

A Model of Trust in Quality and North-South Trade

12 February 2008

Eric Rasmusen

Abstract

Why do some countries produce higher quality goods than other countries? This article suggests that one reason is self-perpetuating reputations, modelling the idea with a Klein-Leffler reputation model embedded in a general equilibrium model of trade. Reputation differences are particularly interesting because reputation is a form of ‘social capital’ that is amenable to modelling. Like product differentiation, it can explain why countries might trade even if their technologies and endowments are identical, why firms could profit from exports even if the foreign price is no higher than the domestic one, and why governments like to have ‘high-value’ sectors. Ideally, a developing country would shift its own producers to a high-quality equilibrium; if that is not possible, the next best thing is to import experience goods and substitute to home production of goods for which reputation is not important.

Dan R. and Catherine M. Dalton Professor, Department of Business Economics and Public Policy, Kelley School of Business, Indiana University. BU 438, 1309 E. 10th Street, Bloomington, Indiana, 47405-1701. Office: (812) 855-9219. Fax:812-855-3354. erasmuse@indiana.edu, <http://www.rasmusen.org>. Copies of this paper can be found at <http://www.rasmusen.org/papers/trade-rasmusen.pdf>.

JEL codes: F10, L15. Keywords: trust, reputation, development, social capital, product quality, comparative advantage.

I thank David Greenstreet, David Hummels, Peter Neary, Manu Raghav, and those attending the IU BEPP Brown Bag Lunch and the Midwest International Economics meetings and a workshop at Oxford University for their comments, and Allen Chang, Barick Chung, Adam Rees, and Benjamin Warolin for research assistance.

1. Introduction

Why quality differs among exporters has been studied in many models of international trade. Since Linder (1961), a common theme has been that proximity to buyers is a source of comparative advantage, so that countries whose consumers have a high preference for quality will not only consume high-quality goods but produce and export them. More recent versions of this idea include Murphy & Shleifer (1997), which uses a one-factor, two-good model to make the point that because richer countries have a stronger preference for high-quality goods, we will see efficient differences in quality between goods consumed in different countries; and Hallak (2005) and Choi, Hummels & Xiang (2006), which model the idea in such a way that he can empirically measure how incomes and quality flows interact.

As an alternative, comparative advantage might be based on differences in technologies. In Flam & Helpman (1987), a model of North-South trade, the North has a technological advantage in producing high quality, but products are differentiated and both high and low quality are produced and traded in equilibrium. This approach raises the question, surveyed in Keller (2004), of why technologies would differ across countries. Or, it may be that quality happens to be linked to endowments of particular factors such as capital or skilled labor-- or even, conceivably, unskilled labor, which may be the cheapest way to find and eliminate defects.¹

Empirical studies show that quality does matter. Schott (2004) and Hummels & Klenow (2005) find that prices per unit of various goods vary considerably across exporters and are correlated with the exporters' incomes and endowments of capital and skilled labor, confirming what casual observation would suggest. Hallak (2006) points out that countries with higher prices for a class of good also have higher shares in the export markets in which they sell. Navaretti & Soloaga (2001) find that European transition economies import equipment at lower average prices than does the United States.

¹A rather different view of quality is as a characteristic of intermediate goods, in Grossman & Helpman's 1991 *Innovation and Growth in the Global Economy* and models that follow it. There, intermediate goods vary in quality, and innovation and technological diffusion allows that quality to increase, good by good.

Hummels & Klenow (2005) use changes in prices over time to extract information on whether product quality has changed; roughly speaking, if prices rise but quantities do not, we might deduce that quality has risen. There also exists a voluminous literature in marketing and international business on ‘‘country of origin effects’’; for a survey, see Papadopoulos & Heslop (2002), and for more recent references, see Pappu, Quester & Cooksey (2007). This takes a more psychological approach, trying to determine at what stage of the buying process and to what extent consumers see country of origin as important, and how that interacts with brand name. An example is Johansson & Nebenzahl (1986), which uses questionnaires to find out how closely consumers link brands to countries and how much they would pay for cars of a given brand built in a particular country. Consumers were willing to pay 14% more compared for a Buick made in Germany than for one made in the U.S.A., but 16% less for one made in Mexico. These findings confirm that quality is an important element in international trade, and work continues on trying to measure quality. Another example, much-cited, is Roth & . Romeo (1992), which surveys consumers in Ireland, Mexico, and the United States to see how perceptions of different country’s product qualities vary across type of product.

The present paper constructs a theoretical model of product quality, but will take a different line of attack. Rather than looking at differences in countries’ consumption preferences, technologies, or endowments, I will focus on the problem of whether firms can persuade customers of the high quality of their experience goods, goods whose quality the consumer cannot verify before purchase. The quality of insurance or a consultant’s services must be taken on trust, since it cannot be verified till after the purchase and for some buyers may never be verifiable. Why, then, would any buyer believe a seller’s claim that his high prices are justified by high quality, when the supposed high level of quality cannot be verified?

This is an aspect of quality that has been of central importance in the industrial organization literature since the Lemons model of Akerlof (1970). Typically, models in this literature have assumed that firms are heterogeneous in their technologies for producing high quality and that advertising or some other expenditure signals

a firm's type to consumers. Farrell (1986), Milgrom & Roberts (1986), Bagwell & Riordan (1991) and Rasmusen & Perri (2001) all take this approach. Here, I will assume that all firms are identical, because I wish to show how differences in reputation and trust can generate trade between otherwise identical countries. In this, I will follow a line of research begun by the model of reputation in Klein & Leffler (1981) and continued in Shapiro (1983), in which firms acquire a good reputation by selling high quality at a low price for a long enough period of time; Allen (1984), in which firms have both a positive fixed cost of entry and increasing marginal cost; and Rogerson (1987), which synthesizes those two ideas. I will use a simple formalization based on Rasmusen (1989) so that I can embed reputation into a simple general equilibrium model of one factor, two products, and two countries where production is repeated for many periods.

