

A Trust Model of Quality in North-South Trade

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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.

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From the year 2007:

News of the execution came on a day when newspapers were reporting that 50 per cent of all water coolers in Beijing likely contain nothing more than tap water.

Citing a Beijing Times report, the government-controlled China Daily newspaper said unnamed sources at major bottling companies confirmed a report casting suspicion on the quality of major-brand bottled water marketed in the city.

From the year 2007:

What I most regret now is that I should not have gone into government.

In 1968 when I graduated from the biology department of Fudan University, I should have continued on in the field. If I had continued on in the field, then there's no question that I would have become a professor long ago. I would be living a good life, and I would not have fallen to today's outcome.

If there is reincarnation I will definitely not go into government!

2. The Model

Firms use one factor of production, labor, in two countries, the North and the South. The North has 1 unit of labor and the South has $S < 1$.

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.

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

$$U = x_0^\alpha (x_l + \theta x_h)^\alpha \quad (1)$$

where $\alpha < 1$, and where $\theta > \phi$ is the relative value of high quality.

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

The discount rates 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 p_0 for the simple good, with $p_0 \equiv 1$ as a normalization, and p_l and p_h for the low and high-quality experience goods.

3. Optimistic and Pessimistic Equilibria

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.

In the 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.

In the optimistic equilibrium, 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. Consumers buy the good from a firm if and only if its price equals p^* and the firm has never produced low quality.

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The firm's value if it produces high quality is:

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

so

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

The firm's value if it produces low quality is:

$$(p^* - 1) + \left(\frac{1}{1+r}\right) (0), \quad (4)$$

For the firm to choose high quality it must be true that

$$\frac{(1+r)(p^* - \phi)}{r} \geq p^* - 1 \quad (5)$$

Competition among firms turns this weak inequality into an equality,

$$p^* = \phi + (\phi - 1)r \quad (6)$$

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

Two reasons that a firm might have a good reputation

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 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^* .

The greatest number of firms for which investment is profitable is M , where M is the biggest integer such that:

$$Profit(M) = -A + \left(\frac{X}{M}\right) \left((1+r)(\phi-1)\right) \geq 0, \quad (7)$$

4. North and South under Autarky

(1) Autarky quality might be low in both countries. Maybe $p^* > \theta$
Or, expectations are pessimistic everywhere, 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:

$$\underset{x_0, x_l, x_h}{\text{Maximize}} \quad U = x_0^\alpha (x_l + \theta x_h)^\alpha \quad \text{such that} \quad x_0 p_0 + x_l p_l + x_h p_h = \text{income} \quad (8)$$

which has the first order conditions:

$$\frac{\alpha U}{x_0} - \lambda p_0 = 0, \quad \frac{\alpha U}{x_l + \theta x_h} - \lambda p_l = 0, \quad \frac{\theta \alpha U}{x_l + \theta x_h} - \lambda p_h = 0 \quad (9)$$

If it is optimal to consume all three goods then:

$$\lambda = \frac{\alpha U}{x_0 p_0} = \left(\frac{1}{p_l} \right) \left(\frac{\alpha U}{(x_l + \theta x_h)} \right) = \left(\frac{\theta}{p_h} \right) \left(\frac{\alpha U}{(x_l + \theta x_h)} \right) \quad (10)$$

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.

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, (in because expectations are pessimistic, so $x_l > 0$ and $x_h = 0$). Then:

$$x_0(\textit{South}) = x_l. \quad (11)$$

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

$$x_0(\textit{South}) = \frac{S}{2}, \quad x_l(\textit{South}) = \frac{S}{2} \quad (12)$$

Utility of a Southerner with one unit of income is:

$$U(\textit{South}) = \left(\frac{1}{2}\right)^\alpha \left(\frac{1}{2} + 0\right)^\alpha = \frac{1}{4^\alpha} \quad (13)$$

Next, consider the North, where $p_0 = p_l = w = 1$ 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 $x_h > 0$. Then:

$$x_0 = p^* x_h \quad (14)$$

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, $p_0 x_0 + p_h x_h = \text{income}$ is:

$$x_0 + p^* x_h = 1 + (p^* - \phi)x_h \quad (15)$$

Northern consumption is:

$$x_h(\text{North}) = \frac{1}{p^* + \phi} \quad (16)$$

and

$$x_0(\text{North}) = \frac{p^*}{p^* + \phi} \quad (17)$$

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

$$U(\text{North}) = \left(\frac{p^*}{p^* + \phi} \right)^\alpha \left(0 + (\theta) \left(\frac{1}{p^* + \phi} \right) \right)^\alpha \quad (18)$$

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

$$U(\textit{North}) = \left(\frac{p^*}{p^* + \phi}\right)^\alpha \left(0 + (\theta) \left(\frac{1}{p^* + \phi}\right)\right)^\alpha \quad (20)$$

The North's utility is higher than the South's.

First, the North consumes more of the simple good. The South consumes $1/2$ per capita of the simple good, while the North consumes $x_0(\textit{North}) = \frac{p^*}{p^* + \phi}$, 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 (??), becomes:

$$x_0 + p^* x_h = 1 + 0 \quad (21)$$

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

$$x_0 = \frac{1}{2} \text{ and } x_h = \frac{1}{2p^*} \quad (22)$$

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 $p_l = 1$.

