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A Reputation Model of Quality in North-South Trade

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Abstract

Countries have different comparative advantages in quality. These might be due to technological differences, or to reputation differences of the sort described in Klein & Leffler (1981). Reputation differences are particularly interesting, since good reputations are a form of “social capital” that is amenable to modelling. They can explain why firms in these industries like to export even if the foreign price is no higher than the domestic one, and why governments would like to have large “high- value” sectors.

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1. Introduction

Differences in the productiveness of countries is a major theme— the major theme?— in both international economics and development economics. In both fields, the most basic models are those in which countries either have different technologies available, or the same technologies but different endowments of factors of production. Different endowments and technologies are sufficient to build theoretical models for why countries trade and why some countries are richer than others, but they do not leave us satisfied. The United States and India do not trade just because India has more labor and less capital, and India is not poorer just because it does not have access to American patents. In particular, the question of why the most advanced technology does not spread to every country is a nagging one, the subject of the entire literature surveyed in 2004 by Wolfgang Keller for the *Journal of Economic Literature*.

Another class of differences between countries is institutions. Most obvious of these is the quality of a country’s government, including not only its economic policies, but its degree of corruption, the quality of administration, its provision of public goods, and the reliability of its courts. Much recent work, including notably La Porta, Lopez-de-Silanes, Shleifer & Vishny (1998) and Acemoglu, Johnson & Robinson (2002) has suggested that differences in institutions can explain trade and backwardness. Institutional differences extend beyond just the government, however. The idea of “social capital” has tried to get at the importance not just of government institutions, but of private institutions. The literature is large, including such works as Knack & Keefer (1997), La Porta, Lopez-de-Silanes, Shleifer & Vishny (1997), Putnam (2000), and Routledge & von Amsberg (2003) . Some of the attention has been on public institutions that overcome problems of asymmetric information, opportunism, and simple theft; other work looks at private institutions (e.g., Rauch & Trindade [2002] on how networks of overseas Chinese result in increased trade between countries). In law-and-economics, a similarly large literature has developed around the topic of “law and norms” to explain why formal law so often seems to be unimportant in determining behavior. For a survey, see McAdams & Rasmusen (2004).

The present paper takes an approach to trade based not so much on formal or informal institutions as on differences in expectations, something akin to the role of “trust” in the part of the social capital literature exemplified by Putnam (2000). The courts are never sufficient in themselves to protect parties to a bargain from being cheated in small ways. Macaulay (1963) pointed out long ago that in the ordinary course of dealing, businesses rely not so much on the courts as on industry custom and, most importantly, on reputation. 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.

When there are multiple equilibria, it is quite possible to have identical technologies and endowments but different outcomes. One outcome is high quality, profitable firms, and consumers earning surplus from buying high quality at premium prices. The other outcome is low quality, zero-profit firms, and less consumer surplus—indeed, the possibility that the industry vanishes completely because consumers would rather buy nothing than buy low quality at low prices. While much of the development literature has been about rapacious, self-defeating governments with incentive that ruin their own attempts to profit from their citizens, the Klein-Leffler model is about rapacious, self-defeating firms with incentives that ruin their own attempts to profit from their customers. Instead of the trick being to change the

structure of government so as to reduce rent-seeking, the trick becomes to change expectations in the product markets, an equally difficult task– but one in which international trade might help. The present paper will explore the implications of these multiple equilibria, transferring the Klein- Leffler model to international trade.

Quality has been studied in a number of models of international trade. Flam & Helpman (1987) construct a model of North-South trade in which the North has a technological advantage in producing high quality, but products are differentiated and both high and low quality will be produced and traded in equilibrium. The “technology model” of the present paper can be seen as a simple version of this, without product differentiation. More similar to the technology model is Murphy & Shleifer (1997), which uses a one-factor, two-good model to make the point that richer countries may have a taste for higher-quality goods, so in equilibrium we will see efficient differences in quality between goods consumed in different countries.

The word “quality” has been most often used in recent years in models along the lines of in Grossman & Helpman’s 1992 book. There, intermediate goods vary in quality, and innovation and technological diffusion allows that quality to increase, good by good. Moreover, trade in those intermediate goods aids diffusion of the superior technology. In the present model, the emphasis will not be on how quality improves, whether in one country or by diffusion, but on how differing quality affects trade. Moreover, the most interesting results will depend on quality being unobservable before purchase, an issue absent from most models.

Several papers, however, have looked at the problem introduced by uncertain quality and the need for some solution to it– government institutions, private institutions, or reputations. Falvey (1989) uses a version of the Klein-Leffler reputation model and asks how reputation will affect trade patterns. The key assumption in that paper, however, is that consumers know the reputations of domestic firms but not foreign firms, which leads to a bias against imported goods. In the present paper, we will assume that firms can take their reputations abroad with them, which will give an advantage to a

country in which firms have reputations for high quality.

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 which will not be present in this paper's model: (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. Due to feature (1), a country will tend to specialize in the high- quality good if its firms have a technological advantage in producing it. The reason this is an advance on simple models of technological advantage is that because quality is unobservable, it is hard for a company that can product high quality at low cost to convince the customers of that. Technological advantage plus reputation is needed. Due to feature (3), 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 difference is that in the present paper it will be the firm's identity— pure reputation— rather than some signal such as location that gives consumers confidence that its quality will be high. One implication of this is that in the present paper's model, a firm from the rich country will be able to retain its reputation for high quality even if it uses

direct investment to produce in the poor country.

This paper was inspired by Levchenko (2003), which asks the same question of how institutions affect trade but comes to different conclusions. 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 Grossman & Hart (1986) and 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.

A similar story and similar empirical findings can be found in Berkowitz, Moenius, & Pistor (2003) and Moenius & Berkowitz (2004). As in Levchenko (2003), the models explore the effect of the quality of a country's institutions on its tendency to export or import complex products. Empirical examination of quality is difficult because of the problem of measuring quality, which is why these papers look at complexity, which can be defined by looking at the number of industries that provide inputs to a given product. Another approach is to look at average prices within industry categories. Thus, Schott (2001) finds that richer countries exported to the United States at higher average prices than poorer countries, and Navaretti & Soloaga (2001) find that European transition economies import equipment at lower average prices than does the United States. Another approach is pioneered by Hummels &

Klenow (2002), who 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). 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. One well-known article in the literature, for example, Johansson & Nebenzahl (1986), 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. They find that consumers were willing to pay 14% more for a Buick made in Germany than for one made in the United States, but 16% less for one made in Mexico (compared to the U.S.).

The present paper’s focus will be on product quality and the problem of contracting between buyer and seller rather than on the difficulties of contracting between factors of production. Rather than having both capital and labor as inputs, the only input will, as in Flam & Helpman (1987), be labor, although “reputation” will end up behaving like an input despite being absent from the production function. Unlike in Berkowitz, Moenius, & Pistor (2003) and Moenius & Berkowitz (2004), countries will differ not in the public institutions such as courts which try to overcome information asymmetries, but in private customs. Like Levchenko (2003), I will contrast a technological model with an information-based model, but the differences between the two will not be so striking here. In both models, trade will benefit both North and South, but the models will differ in such things as whether Northern firms benefit from trade, whether the North benefits from trade with a South too small to affect prices, and the long-term effects of direct investment.