Klein and Leffler's idea is that buyers know that a seller with a good reputation wants to preserve that reputation as a valuable asset, and hence can be trusted. As a solution to the problem of unobservable quality, trust is an old idea. As Macaulay pointed out as long ago as 1963, businesses rely not on the courts but on relationships and reputation in the ordinary course of dealing. A firm honors its commitments, not just in letter but in spirit, because it wants to keep its good reputation. Klein & Leffler (1981) put this in economic terms. If a firm can charge a premium for a high-quality product, then even if it could get away with cutting corners in the short run because courts cannot enforce subtle cheating in quality, it will choose to deal honestly with its customers. The reason need not be simple integrity: it can be the result of selfish profit maximization. If the firm does cheat, it will lose repeat business, and if it can charge a price high enough to earn economic profits from its reputation and it cares enough about future profits it will refrain from taking the short-run gain from cheating. Buyers, knowing this, are willing to pay a premium price, which is what gives the firm its economic profit. This, however, is just one possible equilibrium, one set of self-fulfilling expectations. Another equilibrium is for buyers not to trust promises of quality and to refuse to pay premium prices. The sellers, in turn, then have no incentive to provide high quality.

We will go straight to the model in the next section, first laying out the assumptions of the simple general equilibrium model, next showing how a reputation equilibrium could arise in a single product market. I will then return to the model of trade and reputation and explore its implications. Having explained the model, I will be able to explain how it differs from other models of trust and quality such as Acemoglu, Johnson & Robinson (2002), Basu & Chau (1998), Berkowitz, Moenius & Pistor (2003), Chisik (2003), Moenius & Berkowitz (2004), Haucap, Wey & Barbold (2000), and Levchenko (2006).

2. The Model

Firms use one factor of production, labor, in two countries, the North and the South. The F firms in each country compete in prices: each chooses its price simultaneously, as in Bertrand competition. A firm can produce two kinds of goods: the simple good, with subscript 0 (our numeraire); and the experience good, subscripted l or h depending on whether its quality is low or high. Ownership of labor and firms is evenly distributed across the population in each country. Transportation costs are zero for produced goods but labor cannot be moved.

Technologies are the same in both countries. Each unit of the simple good or the low-quality good costs one unit of labor to produce in either North or South, but each unit of the high-quality experience good costs $\phi > 1$.

If x_0 is consumption of the simple good and x_l and x_h are the consumptions of the experience goods, a consumer's utility in a given period is assumed to be

$$U = x_0^\alpha (x_l + \theta x_h)^\alpha \tag{1}$$

where $\alpha < 1$ and where $\theta > \phi$ is the relative value of high quality. Low and high-quality experience goods are perfect substitutes for each other in the sense that their only difference in the utility function is the multiplier θ .

Production is repeated in each of an infinite number of periods, with quality and prices chosen anew each period. The discount rate

is r in both countries. Consumers buying in period t cannot observe quality before purchase, but they do observe the quality that each firm sold in period $(t - 1)$.

Prices are denoted by $p_0 \equiv 1$ for the simple good, as a normalization, and p_l and p_h for the low and high-quality experience goods.

The North has 1 unit of labor and the South has S . Most of this article will make the ‘‘large North’’ assumption that

$$S \leq \frac{2(\phi + (\phi - 1)r)(\phi - 1)}{2\phi + (\phi - 1)r + 1}. \quad (2)$$

a condition which, as explained below, will imply that the North’s prices become the world prices under free trade. I make this assumption for simplicity of exposition. Section 6 explains what happens in the opposite case, when the North is ‘‘small’’.

3. Optimistic and Pessimistic Equilibria

In equilibrium, the simple good and one of the experience goods will always be produced, since the fact that otherwise utility would fall to zero in equation (1) means there will be demand for both even at very high prices, as formalized below. If consumers could observe quality before purchase, firms would produce high quality, not low quality. Its price would be $p_h = \phi$ under price competition, because it costs ϕ times as much labor to produce as the simple good does.

Under the model’s assumption that consumers cannot observe present-period quality before purchase, firms would all produce low quality if there were just one period instead of an infinite number of periods. Regardless of what consumers expect, it is cheaper for the firm to produce low quality, and hence choosing low quality would be a dominant strategy.

We will start by explaining how multiple periods can lead to high quality and then apply the idea to different countries. Consider a partial-equilibrium model in which firms produce either low quality at cost 1 or high quality at cost $\phi > 1$ and consumers (with fixed

consumption of the numeraire good) have reservation prices of 1 for low quality and $\theta > \phi$ for high quality. Firms compete in prices. Consumers can observe quality after purchase but not before, the game is repeated an infinite number of periods, and the discount rate is r .

The model is a mathematized version of Klein & Leffler (1981)'s verbal idea. They aimed to explain two things: (1) why some firms produce high quality instead of low, even though consumers cannot tell quality before purchase, and (2) why firms that produce high quality charge a price higher than cost, even under Bertrand competition.

A subgame perfect Nash equilibrium of a game is a combination of strategies for each player such that at any point in the game a player who expects the other players to follow the strategies the equilibrium specifies for them has no incentive to deviate from the strategy it specifies for him. Thus, different expectations may be able to support different equilibrium strategy combinations. Here, because the interaction is repeated an infinite number of times, multiple equilibria do exist. We will focus on two equilibria: the 'pessimistic' and the 'optimistic'.

In a pessimistic equilibrium, a firm's strategy is to produce low quality. A consumer's strategy is to pay at most a price of 1, regardless of the claims the seller makes about quality. Firms choose the price $p_l = 1$, equal to cost because of competition.

These strategies form a subgame perfect Nash equilibrium for the repeated game. No firm has an incentive to produce high quality, since no consumer would pay any higher price. If a firm did produce high quality once, consumers would be surprised, but the equilibrium calls for the firm to return to producing low quality in the next period, so the consumers would not be willing to switch to paying a higher price for that firm's goods. They would regard the deviation as a fluke not to be repeated.

In the optimistic equilibrium, on the other hand, a firm produces high quality and sells at a price p^* to be explained below, unless it deviated from equilibrium and produced low quality in the past

(in which case it produces low quality). Consumers buy the good from a firm if and only if its price equals p^* and the firm has never produced low quality.

