Economics Bulletin

Volume 34, Issue 1

The gains from external scale economies and comparative advantage

Kwok Tong Soo
Lancaster University

Abstract

This note develops a model of inter-personal trade which combines comparative advantage and external scale economies. It is shown that the gains from external scale economies outweigh those from comparative advantage as the population size increases.

Thanks to Roy Ruffin and seminar participants at Lancaster University and the European Trade Study Group in Copenhagen for useful comments and suggestions. The author is responsible for any errors and omissions.
Citation: Kwok Tong Soo, (2014) "The gains from external scale economies and comparative advantage", *Economics Bulletin*, Vol. 34 No. 1 pp. 84-88.
Contact: Kwok Tong Soo - k.soo@lancaster.ac.uk.
Submitted: October 31, 2013. **Published:** January 20, 2014.

1. Introduction

Ruffin (2009) develops a model of inter-personal trade with many individuals. In the Ruffin (2009) model, individuals are different from each other, in the sense that each has a comparative advantage in a different good. He shows that the gains from specialisation according to comparative advantage are larger, the larger is the population involved.

This note extends the model developed in Ruffin (2009) by including both comparative advantage and external scale economies. The main idea is that not only are individuals different from each other, but there are additional gains from specialisation; it may be that individuals gain experience from repeating the production process and therefore become more efficient. The main result we obtain is that external scale economies play a bigger role in the gains from trade than comparative advantage as the number of goods and individuals rises.

In terms of related literature, Ethier (1982) develops the modern theory of international trade with external scale economies, while Grossman and Rossi-Hansberg (2010) provide a more recent treatment. Ruffin (1988) develops an alternative model of inter-personal trade. Kremer (1993) shows that population size is a key determinant of technological change, while Caballero and Lyons (1990) show that external scale economies are important in European industry.

2. The model

There are n individuals and n goods, $1, \ldots, n$. Each individual has 1 unit of labour. Individual *j* has a comparative advantage in good *j*; the production functions for individual *j* take the following form:

$$q_j = L_j^{\beta} \qquad q_i = (\alpha L_i)^{\beta} \qquad i \neq j \qquad \beta > 1 \qquad \alpha < 1 \qquad (1)$$

That $\beta > 1$ signifies that the production technology exhibits external scale economies: the more that is produced, the lower the average cost. Similarly, $\alpha < 1$ signifies that individual *j* has a comparative *dis*advantage in goods i (equivalently, a comparative advantage in good *j*).

Each individual's utility is a Cobb-Douglas function:

$$U = n^{\theta+1} \prod_{i=1}^{n} c_i^{\frac{1}{n}}, \qquad \theta > 0 \qquad (2)$$

Where the term $n^{\theta+1}$ indicates that individuals have a love for variety[1]. In autarky, each individual *j* will produce all goods, and given the Cobb-Douglas utility, will devote $1/n$ labour to each good, producing $(1/n)^{\beta}$ units of good *j* and $(\alpha/n)^{\beta}$ units of all other goods i. Utility under autarky will be:

$$U_A = n^{\theta+1} \left(\frac{1}{n}\right)^{\frac{\beta}{n}} \left(\frac{\alpha}{n}\right)^{\frac{\beta(n-1)}{n}} = n^{1+\theta-\beta} \alpha^{\beta\left(\frac{n-1}{n}\right)} \qquad (3)$$

[1] Note that the love for variety term $n^{\theta+1}$ plays no role in the gains from trade results below, since it cancels out of the respective formulae. It has been retained to highlight the similarity with the formulation in Ruffin (2009).