I will model product quality in two ways. First, I will construct a purely technological model, in which the advanced country, the North, is able to produce high quality more cheaply than the South. Second, I will construct a reputation model, in which the North and South have exactly the same

technology, but Northern firms have reputations for high quality and Southern firms do not. For each model, we will compare autarky with free trade, technology diffusion, and direct investment under the two assumptions that the North is large (the free trade prices are the North's autarky prices) and small (the free trade prices are the South's autarky prices).

2. A Technology Model of Comparative Advantage in Quality Production

2a. The Technology Model

There are two countries, the North and the South, and one factor of production, labor. Each of the many infinitesimal firms can hire labor to produce either of two kinds of goods: the simple good (good 0, our numeraire) or the reputation good (subscripted L or H depending on quality). The quality of the simple good is always the same, but the quality of the reputation good can be either Low or High. The North has 1 unit of labor and the South has L units. If $L > 1$ we will say the North is Small; if $L < 1$ we will say the North is Large. Ownership of labor and firms (relevant later, in the reputation model, even though capital is not a factor) is evenly distributed across the population in each country. Production and trade is repeated in each of an infinite number of periods, with quality and quantity chosen anew each period, and the discount rate is $r < 2 - \phi$ (a constraint relevant later in the reputation model). Transportation costs are zero, but we will limit ourselves to those equilibria that require the least transportation.¹

One unit of the simple good costs one unit of labor to produce in either North or South. One unit of the low quality reputation good (quality $\theta_L = .5$) costs one unit of labor to produce in either North or South. One unit of the high quality reputation good (quality $\theta_H = 1$) costs ϕ units of labor to produce in the North, with $1 < \phi < 2$. Prices will be p_0 for the simple good,

¹Thus, if the price of the simple good is the same in both countries and each country produces enough for its entire domestic demand, we will assume there is no intraindustry trade.

with $p_0 \equiv 1$ as a normalization, and p_L and p_H for the low and high-quality reputation goods.

If x_0 is consumption of the simple good and x_L and x_H are the consumptions of reputation goods with low and high quality, a consumer's utility in a given period is assumed to be

$$U = x_0^\alpha (\theta_L x_L + \theta_H x_H)^\alpha \quad (1)$$

where $\alpha < 1$, $\theta_L = .5$, and $\theta_H = 1$. Low and high quality reputation goods are perfect substitutes for each other, in the sense that their only difference in the utility function is in the multipliers θ_L and θ_H .

The assumptions so far will apply to both the reputation model and technology model. The technology model adds two other assumptions:

(A1) One unit of the high quality reputation good costs $\phi_s > 2$ units of labor in the South.

(A2) Consumers observe quality before they purchase.

These assumptions will imply that high quality is efficient in the North and low quality in the South. In this technology model, information is symmetric, and North will produce the high quality reputation good only because it has a superior technology for producing high quality.

In the technology model, there is no connection between time periods, since discounting makes consumers wish to consume as early as possible and there is no uncertainty that might create a precautionary motive for saving. The model is just a series of unconnected one-period models. The multiple periods will have importance only in the reputation model, in Section 3.

Note that the high and low quality of the model can apply to services as easily as to goods. Indeed, it is perhaps even harder to contract in advance over the quality of services than of goods, and harder to recover damages for low quality via a lawsuit. Services customers often depend heavily on reputation, whether the service is legal advice, business consultancy, medicine, or machine repair. Indeed, the customer may not be able to detect low

quality even for some time after he has “consumed” it. Even much of the quality involved in goods trade is often most variable in services attached to the goods, such things as the delay before payment, reliability of delivery, help in understanding how to operate the good, and advice in packaging and marketing.

2b. The Technology Model under Autarky

First, what will happen under autarky? In the North, the price of the simple good will be $p_0 = 1$ (as a normalization), the price of a low- quality reputation good will be $p_L = 1$, and the price of a high- quality reputation good will be $p_H = \phi$, since prices will equal marginal costs. The wage will equal $w = 1$, and firms will earn zero profits, since we assume perfect competition.

In the South, the price of the simple good will be $p_0 = 1$ (as a normalization), the price of a low-quality reputation good will be $p_L = 1$, and the price of a high-quality reputation good will be $p_H = \phi_S$, since price will equal marginal cost. The wage will equal $w = 1$, and firms will earn zero profits.

In summary: prices will be:

South: $p_0 = 1, p_L = 1, p_H = \phi_S, w = 1$.

North: $p_0 = 1, p_L = 1, p_H = \phi, w = 1$.

Consumers in each country solve the problem

$$\underset{x_0, x_L, x_H}{\text{Maximize}} U = x_0^\alpha (\theta_L x_L + \theta_H x_H)^\alpha \text{ s.t. } x_0 p_0 + x_L p_L + x_H p_H = \text{income}, \quad (2)$$

which has the first order conditions

$$\frac{\alpha U}{x_0} - \lambda p_0 = 0 \quad (3)$$

and

$$\frac{\theta_L \alpha U}{\theta_L x_L + \theta_H x_H} - \lambda p_L = 0. \quad (4)$$

and

$$\frac{\theta_H \alpha U}{\theta_H x_H + \theta_L x_L} - \lambda p_H = 0. \quad (5)$$

If it were optimal to consume all three goods, then

$$\lambda = \frac{\alpha U}{x_0 p_0} = \left(\frac{\theta_L}{p_L} \right) \left(\frac{\alpha U}{(\theta_L x_L + \theta_H x_H)} \right) = \left(\frac{\theta_H}{p_H} \right) \left(\frac{\alpha U}{(\theta_L x_L + \theta_H x_H)} \right). \quad (6)$$

This implies that

$$x_0 = \left(\frac{p_L}{\theta_L} \right) (\theta_L x_L + \theta_H x_H) = \left(\frac{p_H}{\theta_H} \right) (\theta_L x_L + \theta_H x_H). \quad (7)$$

It will not ordinarily be optimal to consume all three goods, however; there will be a corner solution unless $\frac{\theta_L}{p_L} = \frac{\theta_H}{p_H}$. Of the two reputation goods, only low quality will be consumed if $\frac{\theta_L}{p_L} > \frac{\theta_H}{p_H}$, and only high quality will be consumed if the inequality is reversed.