In this equilibrium, a firm's punishment for deviating and producing low quality is that consumers believe it will produce low quality in the future and switch to another firm. For this to be a punishment, however, the firm's profits must be lower if it sells zero than if it sells a positive amount, which requires that the price p^* be greater than cost. The exact value of p^* is derived as follows. Denote the present discounted value per unit of sales by a firm with a reputation for high quality by V . If the firm produces high quality today, it keeps its good reputation, and the present value of profits per unit sold is, assuming cash flows occur at the beginning of periods,

$$V = (p^* - \phi) + \left(\frac{1}{1+r} \right) V, \quad (3)$$

where the first term is the current period's profit and the second term is the discounted value of capitalized future profits. Solving for V , we get

$$V = \frac{(1+r)(p^* - \phi)}{r} \quad (4)$$

If the firm produces low quality the present value of its profits is

$$(p^* - 1) + \left(\frac{1}{1+r} \right) (0), \quad (5)$$

since it will lose its reputation. For the firm to choose high quality it must be true that

$$\frac{(1+r)(p^* - \phi)}{r} \geq p^* - 1 \quad (6)$$

Competition among firms turns this weak inequality into an equality,

$$p^* = \phi + (\phi - 1)r \quad (7)$$

For consumers to be willing to buy high quality instead of not buying anything, we also need $p^* \leq \theta$. That requires

$$p^* = \phi + (\phi - 1)r \leq \theta. \quad (8)$$

If this is not true (because r , the discount rate, is too high or θ , the valuation of high quality, is too low), the optimistic equilibrium will not exist.

The optimistic equilibrium is pareto-superior to the pessimistic equilibrium. In the pessimistic equilibrium of this partial- equilibrium model, consumers have zero surplus and firms have zero profits. In the optimistic equilibrium, consumers have positive surplus (if $p^* < \theta$ strictly) and firms have positive profits.

Let us define ‘‘optimistic expectations’’ for the players in a game as expecting that the pareto-optimal equilibrium will be the one played out in the game between a particular firm and its customers, and ‘‘pessimistic expectations’’ as expecting the pareto-worst equilibrium. Let us define a ‘‘good reputation’’ for a firm as the expectation, based on its past behavior and its incentives, that it will produce high quality. We will assume that expectations about a firm’s behavior do not change if it begins to export its product.

We will briefly analyze two reasons that a firm might have a good reputation. Both apply only if $p^* < \theta$, because otherwise only the pessimistic equilibrium exists.

First, a country may have ‘‘trust’’. All players have optimistic expectations and all firms are expected to produce high quality in accordance with the optimistic equilibrium. Firms have no incentive to deviate from this equilibrium, and so will keep their good reputations.

Second, a firm in a country may be able to use ‘‘reputational investment’’. All players believe that a firm in that country which invests amount A in acquiring a reputation will produce high quality in accordance with the optimistic equilibrium.

If a firm has a good reputation, consumers expect it to produce high quality. Given that expectation, high quality is in the firm’s best interest. If a firm has a bad reputation, it is expected to produce low quality. Given that expectation, low quality is in the firm’s best interest. A firm with a bad reputation would like to have a good reputation and sell high quality at a high price, but

it cannot do so unless consumers change their expectations. Consumers, too, would like to be able to trust a firm to sell high quality, but if the firm has a poor reputation they rightly distrust it.

‘‘Trust’’ is purely a matter of expectations and is exogenous to a firm. It is a matter of culture or history-- of what is called social capital. A nation blessed with high trust will be richer than one with low trust, but there is no easy way to switch from one trust level to another.

‘‘Reputational investment’’ is endogenous to the firm, and refers to any investment that creates a good reputation for a particular firm. This investment might be advertising, it might be observable sunk costs that make consumers believe the firm will want to preserve its reputation for the future, or it might be the sale of high quality at a low price for some period of time by a firm that starts with a poor reputation.

Whichever form investment takes, investment’s ability to generate a good reputation is an assumption, not a necessary consequence of there being multiple periods. Without this assumption, it remains an equilibrium for consumers to continue to have pessimistic expectations even if they observe some firm investing large amounts to try to acquire a good reputation. If consumers think the firm’s effort is a waste of resources, it will be. The firm will then not have any incentive to produce high quality after its investment, and the consumers’ pessimistic beliefs will be confirmed. Depending on expectations, reputational investment might be effective in one country and ineffective in the other.

Reputational investment introduces a complication. If firms use investment to acquire reputations, the number of firms producing high quality becomes endogenous. The equilibrium involves a firm’s decision of whether to invest amount A to acquire a good reputation. The firm must trade off the immediate cost A against the flow of profits from selling at p^* . That flow value is V from equation (3), where by substituting (8) for p^* we get

$$V = (1 + r)(\phi - 1) \tag{9}$$

Thus, if there are X consumers and they are split equally among high-quality firms, the greatest number of firms for which investment is profitable is M , where M is the biggest integer such that:

$$Profit(M) = -A + \left(\frac{X}{M}\right) \left((1+r)(\phi-1)\right) \geq 0. \quad (10)$$

If $N > M$, only some firms will acquire reputations and their lifetime profits will be positive only because of the integer problem. If $N < M$, all firms will acquire reputations, and their lifetime profits will be positive because sales per firm will be higher and a firm's investment will not dissipate its future profit stream.

These explanations for differing reputations are separable from the rest of this model, however. Reputations can be entirely arbitrary, since they are really just self-fulfilling rational expectations equilibria. If consumers believe a firm will produce high quality, it has incentive to do so. If a few firms in an industry are lucky enough to acquire such reputations, those are the firms that will survive and come to dominate the market. We may imagine that the North had some firms which did this, driving out the pessimistic-expectations Northern firms, but the South did not, and so retains pessimistic-expectation firms.

4. North and South under Autarky

Now let us return to general equilibrium, starting with the case of autarky. From equation (8), the quality-guaranteeing price is:

$$p^* = \phi + (\phi - 1)r \quad (11)$$

Three patterns of production are possible, depending on the level of p^* and expectations.

(1) Autarky quality might be low in both countries. If $p^* > \theta$, we will see shortly, the level of price which would lead a firm to choose high quality is greater than the value of high quality to

the consumer, so that price could not be charged in equilibrium. Trade, of course, would make no difference, and this is an uninteresting case. Or, it might be that expectations are pessimistic in both countries, even if $p^* \leq \theta$

(2) Autarky quality might be high in the North and low in the South. This happens if $p^* < \theta$ but expectations are optimistic in the North and pessimistic in the South. It is also possible to have autarky quality high in the South and low in the North, if the expectations are reversed.

(3) Autarky quality might be high both countries, because $p^* \geq \theta$ and expectations are optimistic in both countries.