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 $p_h = p^* > 1$. 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 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:

$$x_0 + p^* x_h \leq \text{income} = S \quad (23)$$

Combining this with $x_0 = p^* x_h$, total consumption in the South is:

$$x_0(\text{South}) = \frac{S}{2} \quad x_h(\text{South}) = \frac{S}{2p^*} \quad (24)$$

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

The North is more complicated because its national income contains profit, and possibly reputational investment which eats into profit. The value of goods purchased is $(x_0 + p_h x_h)$. Income includes not just wages, equal to w times the one unit of labor, but profit, $x_h(p_h - \phi w)$, where 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:

$$p_0 x_0 + p^* x_h = w(1) + (p^* - \phi w)[x_h(North) + x_h(South)] \quad (25)$$

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

$$x_0 + p^* x_h = 1 + (p^* - \phi) \left[x_h(North) + \left(\frac{1}{2p^*}\right) S \right] \quad (26)$$

This can be combined with $x_0 = p^* x_h$ to yield:

$$\begin{aligned} x_h(North) &= \frac{1}{2p^* - (\phi - 1)r} + \frac{S}{2p^*(2p^* - (\phi - 1)r)} \\ &= \frac{1}{p^* + \phi + (\phi - 1)r - (\phi - 1)r} + \frac{S}{2p^*(2p^* - (\phi - 1)r)} \\ &= \frac{1}{p^* + \phi} + \frac{S}{2p^*(2p^* - (\phi - 1)r)} \end{aligned} \quad (27)$$

in which case:

$$x_0(North) = \frac{p^*}{p^* + \phi} + \frac{S}{2(2p^* - (\phi - 1)r)} \quad (28)$$

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 (??) that $x_0(North) = \frac{p^*}{p^* + \phi}$, 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 (??)) and higher than the South's consumption under free trade (since $\frac{1}{p^* + \phi} > \frac{1}{2p^*}$, even if $S = 0$.)

What if it is the South that has optimistic expectations and the North that does not?

The world price becomes the South's price of p_{hs}^* , the South has higher utility, and both countries benefit from trade. Something over half of the world's labor is used in producing the simple good, just as in the analysis earlier in this section it turned out that some. The South produces both the simple good, for domestic use only, and the high-quality good, mostly for export.

If, however, the South is enough smaller than the North, the results are different. Opening up trade generates endogenously the knife-edge case that $p_h = \theta$ and consumers in both countries are indifferent between the low- and high-quality experience goods. The South specializes in the high-quality experience good, but the North produces the low-quality experience good too, because both are equally attractive to consumers at the equilibrium price. The North's welfare is unchanged compared to autarky. The South's welfare rises, because although consumption prices have worsened, not just profits but wages will rise with the increased demand for the Southern high-quality good, as will prices.

A Technology Model of Quality Differences across Countries

How does the trust model compare with a purely technological model of quality differences across countries?

Let one unit of the high-quality reputation good cost $\phi_n < \theta < \phi_s$ units of labor to produce in the North and the South.

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.

All that is just as in the trust model. 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: $p_h = 1$ 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.

From the year 2000:

The Chinese legislature is revising the Pharmaceutical Administration Law to strictly control the country's drug market.

At the 17th meeting of the Standing Committee of the National People's Congress today, a hearing was held for the report on the draft revision of the law delivered by Zheng Xiaoyu, director of the State Drug Administration.

Since being implemented on July 1, 1995, the law has played a big role in curbing the making and sale of counterfeit and inferior drugs, Zheng said.

But the law is out of date and needs to be revised to keep up with the times, according to the official.

From the year 2004:

Speaking at a press conference, Zheng Xiaoyu, director of the State Food and Drug Administration (SFDA), said the Chinese government always attaches great importance to combating counterfeit medicines.

Since 2003, in order to further rectify and regulate the order of the pharmaceutical market and crack down on the illegal activities concerning counterfeit drugs and medical devices, the State Council has carried out the "Safe Food and Drug Campaign".

Zheng said that due to the effective combat against counterfeit drugs, in 2003, the acceptance rate of drugs nationwide was 97.1 percent, the fourth consecutive year of the rate of 95 percent or above.

From the year 2007:

From 1997, Zheng exploited his grip on drug approval powers to squeeze bribes that went to his wife and son, Xinhua news agency reported. One company in Zhejiang province in the east fed them "consultancy fees" and other rewards worth 2.9 million yuan.

From 2001, Zheng used a shake-up of drug approval rules to concentrate power with him and some close associates, and companies – including some investigated for using fake ingredients – were allowed to register substandard medicines for a price.

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 Economy*, 89(4): 615-641 (August 1981).

- Levchenko, 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.

- Papadopoulos N. & Heslop L. (2002) "Country Equity and Country Branding: Problems and Prospects," *Journal of Brand Management*, 9(4-5): 294-314 (April 2002).
- 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 (2006) "A Reputation Model of Quality in North-South Trade " (working paper version)<http://rasmusen.org/special/trade-jan06.pdf>.
- 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).
- 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).