First, consider the North, where $p_0 = 1, p_L = 1, p_H = \phi$. There, $\frac{\theta_L}{p_L} = \frac{5}{1} < \frac{\theta_H}{p_H} = \frac{1}{\phi}$, since $\phi < 2$ by assumption, so $x_L = 0$ and $x_H > 0$. We can rewrite the part of equation (7) that applies to a country that consumes only the simple good and the high-quality reputation good as

$$x_0 = p_H x_H. \quad (8)$$

Since there is one unit of labor in the economy, with a price of $w = 1$,

$$(1)x_0 + p_H x_H = 1 \quad (9)$$

so since $x_0 = p_H x_H$ from equation (8), we have $p_H x_H + p_H x_H = 1$ and

$$x_H(\text{North}) = \frac{1}{2p_H} = \frac{1}{2\phi}, \quad (10)$$

which in turn implies that

$$x_0(\text{North}) = \frac{1}{2}. \quad (11)$$

Half of the North's labor will be used to produce each good, but the quantity of the reputation good will end up lower.

Utility of someone with one unit of income would be

$$U(North) = \left(\frac{1}{2}\right)^\alpha \left(1 \cdot \frac{1}{2\phi}\right)^\alpha = \frac{1}{2^{2\alpha}\phi^\alpha} \quad (12)$$

Next, consider the South, where $p_0 = 1, p_L = 1, p_H = \phi_S$. There, $\frac{\theta_L}{p_L} = \frac{.5}{1} > \frac{\theta_H}{p_H} = \frac{1}{\phi_S}$, since $\phi_S > 2$ by assumption, so $x_L > 0$ and $x_H = 0$. We can rewrite the part of equation (7) that applies as

$$x_0(South) = x_L. \quad (13)$$

Since there are L units of labor in the economy, $x_0 + x_H = L$, so

$$x_0(South) = \frac{L}{2} \quad x_L(South) = \frac{L}{2}. \quad (14)$$

Utility of someone with one unit of income would be

$$U(South) = \left(\frac{1}{2}\right)^\alpha \left(.5 \cdot \frac{1}{2}\right)^\alpha = \frac{1}{2^{3\alpha}} \quad (15)$$

Comparing, we see that utility in the South is lower:

$$\frac{1}{2^{3\alpha}} < \frac{1}{2^{2\alpha}\phi^\alpha}, \quad (16)$$

because $2^\alpha > \phi^\alpha$.

Thus, under autarky it is efficient for the North to produce the high-quality reputation good and for the South to produce low quality. As a natural consequence of the North having superior technology, it also has higher welfare.

2c. Opening Up Trade: Large North

Now let us open up trade between North and South. Prices will be equal in North and South, since there is free trade and no transportation

costs. Since the production function does not have diminishing returns, production is constrained only by the amount of labor available, and the free trade price will equal one of the two country's autarky price levels, although wages can differ between the two countries.

We will start with the assumption that the North is Large— that under free trade, when prices equalize they will equalize at the North's autarky level (which will happen if $L < 1$). Under free trade, since North is more effective at turning labor into reputation goods, the South will specialize in the simple good. Because the North is Large, it will be able to absorb all the simple good the South wants to export without any change in prices.

The new world price of the simple good will be $p_0 = 1$ (as a normalization), the price of a low-quality reputation good will be $p_L = 1$, and the price of a high-quality reputation good will be $p_H = \phi$. In the North and South alike, the wage will equal $w_S = w_N = 1$. Firms will earn zero profits.

To sum up: free trade prices (Large North) will be $p_0 = 1$, $p_L = 1$, $p_H = \phi$, $w_S = 1$, $w_N = 1$.

The South will produce only the simple good, some of which it will export to the North. The North will produce both goods, and export some of the reputation good to the South.

These will be the prices because there must be a single world price for the traded goods, and since, as we will see below, the North will be producing both the simple good and the high-quality reputation good in equilibrium, for firms to earn zero profits it must be that the high-quality good, requiring ϕ units of labor to the simple good's 1 unit, must have a price ϕ times as high. Since the simple good is produced in both countries, and using the same amount of labor in each, for firms to earn zero profits also requires that the wage be the same everywhere.

Since prices have not changed in the North, its consumption is un-

changed:

$$x_0(North) = \frac{1}{2} \quad x_H(North) = \frac{1}{2\phi}. \quad (17)$$

The South's prices have changed to become equal to the North's so its consumption proportions will change to equal the North's instead of being $x_0(South) = L/2$ and $x_L(South) = L/2$.

$$x_0(South) = \frac{1}{2}L \quad x_H(South) = \frac{1}{2\phi}L. \quad (18)$$

Thus, consumption of the simple good is unchanged in the South. Consumption of the reputation good has fallen, but it has changed from low to high quality, and since high quality adds twice as much to someone's utility as low quality, utility has risen in the South.

We can now see what determines when the North is "Large". The South will produce only the simple good, producing a quantity of L . The North will be importing $L/2$ of the simple good from the South. That is why $L < 1$ defines the case of "Large North". If L is any larger, then the North will not wish to import as much of the simple good as the South wishes to export at the equilibrium prices. The South wishes to export half of its production of the simple good, so if $L = 1$, the South wants to export $L = 1/2$, which is all the North wishes to purchase at equilibrium prices. The North will export $L/2\phi$ of the reputation good to the South.

We have found that in the technology model, when trade is opened up and the North is large relative to the South, the price of the reputation good falls in the South. Thus, the North's welfare is unaffected, but Southern consumers are now better off.

2d. Opening Up Trade: Small North

Suppose, instead, that we open up trade between North and South under the assumption now that the North is Small ($L > 1$). The North is more effective at turning labor into reputation goods, so the South will tend to

specialize in the simple good. But the South will not specialize completely. Instead, the North will specialize completely, in the high-quality reputation good, while the South will produce both the simple good and the low-quality reputation good.

The world price of the simple good will be $p_0 = 1$ (as a normalization), the price of the low-quality reputation good will be $p_L = 1$, and the price of the high-quality reputation good will be $p_H = 2$. This last is true because in equilibrium, both the low-quality and the high-quality reputation good will be consumed in the South, and if the price of the high-quality good were less than $p_H = 2$, there would be excess demand for the high-quality good, pushing up its price.

Wage will equal $w_S = 1$ and $w_N = \frac{2}{\phi} > 1$. At these levels, firms will earn zero profits; a unit of the simple good or the low-quality reputation good costs $(1)w_S$ in the South and earns a price of $p_0 = 1$ or $p_L = 1$; a unit of the high-quality reputation good costs ϕ units of labor at w_N per unit in the North and earns a price of $p_H = 2$.

To sum up: free trade prices (Small North) will be $p_0 = 1$, $p_L = 1$, $p_H = 2$, $w_S = 1$, $w_N = \frac{2}{\phi} > 1$.

The South will produce the simple good and the low-quality reputation good, and will export some of the simple good to the North. The North will produce just the high-quality reputation good, and will export some of it to the South.²

²This is just one possible pattern of trade, though the most plausible one. Since we have assumed zero transportation costs, and since consumers are indifferent between the low-quality good and the high-quality good at the equilibrium prices, there are other equilibria with the same prices but with different distributions of where the low-quality reputation good is consumed. It could be, for example, that in equilibrium the North exports all of its high-quality reputation good production to the South in exchange for imports of the simple good and of the low-quality reputation good. Infinitesimal positive transportation costs would, however, eliminate any equilibrium in which the South exported the low-quality reputation good to the North.