If consumers in a country believe claims that the experience good's quality is high, they solve the following problem in each period:

$$\begin{array}{l} \text{Maximize} \\ x_0, x_l, x_h \end{array} \quad U = x_0^\alpha (x_l + \theta x_h)^\alpha \quad \text{such that} \quad x_0 p_0 + x_l p_l + x_h p_h = \text{income}, \quad (12)$$

which has the first order conditions:

$$\frac{\alpha U}{x_0} - \lambda p_0 = 0, \quad \frac{\alpha U}{x_l + \theta x_h} - \lambda p_l = 0, \quad \frac{\theta \alpha U}{x_l + \theta x_h} - \lambda p_h = 0 \quad (13)$$

If it is optimal to consume all three goods then:

$$\lambda = \frac{\alpha U}{x_0 p_0} = \left(\frac{1}{p_l} \right) \left(\frac{\alpha U}{(x_l + \theta x_h)} \right) = \left(\frac{\theta}{p_h} \right) \left(\frac{\alpha U}{(x_l + \theta x_h)} \right) \quad (14)$$

A consumer consumes both experience goods only in the knife-edge case that $\frac{1}{p_l} = \frac{\theta}{p_h}$. Otherwise utility maximization has a corner solution. Only low quality will be consumed if $\frac{1}{p_l} > \frac{\theta}{p_h}$, and only high quality if the inequality is reversed. Consumers can rationally believe that quality is high only if $p_h \geq p^*$, so if that inequality is false, only the pessimistic equilibrium exists and quality is low, which is case 1 above. Otherwise, depending on expectations, from equation (14) we get either:

$$x_0 = p_l x_l \quad (15)$$

or:

$$x_0 = p_h x_h \quad (16)$$

All this holds true for either North or South.

Consider case (2), in which the North has high quality and the South has low quality. In both countries, $p_0 = 1, p_l = 1$, and $w = 1$. High quality is not produced in the South. In the North high quality is produced, at the price $p^* = \phi + (\phi - 1)r$.

In the South, firms produce only low quality, whatever they may claim (because expectations are pessimistic) so $x_l > 0$ and $x_h = 0$. We can rewrite equation (15) as:

$$x_0(\text{South}) = x_l. \quad (17)$$

Since there are S units of labor in the South, $x_0 + x_l = S$, and:

$$x_0(\text{South}) = \frac{S}{2}, \quad x_l(\text{South}) = \frac{S}{2} \quad (18)$$

Utility of a Southerner with one unit of income is:

$$U(\text{South}) = \left(\frac{1}{2}\right)^\alpha \left(\frac{1}{2} + 0\right)^\alpha = \frac{1}{4^\alpha} \quad (19)$$

In the North, $p_0 = p_l = w = 1$ and $p_h = p^*$. High quality is maintained by reputation, since $p_h = p^* < \theta$ and there is either trust or firms invest A in reputation. Thus, $x_l = 0$ and $x_h > 0$. Equation (16) becomes:

$$x_0 = p^* x_h \quad (20)$$

The North has one unit of labor and the wage is $w = 1$, so labor income is 1 per capita, as in the South. The North also has profits, though, of $(p^* - \phi)x_h$, because high price $p_h = p^*$ does not reflect a real production cost. The amount $(p_h - \phi w)$ is profit, not extra

labor needed for higher quality. Thus, for the North the budget constraint, $p_0x_0 + p_hx_h = \text{income}$ is:

$$x_0 + p^*x_h = 1 + (p^* - \phi)x_h \quad (21)$$

Combining equations (20) and (21) yields:

$$x_h(\text{North}) = \frac{1}{p^* + \phi} \quad (22)$$

where p^* can be written in terms of the primitive parameters as $p^* = \phi + (\phi - 1)r$. Combining (22) with equation (20), yields consumption of the simple good:

$$x_0(\text{North}) = \frac{p^*}{p^* + \phi} \quad (23)$$

Utility of a Northerner with one unit of income would be:

$$U(\text{North}) = \left(\frac{p^*}{p^* + \phi} \right)^\alpha \left(0 + (\theta) \left(\frac{1}{p^* + \phi} \right) \right)^\alpha \quad (24)$$

The North's utility is higher than the South's for two reasons. First, the North consumes more of the simple good. The South consumes $1/2$ per capita of the simple good, while the North consumes $x_0(\text{North}) = \frac{p^*}{p^* + \phi}$, a larger amount because $p^* > \phi$. Second, the North's utility of $\left(\frac{\theta}{p^* + \phi} \right)^\alpha$ from its high-quality consumption is greater than the South's utility $(1/2)^\alpha$ from its low-quality consumption, because $\theta > p^*$. The North does better in both components of utility.

The North has higher utility per capita even if trust is low there and firms must use resources in reputational investment. In the worst case, where there is no integer problem, the entire industry profit is eaten up by the investment, so the budget constraint, equation (21), becomes:

$$x_0 + p^*x_h = 1 + 0 \quad (25)$$

From equation (20), $x_0 = p^*x_h$, so:

$$x_0 = \frac{1}{2} \text{ and } x_h = \frac{1}{2p^*} \quad (26)$$

Northern consumption per capita of the simple good is then no higher than Southern, but consumption of the experience good enters the Northerner's utility function as $\left(\frac{\theta}{2p^*}\right)^\alpha$, which is greater than the Southerner's $\left(\frac{1}{2}\right)^\alpha$. Even when profits are zero, the North's utility is higher, because consumers are better off buying high quality at p^* than low quality at $p_l = 1$.

Though there is no differences in factor endowments or production functions, under autarky the South's consumption of the high-quality experience good is even more inefficient than the North's---zero, despite lack of any technological barrier to production. Consumers do not trust Southern firms to produce high quality, and that distrust is self-confirming.

For reasons unrelated to the lack of free trade, the North does not attain the first best. The price of the high quality good exceeds its marginal cost. As a result, too much of the simple good is produced and consumed relative to the high-quality good. The outcome is nonetheless better than if the high-quality good were not produced at all.

5. Opening Up Trade

Now let us imagine that the autarky just described is destabilized by the unexpected opening of free trade between North and South.² Prices will equalize between the countries since transportation costs are zero. Since the production function does not have diminishing returns, production is constrained only by the amount of labor available. One of the countries will specialize in one of the goods, using up its entire labor supply producing it. The marginal rate of transformation in the other country, which produces both goods, will determine the world price, which will thus equal one of the two country's autarky price levels. Since the North is larger, it is the North's price that will become the world price in this model.³ The effects are

²If the opening of free trade is expected, the autarky equilibrium will be different. More firms will advertise, knowing they would not recover their investment if the North were the only market but anticipating the profits they will earn once they can start exporting to the South.

