problem, then protectionist measures may be warranted.

One final implication of the production differentiation model is that in order to actually eliminate child labor, it may not be sufficient to rely solely on industry groups like the FLA. In fact, concern over the corporate membership in the FLA gave rise to the alternative Worker's Rights Consortium (WRC) in early 2000. This second organization specifically does not include corporations in its leadership. Thus, whereas the FLA may be effective in some labor issues, the production differentiation analysis suggests that there may indeed be a role in the child labor debate for non-industry groups like the WRC.

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[4] See Stern (forthcoming) for details about both of these policies and their effect on overseas labor practices.

Before continuing I want to discuss the differences between my results and those of Basu, Chau, and Grote (2000) who focus on the impact of potentially-false labeling schemes on trade, child labor, and welfare. In their model, a Northern country produces only using adult labor. This country imports from the South, where production methods are unobservable and can use either adult or child labor. The Northern consumers have identical and constant marginal rates of substitution between child and adult labor products (compare this to my consumer heterogeneity). Because of production method uncertainty, consumers are willing to pay a premium for Northern goods since by virtue of country of origin information there is a de facto labeling scheme in place. Production method labeling of imports reduces the uncertainty in buying Southern products, thus Northern adult labor firms lose from labeling while Southern adult labor firms gain. Furthermore, since they assume price-taking firms, a tariff on unlabeled imports can induce Southern firms to switch to adult labor products, also hurting Northern firms. My model of production differentiation under Bertrand competition, however, finds that Northern adult labor firms would favor tariffs while opposing import bans. Thus, my model can explain the position of groups like ORIA and the FLA while Basu, Chau, and Grote's cannot.

The remainder of the paper is laid out as follows. Section 2 presents the simplest two firm production differentiation model. Section 3 takes up the issue of charitable donations and tariffs. Since there may be concerns that the results for production differentiation require the existence of only two firms, Section 4 demonstrates that similar results can be found in a setting with several firms. Section 5 concludes.

2. A Simple Model of Production Differentiation

To formalize the above argument, consider a market with two firms, labeled 1 and 2, which engage in Bertrand competition.[5] Although the firms make products with identical physical

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[5] The following analysis borrows heavily from the work on Bertrand competition with quality-differentiated products as presented by Tirole (1988). Although the model presented is extremely simple,

characteristics, they can produce their brand using either adult or child labor.[6] Since the products are

physically the same, the continuum of consumers derives the same baseline utility θ regardless of the

production method. In addition to the baseline θ, consumers also consider the labor input when assigning

a value to the product. Specifically, each consumer i derives utility U^i from consumption which is given

by:

$$U^i = \begin{cases} \gamma^i \theta - p & \text{if i purchases a product made with adult labor} \\ \theta - p & \text{if i purchases a product made with child labor} \\ 0 & \text{if no purchase is made.} \end{cases} \qquad (1)$$

where p is the price and γ^i is a taste parameter which is distributed uniformly across consumers on the

interval $[1, \bar{\gamma}]$. Thus, some consumers are indifferent between production methods, whereas others

derive additional welfare from knowing that their product was made without child workers. In Section 4,

I extend consumer preferences to allow for both production method and brand differentiation. For

simplicity, no consumers prefer the use of child labor, although such preferences could easily be

introduced and would cause no qualitative change in my results. As suggested by Srinivasan (1996) and

Maskus (1997) the additional value placed on adult labor products can be attributed to a "warm glow"

that consumers get because they feel that they are helping underprivileged children (although as Basu,

1999, discusses, such benefits may not actually occur). While there is a tradition of such a warm glow in

the child labor literature, has generally been attributed to the parents of child workers (see Galor and Zeira

(1993) and Chiu (1998) for examples).[7] The size of the consumer population is normalized to one and

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its generality is well-known. Since my goal is not to expound upon the generality of those results but
rather to illustrate why seemingly altruistic behavior may arise from profit-seeking, I proceed with what I
feel is the clearest illustrative example.

[6] Lutz, Lyon, and Maxwell (2000) used a similar approach to question why some firms exceed
minimum environmental standards.

[7] The warm glow has also been used in the public goods literature as an explanation for altruistic
giving (Andrioni, 1990).

each consumer purchases at most one unit. Labor inputs are common knowledge and costless to verify, which avoids any incentive concerns. Since the one primary goal of the FLA and the WRC is to monitor labor standards and make this information easily available to consumers, this assumption is not unreasonable. Typically, this information is communicated to consumers through labeling, such as the RUGMARK program which certifies and labels hand-knotted carpets as "child labor free". RUGMARK also helps displaced child workers through small stipends and education program placement (Collingsworth, 1997).