Equation (8) tells us that

$$x_0 = p_H x_H. \quad (19)$$

Now with $p_H = 2$, and Northern production equal to $1/\phi$ units of the high-quality production good, Northern national income is equal to $p_H(1/\phi) = 2/\phi$, and equation (9) becomes

$$(1)x_0 + p_H x_H = 2/\phi, \quad (20)$$

so $p_H x_H + p_H x_H = 2/\phi$, and

$$x_H(North) = \frac{2}{4\phi} = \frac{1}{2\phi}. \quad (21)$$

It follows that

$$x_0(North) = (2)\left(\frac{1}{2\phi}\right) = \frac{1}{\phi} \quad (22)$$

Because of trade, the wage and the price of the high-quality good have risen in the North. Consumption of the high-quality reputation good is unchanged from the autarky level of $x_H = \frac{1}{2\phi}$, but consumption of the simple good has risen from $x_0 = 1/2$ to $x_0 = \frac{1}{\phi}$, so the North benefits from trade. Note, however, that if there did exist a Northern consumer without wage income, that consumer would be hurt by trade, since he would see the price of the reputation good rising without any increase in his income.

The North produces amount $1/\phi$ of the high-quality reputation good, $1/\phi - \frac{1}{2\phi} = \frac{1}{2\phi}$ of which is exported to the South in exchange for $(2)\left(\frac{1}{2\phi}\right) = \frac{1}{\phi}$ of the simple good. Thus, $x_H(South) = \frac{1}{2\phi}$.

The South is now consuming both low and high-quality reputation goods. From equation (7),

$$x_0(South) = 2(.5x_L(South) + x_H(South)) \quad (23)$$

so

$$x_0 = 2\left(.5x_L + \frac{1}{2\phi}\right) \quad (24)$$

Since Southern income is $w_L L = L$,

$$(1)x_0 + p_H x_H + p_L x_L = L, \quad (25)$$

so $x_0 + 2x_H + x_L = L$. This can be rewritten as

$$[2(.5x_L + \frac{1}{2\phi})] + 2(\frac{1}{2\phi}) + x_L = L \quad (26)$$

or

$$x_L + \frac{1}{\phi} + \frac{1}{\phi} + x_L = L \quad (27)$$

so

$$x_L(\text{South}) = \frac{L - \frac{2}{\phi}}{2} = \frac{L}{2} - \frac{1}{\phi} \quad (28)$$

We can then see from equation (23) that

$$x_0(\text{South}) = 2(.5 \left(\frac{L}{2} - \frac{1}{\phi} \right) + \frac{1}{2\phi}) = \frac{L}{2}. \quad (29)$$

Compared to autarky, the South has not changed its consumption of the simple good. It has reduced its consumption of the low-quality consumption good from $x_L = \frac{L}{2}$ to $\frac{L}{2} - \frac{1}{\phi}$ and increased its consumption of the high-quality consumption good from $x_H = 0$ to $x_H = \frac{1}{2\phi}$, but this has no impact on utility, since each unit consumed of the high-quality good has double the utility effect of each unit of the low-quality good.

Thus, if the South is large and trade opens up, the North benefits because its wage rises, but the South is unaffected.

2e. The South's Technology Improves

What happens if the South develops a better technology— that is, if ϕ_S falls towards but not beyond ϕ ?

If the North is Large, there is no effect. The North is still better at producing high quality, and the price remains at ϕ .

If the South is Large, however, then once $\phi_S < 2$, p_H starts falling as ϕ_S falls. The price of the North's high quality good will be $p_H = \phi_S$, and once $\phi_S < 2$, the South will stop producing the low quality good and start producing its own high- quality goods. The Northern wage will start falling too. In combination, this means Southern welfare rises and Northern welfare falls.

2f. Direct Investment by the North in the South

What happens if the Northern firms engage in direct investment in the South, combining their superior technology with the cheaper Southern labor? In the present model, the effect is simple: since Northern firms compete with each other, their profits are zero, and the effect is just to enable the South to the same pattern of production of the North. Trade is no longer useful.

If the North is Large, this does not affect either country's welfare. If the North is Small, though, the effect of direct investment is that the Northern wage falls back to 1. Welfare in the North falls, and welfare in the South rises. This is just a special case of the Southern improvement in technology that we just discussed, with ϕ_S dropping to equal ϕ because of Northern investment.

The North has an interest in banning direct investment and technology transfer to the South. Its firms end up with zero profits anyway, since the compete with each other, and it loses the scarcity value of its labor. All it gets is the prestige value of Northern company nameplates on Southern products. The result is reminiscent of the celebrated "immiserizing growth" of Bhagwati (1958), in which a country's growth in output ruins its terms of trade when its producers engage in perfect competition and do not hold back output to maintain the price. Here, the problem is that the Northern producers compete the price of technology down to zero.

If, for some reason, the rate of Northern direct investment was slow in the Small North case, or if it is permanently restricted, then this conclusion must be modified, because Northern firms could earn positive profits during

the transition period. Those that invested in the South would be receiving a price of $p_H = 2$ while paying a wage of only $w_S = 1$ instead of the higher wage their competitors in the North pay. If this were the case, then Northern firms would favor direct investment, while Northern workers would oppose it. Northern welfare might well be higher overall if direct investment is allowed, because the combination of Northern technology and Southern cheap and plentiful welfare creates the most world social surplus, and if Northern firms are limited in how much they can sell, they retain this surplus. Even if eventually Northern direct investment grows to where it reduces p_H and w_N , the discounted value of the transition profits might exceed the discounted value of the permanent high w_N that would result if direct investment were banned.

The idea of direct investment brings us to another problem with the technology model, a well-known one. How can technological differences persist? Why doesn't everyone just use the best technology? The survey of Keller (2004) suggests some answers. Reasons such as the need to embody technology in capital investment or human capital are reasonable enough, but the rest of the paper will examine a possible reason why the South might lack high quality even if technology is freely transferable.

3. The Reputation Model

We'll next compare the technology model with a model in which production technologies are identical in North and South, but reputations differ. Keep the same model as in Section 2, except

(A1') One unit of a high quality reputation good costs the same $\phi > 1$ units of labor to produce in the South as in the North: $\phi_S = \phi$ now.

(A2') Consumers cannot observe the quality of a good before purchase in period t , but they do observe the quality of the goods everyone purchased in period $t - 1$, and they know which firms sold the goods.

(A3') Northern producers of reputation goods have good reputations, but Southern producers of reputation goods do not.

Assumption (A3'), which will be made meaningful shortly, becomes relevant because Assumption (A2') introduces the possibility of multiple equilibria. "Reputation" will be the term used to distinguish between the most interesting equilibria.