³I have worked out the small-North case but have not included details here. If the North

summarized in Proposition 1.

Proposition 1. *After trade opens between North and South:*

(1) *The new world prices of the simple good and the high-quality good will be $p_0 = 1$ and $p_h = p^* > \phi > 1$. The North will continue to produce both goods and will export the high-quality good to the South. The South will produce only the simple good, ending production of the low-quality good, and will export some of the simple good to the North.*

(2) *Consumer welfare will rise in both North and South. Profits will rise in the North and will remain zero in the South. Northern consumption per capita of both goods will be higher than Southern consumption.*

The remainder of this section will show why Proposition 1 is true.

The South's prices have changed to equal to the North's so its consumption proportions change to equal the North's too. The South's budget constraint is, since it has S units of labor:

$$x_0 + p^* x_h \leq \text{income} = S \quad (27)$$

Combining this with equation (16)'s $x_0 = p^* x_h$, total consumption in the South is:

$$x_0(\text{South}) = \frac{S}{2} \quad x_h(\text{South}) = \frac{S}{2p^*} \quad (28)$$

The South's utility has risen, because its consumption of the simple good is unchanged and the contribution to its utility function from consumption of the experience good, formerly $(\frac{1}{2})^\alpha$ per capita, is now the greater amount $(\frac{\theta}{2p^*})^\alpha$. The South's utility rises to the level as the North's would take if the North needed to use reputational investment that eats up the entire profit of the Northern firms.

is small, the North specializes in the experience good, the South produces both goods. The North's experience good has a price high enough above the South's that consumers are indifferent about which they consume. The main difference from the large-North case is that trade leaves the South's welfare unaffected. As in the large-North case, the North benefits from trade.

The North is more complicated because its national income contains profit, and possibly reputational investment which eats into profit. The value of goods consumed is $(x_0(North) + p_h x_h(North))$. Income includes not just wages, equal to w times the one unit of labor, but profit, $x_h(p_h - \phi w)$. Once trade opens up, the sales x_h include sales both in the North and the South. Thus, the North's aggregate budget equation is:

$$p_0 x_0(North) + p^* x_h(North) = w(1) + (p^* - \phi w)[x_h(North) + x_h(South)] \quad (29)$$

Once we set $w = 1$, $x_h(South) = \frac{S}{2p^*}$, and $p_0 = 1$, the budget equation becomes:

$$(1)x_0(North) + p^* x_h(North) = 1 + (p^* - \phi) \left[x_h(North) + \left(\frac{1}{2p^*} \right) S \right] \quad (30)$$

This can be combined with equation (16), $x_0(North) = p^* x_h(North)$, to yield:

$$\begin{aligned} x_h(North) &= \frac{1}{2p^* - (\phi - 1)r} + \frac{S}{2p^*(2p^* - (\phi - 1)r)} \\ &= \frac{1}{p^* + \phi + (\phi - 1)r - (\phi - 1)r} + \frac{S}{2p^*(2p^* - (\phi - 1)r)} \\ &= \frac{1}{p^* + \phi} + \frac{S}{2p^*(2p^* - (\phi - 1)r)} \end{aligned} \quad (31)$$

in which case:

$$x_0(North) = \frac{p^*}{p^* + \phi} + \frac{S}{2(2p^* - (\phi - 1)r)} \quad (32)$$

We must check, however, that the North is large enough that its labor can produce enough to satisfy world demand for the high-quality good. Each unit costs ϕ in labor to produce and the North has 1 unit of labor, so for production to be feasible requires that

$$\phi[x_h(South) + x_h(North)] = \phi \left[\frac{S}{2p^*} + \frac{1}{p^* + \phi} + \frac{S}{2p^*(2p^* - (\phi - 1)r)} \right] \leq 1. \quad (33)$$

In equality (33) turns out to be equivalent to the ‘‘Large-North assumption’’ of inequality (2), here repeated:

$$S \leq \frac{2(\phi + (\phi - 1)r)(\phi - 1)}{2\phi + (\phi - 1)r + 1}. \quad (34)$$

The North's consumption per capita of the simple good is higher than the South's (which is $1/2$). Under autarky, we have seen from equation (23) that $x_0(\text{North}) = \frac{p^*}{p^* + \phi}$, so the North's consumption of the simple good rises with free trade. It rises in proportion to the size S of the South, since the North is now earning profits from Southern sales. Similarly, the North's consumption of the high-quality good is higher than under autarky (when it equals just the first term of equation (32)) and higher than the South's consumption under free trade (since $\frac{1}{p^* + \phi} > \frac{1}{2p^*}$, even if $S = 0$.)

Just as under autarky, Northern welfare is not so high if it must use reputational investment. If the opening up of trade is unforeseen, however, and it is incumbent firms that export to the South, the reputational investment under autarky will not eat up the entire Northern profit. It will at most eat up the expected autarky profit, leaving the export profits undissipated.

In short, free trade increases the welfare of both countries. The South benefits because its prices change and it starts to consume the high-quality experience good. The North benefits because though its prices do not change, its income increases as a result of pure profits from exports to the South.

6. The Small-North Case

The analysis above assumed that the North was large enough to supply both its own demand for the high-quality good and the South's demand at the quality-ensuring price of p^* . What if that is not true? I will not analyze this case in detail, but I will outline what will happen if assumption (2) is false because the South is too large relative to the North.

There would then be excess demand for the high-quality good at the price of p^* . Thus, p_h would have to rise above p^* once trade opened up. If it rose above p_h without any further changes, however, Northern firms would be earning more than the profit necessary to give them an incentive to produce high-quality. They would therefore bid up the price of their input, labor, until their profits were again at the minimum level necessary to make them indifferent between

high and low quality. This might occur at a some price for the high-quality good in the interval (p^*, θ) , or the price might rise all the way to $p_h = \theta$, in which case consumers would be indifferent between high and low quality.

If p_h is in the interval (p^*, θ) then the North will specialize in the high-quality good, exporting some of it to the South, and the South will specialize in the low-quality good, exporting some to the North. Compared to autarky, the North will be better off, since it will be exporting to the South at a profit to the firms and a higher wage to the workers. The South will also be better off than under autarky, since it will pay a price of less than θ for high quality.