The demand for each firm, $D^i(p^1, p^2, t^1, t^2)$ depends on the prices (p^1, p^2) and the type of labor (t^1, t^2) used by both. If firm i uses adult labor, then $t^i = a$. If it uses child labor, then $t^i = c$. If both firms produce using the same method, consumers purchase whichever product is cheapest. Thus, if both firms use child labor, for i=1, 2:

$$D^i(p^1, p^2, c, c) = \begin{cases} 1 & \text{if } p^i < p^j \\ 1/2 & \text{if } p^i = p^j \\ 0 & \text{if } p^i > p^j \text{ or if } p^i > \theta. \end{cases} \tag{2}$$

If both firms use adult labor, each firm faces the demand function:

$$D^i(p^1, p^2, a, a) = \begin{cases} \min\{\dfrac{\theta\overline{\gamma} - p^i}{\theta(\overline{\gamma} - 1)}, 1\} & \text{if } p^i < p^j \\ \min\{\dfrac{\theta\overline{\gamma} - p^i}{2\theta(\overline{\gamma} - 1)}, \frac{1}{2}\} & \text{if } p^i = p^j \\ 0 & \text{if } p^i > p^j \text{ or if } p^i > \theta\overline{\gamma} \end{cases} \tag{3}$$

Finally, consider the case where the firms use different labor types. Without loss of generality, assume that firm 1 uses adult labor and firm 2 uses child labor. Here, for given prices, there exists a consumer who is indifferent between the two products, yielding the demand functions (ignoring corner solutions for the moment):

$$D^1(p^1, p^2, a, c) = 1 - \frac{(p^1 - p^2)}{\theta(\overline{\gamma} - 1)} \tag{4}$$

7

and

$$D^2(p^1, p^2, a, c) = \frac{(p^1 - p^2)}{\theta(\bar{\gamma} - 1)}$$

(5)

Production is constant returns to scale. The constant marginal cost of production when using adult

workers is w^a whereas the constant per unit cost when using child workers is w^c, where $w^c < w^a$. Note

that these are per unit costs and do not necessarily correspond directly to wages. As noted by Ranjan

(2001), child workers are generally less productive than adult workers. This alone can imply a lower

wage for child workers.[8]   Two assumptions simplify the analysis:

Assumption 1: $2\theta(\bar{\gamma} - 1) > w^a - w^c$.

Assumption 2: $\theta > \dfrac{w^a + 2w^c + \theta(\bar{\gamma} - 1)}{3}$.

Assumption 1 puts an upper bound on the cost differential. This ensures that the adult labor firm's costs

are not so much greater that it cannot compete with the lower cost firm. This is consistent with the

observed presence of both child and adult labor firms in practice. The second assumption is sufficient to

guarantee that the market is covered in the equilibrium, i.e. that all consumers will purchase one of the

two firms' product.

When the firms use the same type of labor, the equilibrium is the familiar Bertrand Paradox in

which both firms set prices equal to the marginal cost and obtain zero profits. Since this result is so well-

known, I omit its derivation.

When firms use different labor types, their profit functions are:

$$\pi^1 = [p^1 - w^a][1 - \frac{p^1 - p^2}{\theta(\bar{\gamma} - 1)}]$$

(6)

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[8] It is important to note that in Ranjan's (2001) model, child workers receive an efficiency weighted fraction of the adult wage, implying that the unit cost of production is the same when using child or adult workers. My assumption, however, not indicates a lower wage for child workers, but also for a lower unit cost for child-labor produced products.

and

$$\pi^2 = [p^2 - w^c]\frac{p^1 - p^2}{\theta(\bar{\gamma}-1)}. \tag{7}$$

Each firm maximizes its profits with respect to its own price. The Nash equilibrium in the price-setting game is:

$$p^1 = \frac{2w^a + w^c + 2\theta(\bar{\gamma}-1)}{3} \tag{8}$$

and

$$p^2 = \frac{w^a + 2w^c + \theta(\bar{\gamma}-1)}{3}. \tag{9}$$

By Assumption 1, both prices exceed their marginal costs. Furthermore,

$$p^1 - p^2 = \frac{w^a - w^c + \theta(\bar{\gamma}-1)}{3} > 0,$$

which indicates that firm 2 has positive demand. Firm 1's positive sales are ensured by Assumption 2. Finally, equilibrium profits are:

$$\pi^1 = \frac{[2\theta(\bar{\gamma}-1) - (w^a - w^c)]^2}{9\theta(\bar{\gamma}-1)} > 0 \tag{10}$$

and

$$\tag{11}$$

$$\pi^2 = \frac{[\theta(\bar{\gamma}-1) + (w^a - w^c)]^2}{9\theta(\bar{\gamma}-1)} > 0.$$

These results are summarized in the following proposition.