3a. The Reputation Model under Autarky

The reputation model is essentially a general equilibrium and mathematized version of the idea presented in Klein & Leffler (1981) (or, in a different context, in Telser [1980]). Their object was to explain two things (1) why some firms produce high quality even when consumers cannot tell quality before purchase, and (2) why firms that produce high quality often seem to be able to charge a price higher than cost even in a market with free entry. In their article, these profits are explained as a return to the firm's reputation for high quality, a reputation not easily acquired.

Here we are using a formalization of the Klein-Leffler model similar to what I have used before in Rasmusen (1989) and Chapter 5 of Rasmusen (2001), interpreting it as an infinitely repeated game between consumers and firms. The present model adds international trade and competition among firms for the input, labor, but makes firms infinitesimal and without fixed costs.

Since the interaction between consumer and firms selling the reputation good is infinitely repeated, there are multiple equilibria. We will focus on two of them.

In the "pessimistic equilibrium," quality is low and $p_L = 1$, equal to its cost because of competition among firms. The price for high quality, p_H , is undefined because high quality cannot be credibly produced. The equilibrium strategy for a firm is to produce low quality. The equilibrium strategy for a consumer is to pay at most a price of 1 for a reputation good, regardless of the claims the seller makes about quality. The players stay with these strategies regardless of deviations by other players.

These strategies form a subgame perfect Nash equilibrium for the re-

peated game. No firm has an incentive to produce high quality, since it will not be able to get any higher price. If it 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 firms' goods. Rather, they would regard the deviation as a fluke, not to be repeated.

The pessimistic equilibrium is the only equilibrium for the one-shot game (or for the finitely repeated game, due to the Chainstore Paradox— see Chapter 5 of Rasmusen [2001]) for details). It can be seen as a variant of the Prisoner's Dilemma, or the Trust Game: both firms and consumers could be made better off if the firms were forced to choose high quality and the consumers were willing to pay higher prices, but without compulsion, neither side will take the risk.

In the infinitely repeated game, however, there are many equilibria, of which we will focus on the pessimistic equilibrium and the one at the other extreme, the “optimistic equilibrium”.

In the “optimistic equilibrium”, quality is high. For this to be true, a firm must fear punishment if it produces low quality instead. The punishment would be a damaged reputation: consumers believe that the firm will produce low quality in the future and they switch to another firm instead.

The equilibrium strategy for a reputable firm is to produce high quality unless it has ever deviated and produced low quality, in which case it produces low quality thereafter. The equilibrium strategy for a consumer is to buy from a reputable firm charging a price of exactly p^* (to be calculated below), but not to buy if the price is higher or lower, and not to buy if the firm has ever been caught producing low quality. We will focus on the most efficient of the optimistic equilibria, the one in which p^* takes the lowest value possible that sustains the equilibrium.

Here is how we find the equilibrium price, p^* . If the firm produces high

quality today, the present value of its profits is

$$(p^* - \phi w) + \left(\frac{1}{1+r}\right)^1 (p^* - \phi w) + \left(\frac{1}{1+r}\right)^2 (p^* - \phi w) + \dots = \frac{p^* - \phi w}{r} \quad (30)$$

but if it produces low quality, the present value of its profits is

$$(p^* - w) + 0 + 0 + \dots \quad (31)$$

Thus, for the firm to choose high quality it must be true that

$$\frac{p^* - \phi w}{r} \geq (p^* - w). \quad (32)$$

so

$$p^* - \phi w \geq rp^* - rw \quad (33)$$

so

$$p^*(1-r) \geq -rw + \phi w. \quad (34)$$

and

$$p^* \geq \frac{(\phi - r)w}{1 - r} \quad (35)$$

We will focus on the equilibrium with the lowest price that satisfies this constraint. The good with high quality in an optimistic equilibrium will have the price

$$p^* = \frac{(\phi - r)w}{1 - r}. \quad (36)$$

For it to be worth buying the high-quality good at this price instead of simply buying the low-quality good, we need $p^* < 2$. That requires

$$\frac{(\phi - r)w}{1 - r} < 2, \quad (37)$$

or, if $w = 1$,

$$\phi - r < 2 - 2r \tag{38}$$

so

$$r < 2 - \phi, \tag{39}$$

which is true by assumption.

We will focus on the optimistic equilibrium in which competition among firms pushes the price down to the minimum level of p^* that induces high quality production.³

Thus, in equilibrium the prices in the North are $p_0 = 1$, and $p_H = p^*$ and quality is high for the reputation good. The wage will be $w_N = 1$. Firms producing the simple good will earn zero profits; firms producing the reputation good will earn positive profits.

That profits are positive for firms producing high-quality reputation goods in the optimistic equilibrium is important. It is only because their prices are higher than their costs that buyers can trust them to produce high quality, so positive profits are an intrinsic part of the equilibrium. This is a disturbing feature of the model, and one that the original article, Klein & Leffler (1981) tries to downplay. These positive profits could be quasi-rents—returns on an initial sunk investment in reputation. Or, they could be entry costs unrelated to reputation, as in Rasmusen (1989) or Chapter 5 of Rasmusen (2001), or initial investments that signal private information, as in Perri & Rasmusen (2001). But sunk costs that make a firm's lifetime profits equal to zero are not part of the logic of the model. The model does not have to specify a mechanism for reputation creation. Since it is one equilibrium of many, reputations can arise arbitrarily, as a result of expectations, and they

³There is a continuum of other optimistic equilibria in which prices are even higher. In these equilibria, if, out of equilibrium, consumers see a price less than the high equilibrium level, they infer that the firm charging that price intends to produce low quality. They do not buy from him as a result, even in the present period, so even if his quality is really high, he has no chance to prove it. Such equilibria seem implausible, and are in any case irrelevant to the point we are trying to make here.

will be self-fulfilling. The firms with good reputations can simply be lucky. That holds true in the present model too: we need not inquire into why some Northern firms have good reputations and earn positive profits while others do not. It will be important to the welfare results, however, that when demand increases in the market because of exports, the extra profits that result are not eaten up by new fixed costs of some kind. If, for example, when the market increases, new firms with good reputations can enter at a fixed cost, then that will dissipate all of the new profits.

Thus, we will assume that in the North the market for the reputation good has the most efficient optimistic equilibrium, in which sufficient firms have good reputations, and the profits which maintain those reputations are at the lowest feasible level. In the South, on the other hand, we will assume that all firms selling the reputation good are in the pessimistic equilibrium. They will produce low quality and sell it at $p_L = 1$.

Under autarky, the outcome is very similar to what we saw in the technology model. Prices of the simple good are the same in both countries, but reputation goods are more expensive and of higher quality in the North, and welfare is higher in the North than in the South.

Demand can be derived from the utility functions as before. A distortion is introduced because the price of the reputation goods exceeds their social cost. Anything that would reduce the price of those goods (to closer to their social cost) while maintaining high quality would reduce that distortion—for example, laws that punished false claims of high quality, even if only erratically.