If p_h rises aqll the way to θ , then the North will specialize in the high-quality good, exporting some of it to the South, and the South will produce both the simple good and the low-quality good, exporting some of the simple good to the North. Trade will help the North since it will be exporting to the South at a profit to the firms and a higher wage to the workers. Trade will have no effect on the South's welfare, since Southern consumers will be paying a price high enough to be indifferent between the low quality they used to solely consume and the high quality that is their new alternative.

7. Other Models of Quality and Trust

A Technology Model of Quality Differences across Countries

How does the trust model compare with a purely technological model of quality differences across countries? Recall that a technology model has the problem of explaining why technology cannot be transferred from country to country.

The present model could easily be converted to a model of technology differences between countries: simply assume that consumers observe quality before purchase, and that one unit of the high-quality reputation good costs $\phi_n < \theta < \phi_s$ units of labor to produce in the North and the South. If we worked out this model (as I did in the working

paper version of this article, Rasmusen [2006]), we would find that under autarky the South would produce only the low-quality experience good, the North would produce only high-quality, and welfare would be higher in the North. Opening up trade would cause the South to specialize in the simple good, exporting some of it to the North and consuming the rest. The North would produce the simple good and the high-quality good, and would export some of the high-quality good to the South. The price of the experience good would rise in the South, but the quality would rise even more. All that is just as found in the paragraphs above. The difference comes in welfare: in the technology model, the North's welfare is unaffected by trade and the South's per capita utility in the South rises all the way to the North's level; in the trust model, both countries gain from trade, but the South's utility is still lower than the North's.

A Legal Model of Quality Differences across Countries

Another reason for quality differences across countries is differences in laws. One country might have higher quality products because it has laws requiring high quality or because it has laws forbidding false claims of high quality.

The trust model is easily adapted to include such laws. Either kind of law would result in companies producing only high quality, either because low quality would be illegal or because low quality would be outsold by high quality. The differences in the outcome is that welfare would be even higher than in the trust equilibrium because the price of the high-quality good would be lower: $p_h = \phi$ instead of $p_h = p^*$. Its price would equal its cost, instead of being higher, and sellers would earn zero profit. A consequence of profits being zero is that after trade opened up, the North's welfare would be unchanged compared to autarky, and the South's welfare would rise to equal the North's.

Good laws are certainly helpful in promoting efficiency. Prohibiting fraud certainly encourages quality to be higher. Requiring minimum quality levels also can raise quality, though government failure often results in mandated quality being too high so as to raise the

wages and profits of politically influential producers. Between the risk of government failure and the difficulty of legal enforcement of quality standards for subjective characteristics such as the quality of software's documentation or the reasonableness of an insurance claims adjuster, however, laws are not a panacea for product quality.

The Literature on Trust Differences Across Countries

Having shown how trust works in this context, it is now possible to contrast it with other models of trust in international trade and development.

First, note that trust is not mediated by institutions in the present model. Particular institutions may create optimistic expectations by a general atmosphere of trust, something akin to trust in the literature on social capital by Robert Putnam (2000) and others. Trust here, however, is trust between buyers and sellers, not trust established by government or private institutions or trust that generates good institutions. Much recent work, e.g. Acemoglu, Johnson & Robinson (2002), has suggested that differences in institutions can explain trade and backwardness. It might be, for example, that the quality of a country's institutions explain its tendency to trade complex products, as in Berkowitz, Moenius & Pistor (2003) and Moenius & Berkowitz (2004). Here, however, good institutions--- e.g. laws against fraud--- are not the reason for high quality.

Similarly, Levchenko (2006), though using a model adapted from industrial organization, asks the question of how institutions affect trade. Levchenko's starting point is that institutions, modelled as a technological feature, matter more in some sectors than others. He parameterizes institutional quality following the style of Caballero & Hammour (1998), which in turn is in the spirit of the contractual incompleteness approach of Hart & Moore (1990). Institutions affect not just overall productivity, but the relationship between different factors, whose ability to contract with each other depends on institutions such as the laws and the courts. Levchenko starts, as the present paper will, with a model in which North and South differ in technology, leading to a standard difference in comparative advantage. In Levchenko's

version of this model, the South gains more than the North from trade. He then develops a Grossman-Hart-Moore model in which factors are rewarded differently across industries. Some industries depend more on institutions, and labor in those industries earns higher wages. After trade opens up, though, the North's advantage in those industries captures those "good jobs" from the South. Levchenko provides empirical support for the pattern of trade he predicts: the United States imports more from countries that have good institutions, but only in industries that involve more complicated production. Levchenko's model is based on trust, like the reputation model's, but it is trust between producers rather than between producer and consumer.

Several articles in international trade, on the other hand, do look at the relationship between trust, price, and reputation. The closest in assumptions to the present one is Falvey (1989), which also uses a version of the Klein-Leffler reputation model and asks how reputation will affect trade patterns. The key assumption in that paper is that consumers know the reputations of domestic firms but not foreign firms, and this ignorance leads to a bias against imported goods. In the present paper, we have assumed that firms could take their reputations abroad with them, and that consumers had no bias in favor of or against foreign goods per se. That, in combination with consideration of the possibility of multiple equilibria, will lead us to the conclusion that a country that exports in equilibrium has an advantage in quality, not a disadvantage.

Basu & Chau (1998) does not use a Klein-Leffler model, but their model has some of the same flavor. In it, there are both differences in both reputation and technology in North and South. Consumers all prefer high quality to low, but the extent to which they do depends on income. Each country has many firms differing in their production costs for high quality. Each consumer chooses a particular firm's product to sample, after which he receives a noisy signal of that product's quality. He may consume that product, or sample another instead. Thus, there is one period of consumption, preceded by sampling. Firms have some incentive to produce high quality, since that reduces the probability that consumers will get a bad signal and refuse to buy. Thus, the percentage of firms that chooses high quality depends

on the prices they expect from high and low quality. Since consumers only observe country of origin and price before shopping, if they expect the South to have low quality, more Southern firms will choose low quality, hoping to get a good signal by accident. If Southern general reputation and price were to rise, that would increase the profit margin that a Southern firm would lose if consumers rejected its product and increase the number of Southern firms that would find high quality profitable. The driving force is the consumer's ability to roughly test the quality of the product, not the present model's multiple periods and incentive for a firm to maintain its reputation; in the Basu-Chau model, firms are anonymous except for their country of origin. Both models, however, show mechanisms by which higher prices can make firms prefer to produce high instead of low quality, and in both models the reputations-- of countries in Basu- Chau and of firms in the present paper-- arise from exogenous expectations but are self-fulfilling.