Proposition: *Both firms' profits are strictly higher when they use different labor types.*

By using different types of labor, firms are able to differentiate between themselves. In particular, although the firm's products are identical physically, firms can exploit the fact that consumers

differentiate between them according to production methods. Whether firms enter sequentially or simultaneously, the only pure strategy Nash equilibria are for one firm to service the high end of the market, i.e. the consumers with a strong preference for adult-labor products, and for the other firm to service the low end of the market by making inexpensive goods for highly price-sensitive consumers. Without placing additional structure on the model, it is impossible to say which end of the market a firm would prefer to serve since:

$$\pi^1 - \pi^2 = \frac{3\theta(\overline{\gamma} - 1) - 2(w^a - w^c)}{9}$$

which even in light of Assumption 1 is ambiguous in sign. Nevertheless, the results indicate that both firms gain by using different labor pools. If Assumption 2 is relaxed, as long as both firms sell positive amounts when using different labor pools, profits will still be weakly greater with differentiation, although their expression is more complex.

An important implication of this result is that the firm which abstains from child labor would not be willing to back legislation banning the importation of child-labor goods. Such a ban would lead the other firm to begin using adult labor, driving industry profits to zero. By publicly committing to using different labor types, the firms are able to split the market implying that neither firm has an incentive to back such a ban. Additionally, not all consumers would necessarily benefit from such legislation. The consumers who purchase the adult-labor good in the differentiated product equilibrium would gain as the price for their purchase falls to w^a, however those who were purchasing child-labor output can be harmed. Specifically, if $w^a > \theta$, banning child labor would drive consumers with weak preference for adult labor goods out of the market and make them worse off. Finally, it is important to recognize that this result does not address the effect of legislation on the child workers themselves. As noted by Basu (1999) in a recent survey, there is no clear-cut consensus on the effect of employment on the welfare of child laborers.

3. Charitable Donations and Tariffs

In this section, I use the production differentiation framework to analyze two additional items. First, I consider the practice in which adult labor firms make charitable donations to child welfare groups in locations where their competitors employ children. Second, I consider the use of a tariff on child labor products instead of the outright ban called for by the Harkin Bill.

3.1 Charitable Donations

There are two ways in which charitable donations fit into the above framework. One method is to place the production differentiation story in a broader political economy model. Suppose for example that the government will impose an import ban if the welfare of child workers falls below some minimum level. Here, the industry may well find it desirable to use donations to raise the children's welfare in order to head off an impending ban. Thus, rather than contribute to politicians directly ala Grossman and Helpman (1994), firms may influence policy by donating to child welfare groups. If this is the case, both adult and child labor firms might be expected to donate to charities.

An alternative approach in which only the adult labor firm donates is the case in which the cost of child labor production is affected by charity work. This could arise from support for groups which push to increase the minimum wage for children, increase the length of mandatory schooling, or simply improve the quality and availability of schools. According to Lansky (1997), "Compulsory education has historically proved one of the most effective instrument for eliminating child labor" (pg. 240). This suggests that a firm may indeed be able to increase the unit cost of child labor production through donations to child welfare groups. To consider this case, suppose that firm 1 announces its charitable giving, G, before prices are set. Furthermore, suppose that the unit cost when using child labor is an increasing but concave function of G.[9] For a given level of donations, the child-labor using firm 2's

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[9] Although it may seem somewhat odd that donations have this effect while the employment level has no effect on wages, one can imagine that if donations lead to mandatory schooling this affects the entire pool of child workers of which firm *2* hires only a small portion. Thus, firm *1*'s giving could be

objective function does not change from equation (7). Firm 1, meanwhile has an additional term in its profit function:

$$\pi^1 = [p^1 - w^a][1 - \frac{p^1 - p^2}{\theta(\bar{\gamma} - 1)}] - G.$$ (6')

Since G is announced before prices are set, the Nash equilibrium in prices remains the same, as does the solution for π^2. Firm 1's profits are now:

$$\pi^1 = \frac{[2\theta(\bar{\gamma} - 1) - (w^a - w^c)]^2}{9\theta(\bar{\gamma} - 1)} - G.$$ (10')

Thus, the marginal effect of donations on the adult labor firm's profit is:

$$\frac{2\theta(\bar{\gamma} - 1) - (w^a - w^c)}{\theta(\bar{\gamma} - 1)} \cdot \frac{\partial w^c}{\partial G} - 1.$$ (12)

Using a modified version of Assumption 1 to account for a variable unit cost when using children, this indicates that the adult-labor firm will donate as long as the cost of doing so is recouped through a sufficiently large effect on the child labor firm's cost of production.[10] It is also clear that in this case, the child-labor firm would never engage in such giving since this only increases its own costs. However, whichever approach one chooses to take, charitable donations can arise not from the benevolence of firms, but as a result of profit-seeking.