We can also compute out the amount of income that goes to labor and the amount that goes to reputation. The form of analysis of quantities produced would be the same as in the technology model, except for two things. First, price for the high-quality good will be p^* instead of ϕ . Second, national income must now reflect profit as well as wage income. Unlike in the technology model, the 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.

This means that the outcome even in the North will not be the first best. Too much of the simple good will be produced and consumed relative to the high-quality reputation good. This is nonetheless a better outcome than if the high-quality reputation good were not produced at all.

We have seen that under autarky prices in the reputation model will be:

South: $p_0 = 1, p_L = 1, p_H = \text{undefined}, w = 1.$

North: $p_0 = 1, p_L = 1, p_H = p^* = \frac{(\phi-r)}{1-r}, w = 1.$

The equilibrium consumption and utility in the South under autarky is exactly the same as it was in the technology model of Section 2. As equation (14) told us,

$$x_L(\text{South}) = \frac{L}{2} \quad x_H(\text{South}) = 0 \quad x_0(\text{South}) = \frac{L}{2} \quad (40)$$

The North is slightly more complicated, because now national income contains profit as well as wages. The value of goods purchased is $p_0x_0 + p_Hx_H$, as before. Income, however, includes not just wages, equal to w times the one unit of labor, but profit, which equals x_H times the p_H minus the unit cost of the labor used to produce high quality. Thus, for the North the budget equation is

$$p_0x_0 + p_Hx_H = w(1) + (p_H - \phi w)x_H. \quad (41)$$

This implies $p_0x_0 + (p_H - p_H + \phi w)x_H = w$, so once we set $w = 1$ and $p_0 = 1$,

$$x_0 + \phi x_H = 1, \quad (42)$$

which is identical to what came out of the technology model's budget constraint. The technology model's derivation of demands based on relative prices remains applicable here, but now $p_H - p^*$ instead of $p_H = \phi$. The budget constraint and the real cost of the high-quality good have not changed, but the price of the high quality good is higher. Since $p^* < 2$, Northern consumers will buy only the high-quality good. Equation (8) says that $x_0 = p_Hx_H$, so we can conclude that

$$p_Hx_H + \phi x_H = 1, \quad (43)$$

and

$$x_L(\text{North}) = 0 \quad x_H(\text{North}) = \frac{1}{\phi + p^*} = \frac{1}{\phi + \frac{\phi-r}{1-r}} = \frac{1-r}{1 + \phi - 2r}, \quad x_0(\text{North}) = p_H x_H = \frac{p^*}{\phi + p^*}. \quad (44)$$

Since $p^* > \phi$, the North's per capita consumption of the simple good is higher than the South's (which is $1/2$). Since both ϕ and p^* are less than 2, the North also gets more utility from its consumption of the reputation good: $(2)\frac{1}{\phi+p^*} > 1/2$.

Thus, as in the technology model, in the reputation model the North's utility is higher than the South's under autarky due to the higher quality of its reputation goods.

Though the North does better than the South, however, it does not attain the first-best, though for reasons unrelated to lack of free trade. The need to keep prices high to ensure quality results in inefficiently low consumption of the high-quality good in the North. Observe also the curious difference from the technology model that the North has some of its national income going to firms as pure profit, even though all firms are capable of producing the exact same products and even though they compete in price.

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

3b. Opening Up Trade: Large North ($L < 1$)

Now let us open up trade between North and South. We assume that firms retain their reputations when they engage in international trade (for the implications of the opposite assumption, see Chisik [2003]).

In equilibrium, the South will only produces the simple good, some of which it exports. The North will produce both goods, and export the

reputation good. Northern firms gain. Southern consumers gain. Southern and Northern wages are unchanged. Southern firms are unaffected, earning zero profits.

Prices will be $p_0 = 1$, $p_L = 1$, $p_H = p^*$, $w_N = w_S = 1$.

The new world price of the simple good will be $p_0 = 1$ (as a normalization), the price of a low-quality reputation good will be $p_L = 1$, and the price of a high-quality reputation good will be $p_H = p^*$. In the North and South alike, the wage will equal $w_S = w_N = 1$. Northern firms that produce high-quality reputation goods will have positive profits, which will increase with trade; other firms will have zero profits.

The South will produce only the simple good, some of which it will export to the North. The North will produce both goods, and export some of the reputation good to the South.

These prices result because there must be a single world price for the traded goods and the North will be producing both the simple good and the high-quality reputation good in equilibrium. Its price for the high-quality good must therefore be the minimum which is accepted by consumers as a sign of high quality, which is the p^* we derived under autarky. Since the simple good is produced in both countries, and using the same amount of labor in each, for firms to earn zero profits also requires that the wage be the same in North and South.

The South's prices have changed to become equal to the North's. This means that consumption of the low-quality good, with a price of $p_L = 1$, will fall to zero, since that is more than half the price of the high-quality good, $p_H = p^*$. As a result, equation (8) from Section 2 tells us that the South's consumption proportions will be the same as the North's: $x_0 = p_H x_H = p^* x_H$. The South's consumption levels under trade are lower than the North's under autarky however; we cannot just point to equation (44) above as being the South's consumption when the North's prices become the world prices. The reason is the budget constraint: under autarky, the North's national income includes the profits from the high-quality good, but

under trade, the South's national income does not. Instead, the South's national income derives solely from labor: wL . Thus, its budget constraint is $p_0x_0 + p_Hx_H = wL$ or $x_0 + p^*x_H = L$. Solving this out using the consumption proportions $x_0 = p^*x_H$ from equation (8) yields

$$x_L(\textit{South}) = 0 \quad x_H(\textit{South}) = \frac{L}{2p^*} \quad x_0(\textit{South}) = \frac{L}{2}. \quad (45)$$

This yields higher per capita utility than the South's consumption of $x_L(\textit{South}) = L/2$ and $x_0(\textit{South}) = L/2$ under autarky, if not as high as the North's consumption of $x_H(\textit{North}) = \frac{1}{\phi+p^*}$ and $x_0(\textit{North}) = \frac{p^*}{\phi+p^*}$. The South is better off under trade even though a careless observer, not correcting for quality, might complain that the Southern consumer was now paying more for the reputation good and that part of Southern labor was in effect being shipped overseas to become part of the profit of Northern firms.

We can now determine the level of trade. The South produces none of the reputation good and L of the simple good, exporting $L/2$ to the North and consuming the rest. The North exports the South's entire consumption of the high-quality reputation good, $x_H(\textit{South}) = \frac{L}{2p^*}$.

We have seen that one difference from the technology model is that in the reputation model with a Large North trade does not result in the South's per capita consumption rising all the way to the North's level. Another difference is that even a Large North will gain from trade (as opposed to its welfare remaining unchanged), something that did not happen in the technology model. Let us next look at what happens to the North's consumption under trade.