Chisik (2003) notes that a country will tend to specialize in the goods for which it has good reputations, and that good reputations increase a country's welfare. His model has three features absent in the present paper: (1) Some firms can produce high quality at lower cost than others; (2) Firms can signal their quality, though noisily, by a signalling expenditure; and (3) Reputation for high quality is the same for all firms in an industry from a given country, pooling together the bottom firms and the top firms in the eyes of foreign consumers. Feature (1) means that a country will tend to specialize in the high-quality good if its firms have a technological advantage in quality production. This is an advance on simple models of technological advantage because when quality is unobservable it is hard for a company to convince customers that it can produce high quality at low cost. Technological advantage plus reputation is needed. Feature (2) would be irrelevant in the present model, since signalling can be effective only under the single-crossing property that firms differ in inherent type (their technologies), which the present paper does not allow. Feature (3) means that a country should subsidize high quality because the low-quality firms are dragging down the country's general reputation.

Haucap, Wey & Barmbold (2000) combine a reputation model of a monopolist whose quality type is unobservable to buyers with signalling by location choice (a model similar in style to the purely domestic production model of Rasmusen & Perri (2001) in which firms signal by capital expenditure). The central idea is that only a monopolist with a low marginal cost for high quality would survive in a high-wage, high-tax country, whereas in a low-wage, low-tax country such a firm would be unable to differentiate itself from a firm with a higher marginal cost for quality whose optimal strategy is to produce low quality and cheat the consumer. Hence, consumers will pay high prices for high quality from the richer country, but will expect (and get) low quality from the poor country. Unlike the present paper's model, that of Haucap et al. is partial rather than general equilibrium and monopolistic rather than competitive, but the main differences are that in the present paper firms are ex ante identical, and it is the firm's identity---pure reputation---rather than some signal such as location that gives consumers confidence in its quality.

The present paper shows that quality differences can be driven by reputation alone-- that multiple equilibria with rational expectations exist. A country is fortunate if it has firms for which consumers have optimistic expectations. Such firms will dominate sales in their own country, and will export to a country for whose firms consumer only have pessimistic expectations. This is not as good for the importing country as if it had optimistic expectations for its own firms, but it is better than autarky.

How might the present model be tested? Its explanation is based on the idea that certain companies have reputations for producing high quality that cannot be guaranteed by pre-purchase observation or by contract. This implies that the quality differences should exist only for certain types of products and companies. There should be no quality differences between countries in standardized commodities or manufactured goods where the grade and the terms of delivery can be easily measured and enforced in court. The quality differences should be largest for services, since service quality is hard to observe before purchase and hard to enforce, and for branded goods with features whose quality is hard to measure, e.g. automobiles,

pharmaceuticals, computers. Where quality differences between countries are large, we should also see production in the high-quality country dominated by older firms, which have had time to build up reputations. A country's reputation for high quality would really consist, in this model, of an aggregate of its companies' reputations for high quality. An implication is that consumers or retailers, while believing that Northern firms in general are trustworthy, would be more doubtful if they know the Northern firm in question is a recent start-up.

7. Concluding Remarks

In the trust model, even when two countries have identical technologies and endowments, differences in expectations can lead to different autarky welfares and to gains from trade by both a small country (which obtains better prices) and a large country (which gains extra profits). In one country, firms produce high quality at a profit and consumers earn surplus from buying high quality even at premium prices. Firms compete, but they do not reduce their prices because consumers know that any firm doing so lacks enough of a profit margin to value its future reputation. In the other country, firms produce low quality because that is what consumers expect and no consumer will pay more for a purportedly better product. Trade allows the firms with valuable reputations, too valuable to risk by producing low quality, to sell in both countries instead of in just the rich country.

As so often happens, this model is about economic development as well as about international trade. Much has been written about rapacious, self-defeating governments whose incentives ruin their attempts to profit from their citizens. The story here is a private-sector analog: rapacious, self-defeating firms whose incentives ruin their attempts to profit from their customers. Instead of the key to development being to change the structure of government and reduce rentseeking, it is to change consumer expectations in the product markets. If consumers expect high quality, they will get it. If they do not, quality will be low.

In broad terms, the reputation model shows how important reputation

can be--- behaving, even, like another factor of production. A nation with a greater factor endowment will have higher utility, and one could view good seller reputations as something like a factor of production. Like technology but unlike most factors, however, reputation is nonrivalrous. A firm with a good reputation can expand its output without extra cost, including expanding to a different country. That may be too strong a claim---reputation can be conveyed at zero cost in this model, but in the real world, consumers do need to learn of a firm's reputation, even if the reputation is already established for most consumers. But it does ring true that a firm with the valuable attribute of a reputation for good quality will have lower costs of extending that reputation to new markets than a firm that must start from scratch. If so, one of the benefits of international trade is to expand high-quality firms with good reputations across the world.

References

- Acemoglu, Daron, Simon Johnson & James Robinson (2002) ‘‘Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution,’’ *Quarterly Journal of Economics*, 117(4): 1231-1294 (November 2002).
- Akerlof, George (1970) ‘‘The Market for Lemons: Quality Uncertainty and the Market Mechanism,’’ *Quarterly Journal of Economics*, 84(3): 488- 500 (August 1970).
- Allen, Franklin (1984) ‘‘Reputation and Product Quality,’’ *RAND Journal of Economics*, 15 (3): 311-327 (Autumn 1984).
- Bagwell, Kyle & Michael H. Riordan (1991) ‘‘High and Declining Prices Signal Product Quality,’’ *American Economic Review*, 81(1): 224-239 (March 1991).
- Bagwell, Kyle & Robert Staiger (1989) ‘‘The Role of Export Subsidies when Product Quality Is Unknown,’’ *Journal of International Economics*, 27(1-2): 69-89 (August 1989).
- Basu, Arnab K. & Nancy Chau (1998) ‘‘Asymmetric Country- of- Origin Effects on Intraindustry Trade and the International Quality Race,’’ *Review of Development Economics*, 2 (2): 140-166 (June 1998).
- Berkowitz, Daniel, Johannes Moenius & Katharina Pistor (2003) ‘‘Law, Trade and Product Complexity,’’ working paper, Northwestern University.
- Caballero, Ricardo & Mohamad Hammour (1998) ‘‘The Macroeconomics of Specificity,’’ *Journal of Political Economy*, 106(4): 724-767 (August 1998).
- Chisik, Richard (2003) ‘‘Export Industry Policy and Reputational Advantage,’’ *Journal of International Economics*, 59(2): 423- 451 (March 2003).