Ethier (1982) emphasises the possibility of multiple equilibria in the presence of external scale economies when trade is allowed. Briefly, (possibly unstable) equilibria exist in which countries may be specialised in any of the n goods, or incompletely specialised in some combination of them. To illustrate the main point of this paper, we focus on the equilibrium in which the patterns of trade are consistent with natural comparative advantage. In this case, when there is free inter-personal trade, each individual will specialise in the good in which he has a comparative advantage, and import the other $n-1$ goods from the other $n-1$ individuals. Following Ruffin (2009), assume that individuals behave competitively and hence prices of all goods are the same. Therefore, output of each good is equal to 1, so consumption of each good by each individual is equal to $1/n$. Free trade utility is therefore:

$$U_T = n^{\theta} \tag{4}$$

Define the gains from trade as the ratio between free trade and autarkic utility. The gains from trade are:

$$G_{TOTAL} = \frac{U_T}{U_A} = n^{\beta-1}\alpha^{\beta\left(\frac{1-n}{n}\right)} \tag{5}$$

Gains from trade arise since $G_{TOTAL} > 1$.

If $\beta = 1$, then the model reverts to that of Ruffin (2009), in which there are no external scale economies, only differences in productivity across countries. In this case, comparative advantage is the only reason for trade between countries. As a result,

$$G_{CA} = \alpha^{\frac{1-n}{n}} \tag{6}$$

so the gain from trade always increases in the number of goods (and individuals) n, but at a decreasing rate.

If $\alpha = 1$, then the model only has external scale economies, and no comparative advantage. In this case, the gain from trade arises because individuals will experience lower costs when they specialise. Hence:

$$G_{SCALE} = n^{\beta-1} \tag{7}$$

so that the gain from trade increases in n but also at a decreasing rate if $\beta < 2$.

We can decompose the total gains from trade into the component derived from comparative advantage alone, the component derived from external scale economies alone, and the component derived from the interaction between comparative advantage and external scale economies as follows:

$$G_{TOTAL} = G_{CA} \times G_{SCALE} \times \alpha^{\frac{(1-\beta)(n-1)}{n}} \tag{8}$$

Where the last term is the gain from the interaction between comparative advantage and external scale economies; it may be interpreted as the additional gain from having comparative advantage in the presence of external scale economies, or vice versa. This term is always greater than 1; there is complementarity between external scale economies and comparative advantage. If either α or β is equal to 1, this interaction term vanishes[2]. Figure 1

[2] The complementarity between external scale economies and comparative advantage arises because of the way the production functions have been formulated in equation (1).

shows the decomposition of the gains from trade as a function of n, drawn for $\alpha = 0.4$ and $\beta = 1.3$.

Figure 1 shows that the gains from external scale economies increase faster in n than do the gains from comparative advantage. This can also be seen by dividing equation (7) by equation (6). This gives:

$$\frac{G_{SCALE}}{G_{CA}} = n^{\beta-1}\alpha^{\frac{n-1}{n}} \tag{9}$$

This expression increases as n increases; that is, the gains from external scale economies become more important relative to the gains from comparative advantage as n increases, as shown in Figure 1.

Setting $G_{CA} = G_{SCALE}$ allows us to solve for the value of n for which the gains from comparative advantage are equal to the gains from external scale economies:

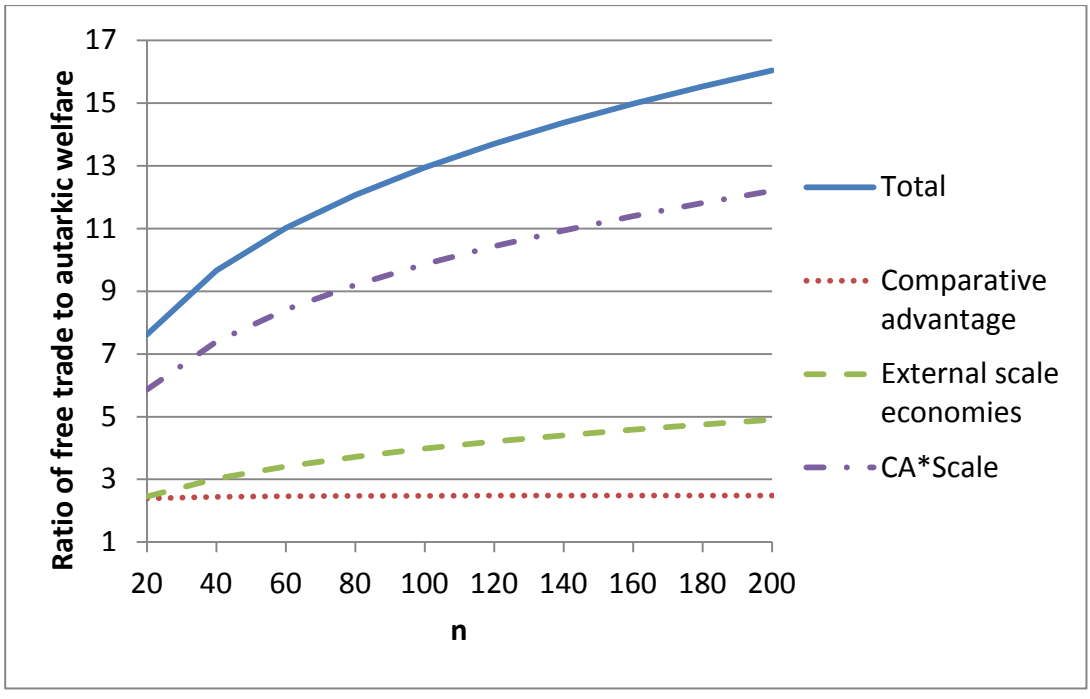
$$(n^*)^{\frac{n^*}{n^*-1}} = \alpha^{\frac{1}{1-\beta}} \tag{10}$$

From equations (9) and (10), values of n greater than n^* imply that the gains from external scale economies exceed those from comparative advantage. Hence we have:

Proposition 1: As the number of goods and individuals $n \to \infty$, the gains from trade predominantly result from external scale economies, not comparative advantage.

What Proposition 1 says is that as global markets become more integrated, and the number of goods and trading partners increases, external scale economies will become an increasingly important source of the gains from trade.

Figure 1: Decomposition of the gains from trade.



Each individual will export the good in which he is specialised, and will import the remaining $n-1$ goods. The volume of inter-personal trade is the same as in Ruffin (2009). Since there are n individuals, each producing one unit of one good in the free trade equilibrium, the volume of trade is $n-1$, so the share of trade in GDP is $(n-1)/n$, which is increasing in the number of goods and individuals n. Hence the larger the population, the larger the share of inter-personal trade in GDP.

3. Conclusions

In this note, we extend the model of inter-personal trade developed in Ruffin (2009) to compare the contributions of comparative advantage and external scale economies to the gains from trade. In the model, as the number of goods and individuals increases, the gains from specialisation due to external scale economies outweigh the gains from comparative advantage. The larger the population, the more specialised individuals become in production relative to consumption, and inter-personal trade as a share of output increases. External scale economies add another source of gains from trade, and hence further justify the argument for trade liberalisation.

References

Caballero, Ricardo J. and Richard K. Lyons (1990). 'Internal versus external economies in European industry', *European Economic Review* 34(4), 805-826.

Ethier, Wilfred J. (1982). 'Decreasing costs in international trade and Frank Graham's argument for protection', *Econometrica*, 50(5), 1243-1268.

Grossman, Gene M. and Esteban Rossi-Hansberg (2010). 'External economies and international trade redux', *Quarterly Journal of Economics*, 125(2), 829-858.

Kremer, Michael (1993). 'Population growth and technological change: One million B.C. to 1990', *Quarterly Journal of Economics* 108(3), 681-716.

Ruffin, Roy J. (1988). 'The missing link: The Ricardian approach to the factor endowments theory of trade', *American Economic Review* 78(4), 759-772.

Ruffin, Roy J. (2009). 'The gains from specialisation and population size', *Economics Letters*, 105(1), 76-77.