Prices in a Large North do not change as a result of trade, which is why its welfare did not change in the technology model. In the reputation model, however, the North earns profits from its export of high-quality goods. Thus, while trade gives the South new prices, it gives the North a new budget constraint. The North's exports are $x_H(\textit{South}) = \frac{L}{2p^*}$, and on each unit of export, a profit of $p^* - \phi w_N$ is earned, which is a total export profit (which

we shall denote as π_x) of

$$\text{North's Export Profit} \equiv \pi_x = \frac{L(p^* - \phi)}{2p^*} \quad (46)$$

Observe that this increases in p^* , though if p^* ever went above $p^* = 2$, the South would switch to the low-quality good and Northern export profit would fall to zero.⁴

The free trade equivalent of (??), the North's autarky budget constraint, is therefore

$$p_0x_0 + p_Hx_H = w(1) + (p_H - \phi w)x_H + \frac{L(p^* - \phi)}{2p^*} \quad (47)$$

Equation (8) tells us that the North's consumption proportions will be unchanged from autarky: $x_0 = p_Hx_H = p^*x_H$. Thus, consumption can be found simply by modifying the autarky levels from (44) to include consumption of the extra profit income:

$$x_L(\text{North}) = 0 \quad x_H(\text{North}) = \frac{1}{\phi + p^*} + \frac{\pi_x}{\phi + p^*} \quad x_0(\text{North}) = \frac{p^*}{\phi + p^*} + \frac{\pi_x p^*}{\phi + p^*} \quad (48)$$

The North's utility has risen as a result of trade, but through higher income, not lower prices.

To summarize: if the North is Large, then when trade is opened up, it benefits both North and South. The South gains the ability to consume high quality, while the North gains profit from increased sales of the high-quality reputation good, even though its price does not rise. The gain to the South was found in the technology model also; the gain to the North was absent there. A secondary result is that free trade does not raise the South's welfare to the same as the North's, whether we compare it to the North's autarky

⁴If a rise in the discount rate caused the price to rise above this limit of $p^* = 2$, exporters could not succeed in keeping their customers by voluntarily restraining their prices. As always in the optimistic reputation equilibrium, the high prices are not caused by the greed of the firms, but the prudence of the consumers, who know that a firm with too low a price has too little incentive to produce high quality.

welfare or free trade welfare. The reason is that a country benefits from being the one producing the high-quality good, since its firms then earn the positive profits from it.

3c. Opening Up Trade: Small North ($L > 1$)

Now let us assume that it is the North that is Small, so the South's autarky prices become the world prices under free trade.

Prices will be $p_0 = 1$, $p_L = 1$, $p_H = 2$, $w_S = 1$, $w_N = \frac{(2-2r)}{\phi-r} > 1$.

If the North is Small, then in equilibrium it will specialize completely in the high-quality good, some of which it will export to the South. The South will produce both the low-quality good and the simple good, some of which it exports to the North. Since the South is producing both goods, zero profits requires that $p_L = 1$ and $p_H = 2$. Since the South is producing the simple good, $w_S = 1$.

What about the Northern wage? Inequality (35) said that the price of the high-quality good had to be high enough that a firm would not sacrifice its profits from reputation in exchange for the one-time windfall profit from selling low quality,

$$p^* \geq \frac{(\phi - r)w}{1 - r}.$$

When the North is Small, p_H is set by competitive conditions in the South, so $p_H = 2$. If the Northern wage remained $w_N = 1$, however, this would yield profits to the Northern firms in excess of those necessary to sustain high quality. To reduce profits to the minimum necessary requires that (35) be satisfied as an equality. Before, we took $w = 1$ and solved for p_H . Now, we set $p_H = 2$ and solve for w_N :

$$2 = \frac{(\phi - r)w_N}{1 - r}, \tag{49}$$

which yields

$$w_N = \frac{(2 - 2r)}{\phi - r}. \tag{50}$$

For the small r that we assume, this says that the Northern wage rises as a result of trade. Northern firms and workers both gain from trade. Northern consumers lose. Southern consumers win.

Next, let us look at production and trade quantities. The North specializes completely in the high-quality good, some of which it will consume and some of which it will export to the South. Since the North has 1 unit of labor and each unit of the high-quality good requires ϕ in labor, its output will be $1/\phi$ units of the high-quality good. Unlike in Section 3b's equation (47), it is now easiest to write the North's budget constraint in terms of total profit, rather than summing domestic profit and export profit:

$$p_0x_0 + p_Hx_H = w(1) + (p_H - \phi w_N)\frac{1}{\phi} \quad (51)$$

so $x_0 + 2x_H = w_N + \frac{(2-\phi w_N)}{\phi}$ and $x_0 + 2x_H = \frac{2}{\phi}$. Equation (8) tells us that the North's consumption proportions will be $x_0 = p_Hx_H = 2x_H$, so we can conclude that

$$x_L(\text{North}) = 0 \quad x_H(\text{North}) = \frac{1}{2\phi} \quad x_0(\text{North}) = \frac{1}{\phi} \quad (52)$$

Compare this with the autarky consumptions from equation (44) of $x_H = \frac{1}{\phi+p^*}$ and $x_0 = \frac{p^*}{\phi+p^*}$. Consumption of both has increased with trade (since $p^* > \phi$), so Northern welfare has risen.

The South's welfare is the same as under autarky. It consumes the same amount of the simple good, and although it now consumes some of the high-quality good, the price is so high that Southern consumers are indifferent between it and the low-quality good.

Northern welfare is higher than under autarky, for two reasons. First, the price of the high-quality good has risen from p^* to 2, which benefits the North through an increase in the wage. Second, Northern sales of the high-quality good have increased, and each unit yields a positive profit to the firm that sells it. Thus, Northern welfare rises.

Qualitatively, there is no great difference between the reputation model and the technology model for the Small North case. In both models, trade

raises the price of high quality in the North, the North exports it to the South, both high and low quality are consumed in the South, and the North sees a rise in welfare while the South's welfare is unchanged.

3d. Southern Firms Improve Technology or Reputation.

In the technology model, technological progress in the South has immediate effects on prices if the South is Large and dramatic effects on trade if the South catches up the North, regardless of relative size.

A striking implication of the reputation model is that the technology available to the South is unimportant. The model begins with equal technologies in North and South: $\phi_s = \phi_n = \phi$. What if we reduced the South's cost of producing high quality slightly, so it became superior to the North? Nothing in the model would change. If the Southern firms have poor reputations, then consumers do not care that the firms *could* produce high quality at low cost—the question is whether they would actually do so, and in a pessimistic equilibrium, they would not. An improvement in technology would only help the South if it were so extreme that $\phi_s < 1$, which is to say that high quality became cheaper to produce than low quality. If that happened, then even firms with poor reputations would switch to high quality, of course. Thus, unless the improvement in technology is extreme, if the reputation model applies it would be a waste of effort for firms or governments in the South to try to improve production technology. The problem is in trust, not technology.

If, on the other hand, the Southern firms did develop good reputations, trade would become unnecessary. The South could produce the high-quality good, and if consumers switched their loyalty, the profits flowing to firms with good reputations would flow to Southern firms instead of Northern firms. Clearly, this helps the South and hurts the North, whether the North is large or small.