3.2 Tariffs

Rather than the ban on child labor products called for by the Child Labor Deterrence Act, an alternative protection measure is the use of a tariff against child labor products. The imposition of a specific, per-unit tariff on imports from the child labor firm, is isomorphic to an increase in its unit cost of production w^c. Thus, just as shown for charitable donations, the imposition of a tariff can benefit the

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magnified through the political process giving it this unbalanced effect. Alternatively, I could introduce increasing marginal costs overall without qualitatively altering the results.

   [10] As a technical note, in order to ensure that the adult firm does not give away all of its profits, there must also be an upper limit on the benefit from charitable donations.

adult labor firm. In fact, if I were to consider a political economy setting in which the tariff arises from

lobbying, I would find a condition identical to (12) where the final term represents the cost of lobbying

rather than the cost of donations. A similar condition can be found for an ad-valorem tariff. Thus, the

production differentiation framework suggests that although the adult-labor firms may fight the Harkin

Bill, they would favor tariffs against child-labor firms. As discussed in the introduction, although the

Harkin Bill has repeatedly failed, the Generalized System of Preferences has been used against countries

that do not enforce "reasonable" labor standards. Thus, while in the U.S. a ban on imports of child labor

products has failed to materialize, the U.S. government has imposed tariffs on child labor products, just as

the production differentiation story predicts. Yanz and Jeffcott (1998) find a similar story in Canada,

where although labor unions do not support a ban on child labor products, the unions have indicated that

they would favor the use of tariffs. Basu, Chau, and Grote (2000) find that the imposition of a tariff can

either benefit or harm the adult labor firms in the importing country. This is because in their model of

price-taking producers a tariff can lead exporters to switch from child to adult labor without the dire

consequences inherent to Bertrand competition.

4. Multiple Firms

One limitation of the simple model of Section 2 is that positive profits only arise in equilibrium

when there two firms. If a third firm were introduced, this would drive industry profits to zero even if

child labor were permitted. To see why, suppose that this third firm used child labor. This then leads to

severe price competition between firms 2 and 3, resulting in zero profits for the child labor sector. This

implies that one of the two firms would have an incentive to switch to adult labor and undercut the adult

labor-using firm 1. Thus, the only equilibrium is one in which all three firms earn zero profits. However,

there are two straightforward ways of extending the above model that again results in equilibria in which

firms prefer to differentiate themselves through their production method. The first way is to allow for an

entirely child labor firm, and entirely adult labor firm, and an intermediate firm that uses some child and

some adult labor. Just as in models in which consumers place varying values on high, medium, and low quality products, this would make it possible for each of the three firms to service a particular segment of the market and enjoy positive profits. However, since I am unaware of any products carrying a label stating "made with very few child workers", I do not feel that allowing for an intermediate type firm is the most satisfying way of incorporating three firms.[11]

Instead, consider a situation in which three firms are differentiated along two dimensions. As above, firms can differ according to their production method by using either child or adult labor. In addition, firms differ in their "brands", described by an exogenous parameter $b^j = \{0,1,2\}$. I denote the three firms firm 0, 1, and 2 according to their brand. Consumer preferences are now described by:

$$U^i = \begin{cases} \gamma^i\theta - p - (\delta^i - b^j)^2 & \text{if i purchases a product made with adult labor from firm j} \\ \theta - p - (\delta^i - b^j)^2 & \text{if i purchases a product made with child labor from firm j} \\ 0 & \text{if no purchase is made.} \end{cases} \quad (13)$$

where δ^i is a consumer's brand loyalty. This parameter is distributed uniformly on the interval [0,2] and is independent of γ^i. Thus, consumers are defined by their preference for adult labor products and their brand loyalty. Under the uniform, independent distributions of δ^i and γ^i, I can represent the space of consumer types by a rectangle with length 2 and height $\bar{\gamma} - 1$. As before, the size of the population is normalized to 1. Note that this representation of brand preference is the same as the well-known problem of horizontal or location differentiation (see Tirole, 1994 for details). One feature of this parameterization is that with three firms and brand loyalty represented by a line, with endogenous brands the only Nash equilibrium involves mixed strategies for firm brand choice. Since the point of this paper is to illustrate the importance of production differentiation instead of brand differentiation, I simply sidestep this problem by making brands exogenous. While I could overcome this mixed strategy problem by assuming