- Choi, Yo Chul, David Hummels & Chong Xiang (2006) ‘‘Explaining Import Variety and Quality: The Role of the Income Distribution,’’ NBER Working Paper No. 12531, September 2006, <http://www.nber.org/papers/w12531>.
- Falvey, Rodney (1989) ‘‘Trade, Quality Reputations and Commercial Policy,’’ *International Economic Review*, 30(3): 607-622 (August 1989).
- Farrell, Joseph (1986) ‘‘Moral Hazard as an Entry Barrier,’’ *RAND Journal of Economics*, 17:(3):440-449 (Autumn 1986).
- Flam, Harry & Elhanan Helpman (1987) ‘‘Vertical Product Differentiation and North-South Trade,’’ *American Economic Review*, 77(5): 810-822 (December 1987).
- Grossman, Gene & Elhanan Helpman (1991) *Innovation and Growth in the Global Economy*, Cambridge MA: MIT Press, 1991.
- Hallak, Juan Carlos (2006) ‘‘Product Quality and the Direction of Trade,’’ Forthcoming, *Journal of International Economics* 68(1): 238-265 (January 2006).
- Hallak, Juan Carlos & Peter K. Schott (2005) ‘‘Estimating Cross-Country Differences in Product Quality,’’ <http://www-personal.umich.edu/~hallak/hs82.pdf>, October 17, 2005.
- Hart, Oliver & John Moore (1990) ‘‘Property Rights and the Nature of the Firm,’’ *Journal of Political Economy*, 98(6): 1119-1158 (December 1990) .
- Haucap, Justus, Christian Wey & Jens Barmbold (2000) ‘‘Location Costs, Product Quality and Implicit Franchise Contracts,’’ *Journal of International Economics*, 52(1): 69-87 (October 2000).
- Hummels, David & Peter J. Klenow (2005) ‘‘The Variety and Quality of a Nation’s Trade,’’ *American Economic Review*, 95(3): 704-723 (June 2005).
- Johansson Johny K. & Israel D. Nebenzahl (1986) ‘‘Multinational Production: Effect on Brand Value,’’ *Journal of International Business Studies*, 17(3): 101-126 (Autumn 1986).

- Keller, Wolfgang (2004) ‘‘International Technology Diffusion,’’
Journal of Economic Literature, 42(3): 752-782 (September 2004).
- Klein, Benjamin & Keith Leffler (1981) ‘‘The Role of Market Forces
in Assuring Contractual Performance,’’ *Journal of Political Econ-
omy*, 89(4): 615-641 (August 1981).
- Levchenkco, Andrei (2006) ‘‘Institutional Quality and International
Trade,’’ forthcoming, *Review of Economic Studies*, September 2006.
http://alevchenko.com/Levchenko_Institutions_Trade_Final.pdf.
- Macaulay, Stewart (1963) ‘‘Non-Contractual Relations in Business,’’
American Sociological Review, 28: 55-70 (February 1963).
- Linder, Staffan (1961) *An Essay on Trade and Transformation*, . Almqvist
& Wiksell, Stockholm.
- Moenius, Johannes & Daniel Berkowitz (2004) ‘‘Institutional Change
and Product Composition: Does the Initial Quality of Institutions
Matter?’’ William Davidson Institute Working Paper Number 662
(February 2004), <http://www.pitt.edu/~dmberk/dev&tr0204.pdf>
- Milgrom, Paul & John Roberts (1986) ‘‘Price and Advertising Signals
of Product Quality,’’ *Journal of Political Economy*, 94(4): 796-821
(August 1986).
- Murphy, Kevin M. & Andrei Shleifer (1997) ‘‘Quality and Trade,’’
Journal of Developmental Economics, 53(1): 1-15.
- Navaretti, Giorgio Barba & Isidro Soloaga (2001) ‘‘Weightless Machines
and Costless Knowledge An Empirical Analysis of Trade and Technology
Diffusion,’’ World Bank working paper, [http://econ.worldbank.
org/files/1720_wps2598.pdf](http://econ.worldbank.org/files/1720_wps2598.pdf).
- Papadopoulos N. & Heslop L. (2002) ‘‘Country Equity and Country
Branding: Problems and Prospects,’’ *Journal of Brand Manage-
ment*, 9(4-5): 294-314 (April 2002).
- Pappu, Ravi, Pascale G. Quester, & Ray W. Cooksey (2007) ‘‘Country
Image and Consumer-based Brand Equity: Relationships and Implications
for International Marketing,’’ *Journal of International Business
Studies*, 38: 726-745.

- Putnam, Robert (2000) *Bowling Alone: The Collapse and Revival of American Community*, (New York: Simon and Schuster, 2000).
- Rasmusen, Eric (1989) ‘‘A Simple Model of Product Quality with Elastic Demand,’’ *Economics Letters*, 29(4): 281-283 (1989).
- Rasmusen, Eric & Timothy Perri (2001) ‘‘Can High Prices Ensure Product Quality When Buyers Do Not Know the Sellers’ Cost?’’ *Economic Inquiry*, 39(4): 561-567 (October 2001).
- Rogerson, William P. (1987) ‘‘The Dissipation of Profits by Brand Name Investment and Entry when Price Guarantees Quality,’’ *Journal of Political Economy*, 95(4): 797-809 (August 1987).
- Roth, Martin S. & Jean B. Romeo (1992) ‘‘Matching Product Category and Country Image Perceptions: A Framework for Managing Country-Of-Origin Effects,’’ *Journal of International Business Studies*, 23(3): 477-497 (3rd Qtr. 1992).
- Schott, Peter K. (2004) ‘‘Across-Product versus Within-Product Specialization in International Trade,’’ *Quarterly Journal of Economics*, 119, 647-678.
- Shapiro, Carl (1983) ‘‘Premiums for High Quality Products as Returns to Reputations,’’ *Quarterly Journal of Economics*, 98(4):659-680 (November 1983).