3e. Direct Investment by the North in the South in the Reputation Model

What if the Northern firms can combine their good reputations with Southern labor?

In the Large North case, such direct investment has results similar to free trade. Direct investment can replace export of the high-quality good from the North to the South, and the South would no longer specialize in the simple good, but prices and welfare would be the same whether Northern firms with their good reputations produce the good in the North or in the South. Whether the Northern firms use exports or direct investment, they pay the same wages, use the same production function, and earn the same profits.

In the Small North case, direct investment does have a different effect from trade, because it overcomes the bottleneck of the limited supply of Northern labor. If direct investment is possible, Southern and Northern labor compete head-to-head, so their wages cannot be different, and Northern workers do not have the high wages generated by trade.

Northern firms would still earn their positive profits under direct investment, and these would in fact rise, but not merely because direct investment allows them to pay lower wages to produce the high-quality good. It does, but the lower wages also result in lower prices, as the firms compete prices down to the minimum necessary to sustain high quality. The price of the high-quality good will not be $p_H = 2$, as with trade, but $p_H = p^*$, as in the North under autarky. The ultimate effect will be to increase the profits of the Northern firms, but only because the lower price will result in greater Southern consumption of the high-quality good. The Northern firms's profit rises because of greater volume, not because of a higher mark-up.

If the South is much larger than the North, direct investment can be far more profitable for the North than trade, because the advantage in profits will dominate the disadvantage in wages. From the Southern consumer's perspective, the Small North case with direct investment looks just like the Large North case with free trade, because prices will adjust to the North's autarky levels, and though production of the high-quality good will increase in the South, all the profits will go to the North. Thus, consumption will be

the same as given in (45):

$$x_L(\text{South}) = 0 \quad x_H(\text{South}) = \frac{L}{2p^*} \quad x_0(\text{South}) = \frac{L}{2}. \quad (53)$$

The North will be earning profits of $p^* - \phi$ per unit on the southern production of $x_H(\text{South}) = \frac{L}{2p^*}$, for a total profit from direct investment of

$$\text{North's direct investment profit} = \frac{(p^* - \phi)L}{2p^*}. \quad (54)$$

If the North is only slightly smaller than the South (L is just above 1) and the quality-inducing markup is small ($p^* - \phi$ is small) then the North's profits from direct investment are small and its workers' wage gains from trade were large. In that case, direct investment reduces the price drastically from $p_H = 2$ to almost $p_H = \phi$, and the North would be better under trade than using direct investment.

If, on the other hand, the North is much smaller than the South (L is a large multiple of 1) and the quality inducing markup is high ($p^* - \phi$ is large) then the North's profits from direct investment are high and its workers' wage gains from trade were small. Direct investment reduces the price only slightly, from $p_H = 2$ to a p^* near 2, the wage falls only slightly in the North, but Northern firms are able to produce and sell a much greater quantity in the South. In that situation, direct investment would enhance Northern welfare much more than trade.

4. Summary and Concluding Remarks

The models used here were deliberately simple. The technology model, with its one factor, two goods, and perfect information is perhaps the simplest possible way to model differences in quality across countries. Its drawback is that technology transfer seems to be too easy to be the only thing at work to explain why quality differs across countries. The reputation model raises the complexity level slightly, by providing a reason why firms would be able—in fact, required—to mark up prices above cost for high-quality goods, and

for those goods alone. Technology transfer no longer can bring the South up to the North's level of production; what is needed is reputation transfer.

In many ways the the technology and reputation models have the same implications. In both, quality under autarky is higher in the North than the South, and opening up trade results in Northern exports of the high-quality good to the South. If the North is Large, its autarky prices determine world prices and wages under free trade, and Southern consumers benefit while Northern consumers and workers everywhere are unaffected. If the North is Small, the South's autarky prices determine world prices under free trade, and Southern consumers derive no benefit but Northern workers see a rise in wages.

There are differences in the implications of the two models, however, chiefly arising from the positive profits the Northern firms earn from the high-quality good in the reputation model even in competitive markets. Because of these positive profits, a country benefits more if its firms produce the high-quality good than the low-quality good or the simple good, and expanding the market always helps, even if it does not change the terms of trade. Thus, Northern firms benefit when trade is opened up, even if the North is Large. This effect also provides a second reason, besides higher wages, why a Small North benefits from opening up trade. Since it is the Northern firms that earn the profits, another implication is that opening up trade will not lift the South to the North's level of prosperity, even if Southern consumers now pay prices just as low as Northern consumers.

Perhaps the most striking implications are in the areas of technology diffusion and direct investment. In the technology model, the South's consumption pattern becomes identical to the North's if either Southern firms acquire Northern technology or Northern firms take their production South. Moreover, technology diffusion and direct investment both leave the North either unaffected, or hurt it, by reducing Northern wages. The problem for the North is that technology diffusion eliminates its advantage, and competition among its firms reduces any profits they might earn from direct investment. In the reputation model, the effects are different. Technology diffusion is

irrelevant, because the South's problem is not poor technology, but poor reputations. What Southern firms need is to be able to acquire the Northern firms' reputations, a less straightforward problem. Direct investment will, as in the technology model, equalize wages in North and South. But Northern firms cannot compete away their profits, because zero markups over cost would destroy their reputations; price competition is limited to keeping the markup at the minimum necessary for consumers to trust that the firms have the incentive to produce high quality. Thus, even in the long run, direct investment would benefit Northern firms— and potentially benefit the North much more than trade, since trade is limited by the number of Northern workers able to produce the high-quality good.

A question unaddressed in this paper is how a firm develops a reputation in the first place. Perhaps like innovation, it requires investment in a fixed cost. In that case, spreading the fixed cost over more markets gives added incentive to invest in reputation. Or it could just be a matter of historical luck. Expectations in the North were optimistic, and sellers developed good reputations and sold high-quality goods. Or, it could be a matter of social capital more generally: internal principles or a tradition of government enforcement of honesty leads to optimistic equilibria even where guilt and the police do not have the ability to induce good behavior. Reputation could be endogenized in a variety of ways, with different implications for policy.

If reputation is combined with one of the differentiated product models commonly used in trade models, we might imagine some firms in a growing South acquiring good reputations in the new products that are developed, rather than having to compete head-to-head with Northern firms. On the other hand, if competition is head-to-head and both reputation and technology are endogenous, Southern firms might be trapped in a situation where their technologies are so inferior that they could not compete at equal prices even if they somehow developed good reputations, but investing in technology by itself would also be useless.

Models are metaphors, this one perhaps more than most. In broad terms, the reputation model is showing how important reputation can be—

behaving, even, like another factor of production. A nation with a greater endowment of the factors of production will have higher utility, and a greater endowment of reputation is no different in that respect. Unlike most factors, however (though like technology and information generally), reputation is a nonrivalrous input: a firm with a good reputation can expand its output without extra cost, including expanding it 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.

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