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[11] One situation where we do see such intermediate-type labeling is for recycled goods. It is quite common to see products such as paper labeled with their specific percentage of post-consumer recycled content. This recycled content ranges widely between brands and across percentages of recycled material.

that brand preferences are distributed on a circle instead of a line and endogenizing brand preference, this only adds complexity and does not change the intuition behind the use of child and adult labor. Therefore, rather than reinventing the wheel (quite literally in this case), I proceed using exogenous brands to highlight the role of production method differentiation.[12]

To follow the two firm case, first suppose that all three firms use the same type of labor, either child or adult. When there is no distinction between firms in production methods, this plays no role in the consumer's choice of which firm to buy from (assuming that a purchase will occur). Instead, the consumer will simply weigh the price differentials between firms with their relative distance from the consumer's brand preference parameter δ^i. As before, I assume that the market is covered in equilibrium. This requires that $\theta > 5/4 + w^a$. Using the consumer's choice problem, I can calculate the δs for which consumers are just indifferent between two firms. Using this information and integrating across the relevant range of consumer types yields demand functions:

$$D_o(p_0, p_1, p_2) = \frac{p_1 - p_0 + 1}{4} \tag{14}$$

$$D_1(p_0, p_1, p_2) = \frac{p_0 + p_2 - 2p_1 + 2}{4} \tag{15}$$

$$D_2(p_0, p_1, p_2) = \frac{p_1 - p_2 + 1}{4} \tag{16}$$

Note that because of the brand differentiation, these demands do not have the discontinuities found in the demand equations (2) or (3). Because of this, positive equilibrium profits arise even if all three firms use the same production method. Plugging these into the profit functions and taking the first order conditions yields the equilibrium prices:

$$p_0 = p_1 = p_2 = 1 + w \tag{17}$$

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[12] For an example of simultaneous vertical and horizontal product differentiation in which consumers types are located on a circle, see Degryse (1996) or Bester (1998). Caplin and Nalebuff (1991) provide sufficient conditions for the existence of pure strategy equilibria when firms can differentiate themselves along multiple dimensions. I merely impose these conditions.

where w = {wᵃ, wᶜ}. This translates into equilibrium profits of:

$$\Pi_0 = \Pi_2 = .25 \text{ and } \Pi_1 = .5. \tag{18}$$

The split of consumers among the three firms is illustrated in Figure 1. There are three things to note about this equilibrium. First, firm 1 enjoys higher profits since it is "closer" to more consumers. Second, the equilibrium does not depend on consumers' preferences for adult labor products. In Figure 1, this is shown by the fact that the consumer preference for labor types γ^i does not influence the split of consumers among firms. Finally, since the equilibrium profits do not depend on the unit cost, the same results arise for when all three firms use either labor type.

I now turn to a case in which the firms use different production methods. Since my goal in this section is to demonstrate that the flavor of the above two firm analysis carries over into the three firm case, I assume that firm 1 uses child labor while firms 0 and 2 use adult labor. I find similar results for the other combinations of adult and child labor across the three firms and these results are available upon request. Since firms 0 and 2 both use adult labor, a consumer with a given γ is indifferent between them when her brand preference is equal to:

$$\widetilde{\delta} = 1 + \frac{p_2 - p_0}{4} \tag{19}$$

Consumers with $\delta \leq \widetilde{\delta}$ will choose between firms 0 and 1 while consumers with $\delta \geq \widetilde{\delta}$ will choose between firms 1 and 2. A low δ consumer is indifferent between firms 0 and 1 when her adult labor preference is:

$$\underset{\sim}{\widetilde{\gamma}} = 1 + \frac{p_0 - p_1 + 2\delta - 1}{\theta}. \tag{20}$$

A consumer with $\delta \geq \widetilde{\delta}$ is indifferent between firms 1 and 2 if her adult labor preference is:

$$\overline{\widetilde{\gamma}} = 1 + \frac{p_2 - p_1 - 2\delta + 3}{\theta}. \tag{21}$$

16

Note that I am assuming that prices are such that $\tilde{\delta} \in (0,2)$ and that both $\overline{\tilde{\gamma}}$ and $\underline{\tilde{\gamma}}$ lie between 1 and

$\overline{\gamma}$. If this is not true, then it is necessary to control for corners. However, in the interest of minimizing

notation, I ignore these difficulties assume that these conditions hold in equilibrium. Using these ranges,

I can write the demand functions of the two adult labor firms as:

$$D_0(p_0,p_1,p_2) = \int_0^{\tilde{\delta}} \frac{\overline{\gamma}-\tilde{\gamma}}{2(\overline{\gamma}-1)} d\delta = \frac{1}{2\theta(\overline{\gamma}-1)}\left[\left(\theta(\overline{\gamma}-1)-p_0+p_1+1\right)(1+\frac{p_2-p_0}{4})-(1+\frac{p_2-p_0}{4})^2\right] \quad (22)$$

and

$$D_2(p_0,p_1,p_2) = \int_{\tilde{\delta}}^{2} \frac{\overline{\gamma}-\tilde{\gamma}}{2(\overline{\gamma}-1)} d\delta = \frac{1}{2\theta(\overline{\gamma}-1)}\left[\left(\theta(\overline{\gamma}-1)-p_2+p_1\right)\left(1-\frac{p_2-p_0}{4}\right)+1+\frac{3(p_2-p_0)}{4}+(1+\frac{p_2-p_0}{4})^2\right]$$

$$\quad (23)$$

Demand for the child labor-using firm 1 is:

$$D_1(p_0,p_1,p_2) = \int_0^{\tilde{\delta}} \frac{\tilde{\gamma}-1}{2(\overline{\gamma}-1)} d\delta + \int_{\tilde{\delta}}^{2} \frac{\tilde{\gamma}-1}{2(\overline{\gamma}-1)} d\delta = 1 - D_0(p_0,p_1,p_2) - D_2(p_0,p_1,p_2). \quad (24)$$

Using these demand curves in the profit functions and taking the first order conditions, the following

three equations are found:

$$p_0 = p_2, \quad (25)$$

$$4(\theta(\overline{\gamma}-1)-p_0+p_1)+(p_o-p_1-\theta(\overline{\gamma}-1)-3)(p_o-w^a)=0, \quad (26)$$

and

$$p_0 - 2p_1 + w^c = 0. \quad (27)$$

Using these three equations, prices are:

$$p_0 = p_2 = \frac{w^a+w^c+2\theta(\overline{\gamma}-1)+10\pm\lambda}{2} \quad (28)$$

and

$$p_1 = \frac{w^a + 3w^c + 2\theta(\overline{\gamma} - 1) + 10 \pm \lambda}{4} \tag{29}$$

where $\lambda = \left((2\theta(\overline{\gamma} - 1) + w^c - w^a + 10)^2 - 16(2\theta(\overline{\gamma} - 1) + w^c - w^a)\right)^{1/2}$.

These prices yield the split of consumers between firms illustrated in Figure 2. Note that now the split between firms does depend on the preference for labor types.

Unfortunately, the quadratic introduced by the interaction between brand differentiation and production method differentiation makes a simple comparison of the profit levels with and without child labor impossible. It is, however, possible to write the equilibrium profits of the child-using firm 1 as:

$$\Pi_1 = \frac{(w^a - w^c + 2\theta(\overline{\gamma} - 1) + 10 \pm \lambda)^2}{16\theta(\overline{\gamma} - 1)} \tag{30}$$

and for the adult labor firms as:

$$\Pi_0 = \Pi_2 = \frac{\left(w^a - w^c + 2\theta(\overline{\gamma} - 1) + 10 \pm \lambda\right)\left(w^a - w^c + 2\theta(\overline{\gamma} - 1) - (10 \pm \lambda)\right)}{16\theta(\overline{\gamma} - 1)} \tag{31}$$

It is easy to find parameter values for which $\Pi_0 = \Pi_2 > .25$ and $\Pi_1 = .5$, that is, in which all firms get higher profits than the case in which they are unable to differentiate themselves through production method.[13] The conditions under which this is true are more strict than those that simply ensure that the market is covered and that the consumers are split between the adult and child labor firms for all values of δ. To find these conditions, simply impose the desired property and use (30) and (31) solve for the set of parameters for which this is true. Since there is little value in the explicit derivation, I omit it here, but merely note that this requires that the gap between the adult cost and the child cost is sufficiently large relative to $\theta(\overline{\gamma} - 1)$ but not so large that adult labor firms cannot profitably compete. This need for a sufficiently large cost differential is so that the potential loss in demand for the child labor firm, that is the reduction in the space it captures between Figures 1 and 2, is not so large that it wipes out the gains from

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[13] One example is to set $\{w^a, w^c, \theta, \overline{\gamma}\} = \{2,1,4,2\}$.

having a higher markup. In any case, while the three firm example does require additional restrictions on the parameters, it does illustrate that the desirability of production method differentiation is not reliant on the assumption of two firms. Therefore, even with many firms, adult labor-using firms need not find it beneficial to eliminate the use of child labor.

Finally, we must consider the effect of entry on these results. At first blush, one would imagine that entry would eliminate any gains from production differentiation in the long run. This, however, need not be true. The reason is that when an adult and a child labor firm are neighbors on the brand line, production differentiation gives the adult firm an incentive to keep its price high relative to the child labor firm in order to earn profits from the high γ consumers between them. Because of this, the firm on the other side of the adult labor firm, regardless of the type of labor it uses, will be able to charge a higher equilibrium price than if there were no production differentiation. As before, whether this production differentiation is enough to increase the profits of all firms depends on the parameters. However, as long as there exist positive returns to brand differentiation in the long run, as would occur with an entry cost, even with entry adult labor firms may prefer to preserve the ability to use child labor. If entry is free, then in the long run the gain from brand differentiation will be eliminated. In this case, it is perhaps best to say that firms prefer production differentiation in the short run, but are indifferent to it in the long run.

5. Conclusion

Although the above presentation is quite specific in functional form, the results are as general as the standard story of quality differentiation with product differentiation. With more general cost structures, distribution of consumer types, or the elimination of Assumptions 1 and 2, the equilibrium may involve only one type of good being produced or only a portion of consumers purchasing. Either way, the result remains that industry profits cannot be lower when firms have the ability to differentiate themselves through their production methods. Furthermore, as long as there exists an equilibrium in which both adult and child labor firms produce, firms will prefer to use different labor pools in order to

increase profits. The result is also robust if I allow for varying mixes of child and adult labor rather than the all-adult or all-child production methods considered above. When consumers vary in how they value various combinations of adult and child labor, the equilibrium will involve one firm using relatively more adult labor than the other. Again, the result is that firms enjoy higher equilibrium profits when they use different labor mixes. Finally, rather than multiple firms the model can be reinterpreted as a single firm with multiple product lines. Here, even though the various lines may be physically identical, the firm will segment the market by using differing production methods. This gives it the ability to price-discriminate and increase profits.

This framework is not limited to the child labor issue. Lutz, Lyon, and Maxwell (2000) use a similar approach to consider the environmental quality choice for firms. They find that when consumers vary in their demand for environmentally-friendly products, firms adopt different production methods with one firm using a clean, expensive technology while the other uses a relatively polluting yet inexpensive production method. They show that the introduction of a minimum quality standard has an effect analogous to that of the Child Labor Deterrence Act: both firms move towards a cleaner technology as industry profits fall. This idea is borne out by Mouritsen, Ernst, and Jrrgensen's (2000) findings. These authors surveyed eleven Danish firms who voluntarily submit themselves to the British Standard 7750, which is a certification that a particular firm has established and follows a set of environmental protection measures. The responses show that one of the primary reasons firms do so is to give them a competitive edge. In fact, one clothing producer said that it "adopted a differentiation strategy and its goal was to produce the 'greenest' product in the market. Price competition from East Europe and East Asia was hard, and this firm attempted to compete with good quality and environment-friendly products" (pg. 178). This is exactly the type of production differentiation I discuss, and survey evidence indicate that this is an important issue for consumers. Consider Brott and Ash (2001) who report that 61 percent of American consumers say that they would rather buy environmentally friendly products. Furthermore, 42 percent reported that they had tried a new product because they felt the product, its packaging, or the

manufacturer benefited the environment. Other instances in which consumers are willing to pay more for a virtually identical product because of the way it is produced are readily found. In the cosmetics industry, there is an active market for "cruelty-free" cosmetics because some consumers are willing to pay a premium to know that their cosmetics are not tested on animals. In agriculture, some consumers are willing to pay more for free-range meat because the animals lead a more pleasant, free-roaming life before slaughter. Finally, the cachet for hand-made or ethnic items cannot be denied even though they may be indistinguishable from their manufactured or domestic counterparts. Even domestic products can exploit this as evidenced by the successful "Made in America" campaign. In all of these situations firms are able to create niche markets based on the fact that some consumers are willing to pay more for an otherwise identical product simply because they prefer the manner in which it was made.

Recognizing that a product's production method matters to consumers has important implications for the World Trade Organization. In Article 2.8 of the WTO's Agreement on Technical Barriers to trade, the WTO rules that "wherever appropriate, members shall specify technical regulations based on product requirements in terms of performance rather than design or descriptive characteristics" (pg. 119, 1994). This "product" versus "process" regulation is especially infamous due to the dispute between the U.S. and Mexico regarding Mexican tuna exports. Because of the nets used by Mexican fishers, a large number of dolphins were inadvertently killed as they harvested tuna. The U.S. claimed that under the U.S. Marine Mammal Protection Act this environmental damage warranted an embargo against Mexican tuna. In response, Mexico filed a formal complaint to the General Agreement on Tariffs and Trade in 1991. Although the GATT never officially ruled, it is generally presumed that it would have agreed with the Mexican complaint since the dolphin deaths would have been part of the production of the product rather than its performance. One might expect that the Child Labor Deterrence Act would face similar difficulties under the WTO. In fact, the WTO openly discourages using trade sanctions to achieve labor market results, preferring to defer this issue to the International Labor Organization (World Trade Organization, 1999). However, if one is willing to extend the definition of "performance" to include

customer satisfaction with the production method, this opens up a broad set of regulations that would be permissible by the WTO. While such a broadening might be hailed by critics of the WTO, it might also lead to a flood of protection disguised as product performance regulations. This could result in problems similar to the alleged abuses of the WTO's anti-dumping provisions.[14] Nevertheless, it is important to recognize the potential implications of this broader notion of product performance on trade policy.

In summary, I have presented one possible explanation for why firms may voluntarily abstain from child labor yet refrain from requiring that all firms do so. Furthermore, this framework can also explain charitable giving by firms as the result of profit-seeking, not altruism. While I do not intend to imply that all such acts are completely self-serving, my results do cast these actions in a different light. It is critical that researchers understand the incentives that drive firms' choice of production method if they hope to anticipate how they will respond to government policies. Therefore, I hope that this simple presentation of production differentiation proves useful for future analysis of the child labor question.

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[14] Hindley and Messerlin (1996) provide an in-depth look at protectionism and anti-dumping.

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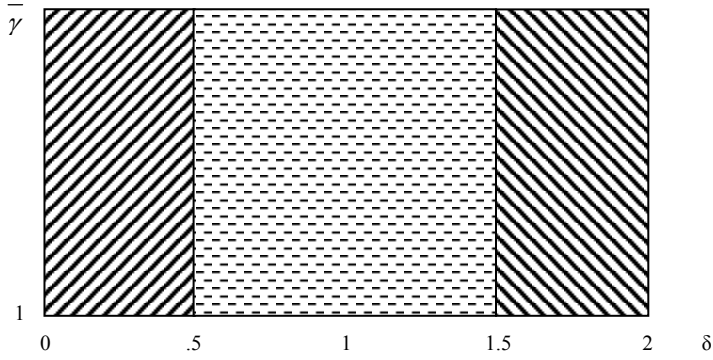
Figures

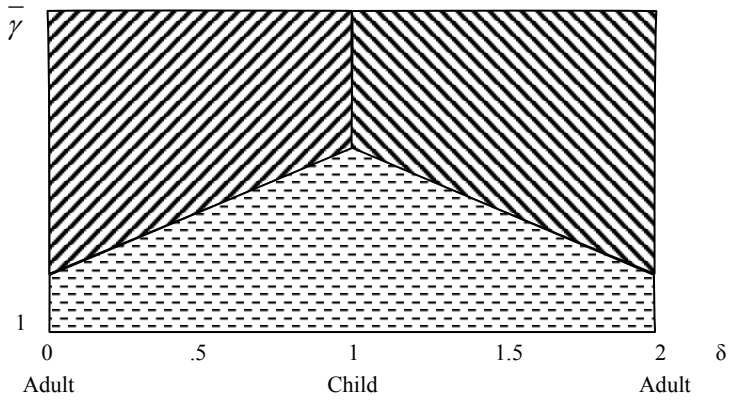Figure 1:
All Firms use Same Labor Type

$\bar{\gamma}$

1

| 0 | .5 | 1 | 1.5 | 2 | δ |

Figure 2:
Firms use Different Labor Types

$\bar{\gamma}$

1

| 0 | .5 | 1 | 1.5 | 2 | δ |
| Adult | | Child | | Adult | |

Key:

Firm 0 Consumers:

Firm 1 Consumers:

Firm 2 Consumers: