

Intra-Industry Trade, Consumer Demand and Wage Inequality

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Abstract

Numerous studies [1] [2] [3] [4] have shown that automation and college education may be a bigger contributor to wage-inequality than international trade. Most of these models of trade focus on “comparative-advantage” based trade (*i.e.* trade in different products). Although much of world-trade is “intra-industry” (*i.e.* trade broadly in the same industry) in nature, relatively fewer studies have examined the relationship between wage-inequality and intra-industry trade. This study examines the relationship between intra-industry trade and wage-inequality, using a two-sector model of monopolistic competition. Unlike previous research, this study examines this relationship through a lens that has not been explored much in the previous literature: *differences in consumer demand*, which can arise from factors such as demographic differences (e.g. whether a population is young or aging) between trade partners. My model suggests that: 1) intra-industry trade may be associated with wage-inequality between two sectors in the same country, 2) the magnitude of wage-inequality may depend on the differences in consumer demand in the countries that engage in international trade, and 3) wage-inequality can arise between sectors even if all workers have similar skills to begin with. These preliminary results may have some interesting implications for future research in the international trade literature.

Keywords

Intra-Industry Trade, Wage Inequality, Monopolistic Competition

1. Introduction

The impact of globalization on wages, especially those of blue-collar workers, has shaped the political landscapes in a number of countries in recent years. Within the economics literature, numerous studies have examined the impact of

international trade on the wage-inequality between skilled and less-skilled workers [1] [2] [3] [4]. The general consensus in this literature appears to be that: 1) automation and college education may be a bigger contributor to wage-inequality than international trade [4] [5], and 2) “comparative-advantage” based trade (*i.e.* trade in different products) can lead to wage-inequality [6]. Alternatively, some studies have examined the impact of “INTRA-industry” trade, which is defined as trade in broadly similar products (such as when US exports and imports automobiles to and from Japan), on wage-inequality. A recent study on intra-industry trade suggests that the presence of fixed cost of exporting allows only the most high skill firms to export, which in turn raises the demand for skilled labor and increases wage-inequality between skilled and unskilled labor [7]. Although intra-industry trade makes-up an important share of world trade, much of the international trade literature generally concentrates on the relationship between comparative-advantage driven international trade and wage-inequality.

In this study, I examine the relationship between intra-industry trade and wage-inequality, using a theoretical, two-sector model of monopolistic competition. The simple model presented in this study builds on the seminal work on intra-industry trade by Krugman [8]; however, unlike previous research in this area, the model used in this study can help us examine wage-inequality and intra-industry trade through a lens that has not been explored much in the international trade literature: *differences in consumer demand*. Such differences in demand can arise for a variety of reasons, such as demographic differences (e.g. whether a population is young or aging) between the countries that trade with each other. There is a growing body of research linking aging population and income-inequality [9]; however, we have not come across any studies that shed some light on the relationship between intra-industry trade, consumer characteristics and wage-inequality. With the theoretical model presented in this study, I am able to show that: 1) intra-industry trade may be associated with wage-inequality (in *real* terms) between two sectors in the same country, 2) the magnitude of wage-inequality may depend on the differences in consumer demand in the countries that engage in international trade, and 3) wage-inequality can arise between sectors even if all workers have similar skills to begin with.

The rest of this study proceeds as follows. In Section 2, I describe the basic model of intra-industry trade. In Section 3, I examine the impact of international trade. In Section 4, I provide some concluding remarks.

2. The Basic Model

2.1. Assumptions of the Model

Suppose there is a small open economy that produces two types of products: luxury automobiles (x) and budget automobiles (y). Both types of goods are produced using only one factor of production: labor (L). For simplicity, the aggregate labor supply is fixed at L . On the demand side, there are two types of consumers: big spenders (b_1) and budget spenders (b_2). Big spenders are more

likely to buy luxury automobiles than budget spenders. So, to simplify the algebra, I assume that b_1 consumers buy luxury automobiles x exclusively, while b_2 consumers only buy budget automobiles, y . Suppose there are n varieties of good x and m varieties of good y . The utility functions are set up so that consumers get more utility from having a greater choice of products. A representative b_1 consumer has the following utility function:

$$U_1 = \sum u_1(c_i). \quad u'_1 > 0, u''_1 < 0 \quad (1)$$

subject to the budget constraint $\sum p_i c_i = I_1$. The utility function of the b_2 consumer is given by:

$$U_2 = \sum u_2(c_j). \quad u'_2 > 0, u''_2 < 0 \quad (2)$$

subject to $\sum p_i c_i = I_2$. The elasticity of demand is also assumed to change as product variety changes, since products that are more differentiated tend to have more substitutes (e.g. Ford automobiles have more substitutes, than “automobiles” since the latter is a broader category).

$$e_i = -u'_1 / (u''_1 c_i). \quad \partial e_i / \partial c_i < 0 \quad (3)$$

$$e_j = -u'_2 / (u''_2 c_j). \quad \partial e_j / \partial c_j < 0 \quad (4)$$

Output $x_i(y_j)$ can be produced using labor $l_i(l_j)$ and resource $r_i(r_j)$ respectively. Both sectors are increasing returns to scale and are characterized by fixed costs α_x and α_y . The markets are monopolistically competitive and the production functions, as shown below are largely inspired by Krugman’s [8] monopolistic competition model of international trade.

$$l_i = \alpha_x + x_i. \quad i = 1, \dots, n \quad (5)$$

$$l_j = \alpha_y + y_j. \quad j = 1, \dots, m \quad (6)$$

Since the demand for luxury automobiles must equal its supply, the output of each variety of x will be equal to its consumption by the big spending consumers (c_i). Similarly, the output of y must equal its aggregate consumption across all budget consumers (c_i). Assume that a fraction $\gamma \in (0,1)$ of the aggregate labor supply L represents the big-spending population and the remaining $(1-\gamma)$ of the population belongs to the budget-spending consumers’ category. In reality, different consumers may have different demands. An important reason for this difference in consumer demand that we can consider in this article is the age distribution of the population, or demographic trends. Holding consumer income and other factors constant, younger population may be more likely to fall under the “big-spending” category, while the older population may be more likely to fall under the “budget-spending” consumer category. Therefore, the market clearing conditions are given by:

$$x_i = \gamma L c_i. \quad (7)$$

$$y_j = (1-\gamma) L c_j. \quad (8)$$

Finally, to consider the simplest possible scenario, assume that the model is symmetric, *i.e.* all varieties of luxury automobiles x are produced in the same

quantity and at the same price. Likewise, all varieties of budget automobiles y are produced in the same quantity and price. So, we have:

$$p_x = p_i, x = x_i. \quad (9)$$

$$p_y = p_j, y = y_j.$$

For simplicity, assume that in the Home country, there is an equal number of big-spenders and budget-spenders, workers are identical and that the real wages are equal in both sectors. In addition, labor market clears. So, the supply of workers equal their combined demand in different sectors:

$$L = \sum_{i=1}^n l_i + \sum_{j=1}^m l_j. \quad (9.1)$$

2.2. Equilibrium before Trade

We can now analyze the equilibrium in a “closed” economy. First, the demand functions can be obtained from consumer utility functions, as shown by Equations (1) and (2). Utility maximization yields the following first order conditions:

$$u'_1(c_i) = \eta_1 p_i. \quad i = 1, \dots, n \quad (10)$$

$$u'_2(c_j) = \eta_2 p_j. \quad j = 1, \dots, m \quad (11)$$

In (10) and (11), p_i and p_j are the price of the i th and j th good respectively. In addition, η_1 and η_2 represent the shadow prices on the budget constraints. To obtain the demand functions, the market clearing conditions shown by Equations (7) and (8) respectively, can be substituted in Equations (10) and (11) respectively:

$$p_i = \eta_1^{-1} u'_1[x_i/\gamma L]. \quad (12)$$

$$p_j = \eta_2^{-1} u'_2[y_j/(1-\gamma)L] \quad (13)$$

Next, I consider the profit maximizing behavior of firms in each sector. Firms in sectors x and y will maximize profits according to the following profit functions:

$$\pi(x) = p_x x - w_x l_x. \quad (14)$$

$$\pi(y) = p_y y - w_y l_y. \quad (15)$$

The profits depend on the wages (w_x and w_y). Next, I maximize the profit function (14) with respect to output x to obtain the following:

$$\frac{\partial \pi(x)}{\partial x} = 0. \quad p_x + \frac{\partial p(x)}{\partial x} x - w_x = 0.$$

$$1 + \frac{\partial p(x)}{\partial x} \frac{x}{p_x} = (w/p)_x.$$

Since the elasticity of demand is $e_x = [-\partial p(x)/\partial x][x/p_x]$ the above can be

rewritten as:

$$\begin{aligned} 1 - (1/e_x) &= (w/p)_x \\ (p/w)_x &= e_x / (e_x - 1). \end{aligned} \quad (16)$$

Thus, Equation (16) provides an expression for a firm's price in terms of the elasticity of demand. I then maximize the profit function (15) with respect to output y , using a process similar to the one shown above that led to Equation (16). This process will give us a similar expression for a firm's price in industry y .

$$(p/w)_y = e_y / e_y - 1. \quad (17)$$

Since the monopolistically competitive markets are characterized by free entry, firms in each industry will earn zero profits in equilibrium.

$$\begin{aligned} \pi(x) &= p_x x - w_x l_x = 0 \\ \pi(y) &= p_y y - w_y l_y = 0 \end{aligned}$$

The "free-entry" assumption, together with the market clearing conditions (7) and (8) yields the following pricing rules:

$$(p/w)_x = (\alpha_x / \gamma L_x) + 1. \quad (18)$$

$$(p/w)_y = [\alpha_y / (1 - \gamma) L_y] + 1. \quad (19)$$

Equations (18) and (19) show the inverse of the real wages in each industry. They suggest that an increase in the number of big-spending consumers (represented by an increase in γ) will lead to an increase in real wages for workers in that industry, but will have the opposite effect on real wages in the other industry.

Figure 1 shows the closed-economy equilibrium prices for luxury automobiles (x) at the point where the curve Z_1 intersects the curve Z_2 . The vertical axis shows the price of x in wage units, while the horizontal axis shows its consumption by big-spending consumers. The curves Z_1 and Z_2 represent the price per unit wage equations as shown in (18) and Equation (20). Z_1 shows that price per unit wage increases with consumption, since Equation (3) suggests that the elasticity of demand falls with consumption. On the other hand, Z_2 illustrates that price is decreasing in consumption, based on the zero-profit condition in equation (20). The closed economy equilibrium for budget automobiles (y) can be shown similarly.

3. The Effects of Trade

If this economy opens up to trade, it will increase market size, although the rate of increase will depend on the extent to which the parameter γ changes. **Figure 1** shows the changes when markets expand as a result of international trade between two countries. Let us start with a simple scenario, where the aggregate labor supply is equal in both countries. Recall that in the Home country, there is

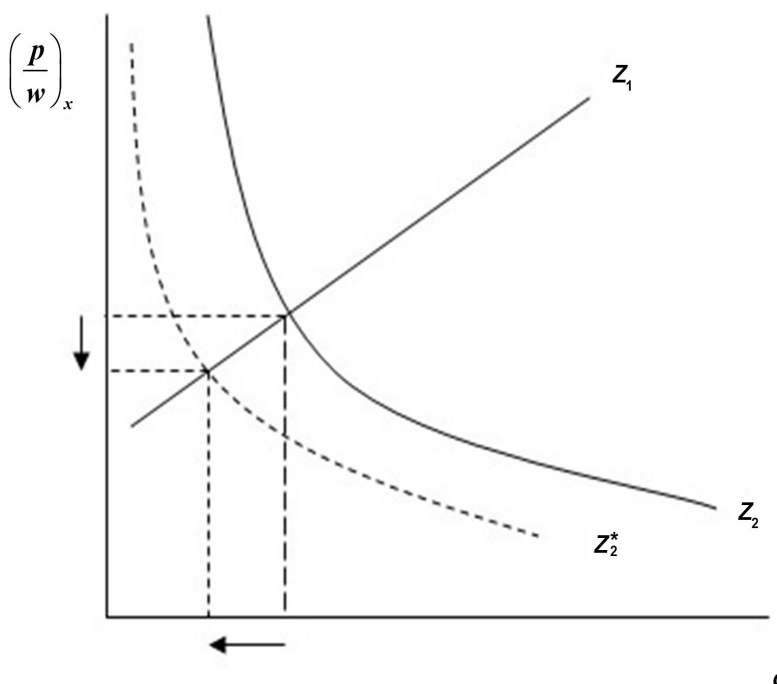


Figure 1. Effects of trade (γ increases).

an equal number of big-spenders and budget-spenders. Now, in the Foreign country, assume there are considerably more big-spenders than budget-spenders. Under these circumstances, trade between these countries will lead to an expansion of the market for luxury automobiles from the perspective of the Home country (represented by an increase in γ), which will decrease the price per unit wage shown in Equation (18). In **Figure 1**, this will cause the Z_2 curve to shift down to Z_2^* and decrease the price per unit wage of the luxury automobiles. The inverse of the price per unit wage is the real wage. So, the equilibrium real wage will increase as producers gain access to additional consumers.

Note that the market for luxury automobiles expands at the expense of the market for budget automobiles. As Equation (19) shows, an increase in γ (which is equivalent to a relative decrease in the size of the market for budget automobiles from the perspective of the Home country) will lead to an increase in price per unit wage and hence, a decrease in real wages in that sector. Since the real wages in sectors x and y were assumed to be equal before trade, as discussed in Section 2.1, trade will increase the difference in real wages due to differences in consumer demand in the two countries. This difference in real wages may eventually disappear if there are no barriers to movement of labor between sectors (such as differences in skill requirements, hiring regulations, etc.). An interesting question to consider is why consumers may have different demand for products in the first place. Such differences can arise due to cultural factors (e.g. consumers in some cultures may tend to save more and focus on buying “budget” products) or demographic trends (e.g. older consumers may be more “budget” friendly than younger consumers, something that may be worth examining em-

pirically in future research, as many industrialized countries have “aging” population and many emerging economies have “young” population).

4. Conclusions

For the first time in the literature, this research attempts to show that intra-industry trade can contribute to wage-inequality, in real terms, due to differences in consumer demand. These differences in consumer demand may arise due to cultural or demographic factors. This is shown by modifying Krugman’s [8] well-known model of intra-industry trade. Similar to the Krugman [8] model, the model discussed in this paper represents a simple world where all labor is identical in skill and consumers only buy one type of product or another. Relaxing these assumptions should not change the main results of this study but will make the theoretical model unwieldy and tedious. Simplifying the model allows us to bypass considerable mathematical complexities, although it inevitably results in the omission of other factors, such as technological innovation, that may also be relevant for explaining wage inequality.

An important limitation is that the model presented in this study does not focus on heterogeneous firms or workers, nor does it attempt to forecast precisely how demographic trends or different consumer behaviors can be related to wage-inequality and trade. All this study does is to provide insights into one of many possible channels linking differences in consumer demand to intra-industry trade and wage-inequality. Thus, these results of the model presented in this study are suggestive rather than conclusive. Nonetheless, from a public policy perspective, these results are significant. This is because they suggest that policies designed to mitigate the impact of international trade on wage-inequality should take into account not only supply side factors (such as technology or education) but also demand side factors (such as demographic trends or consumer spending habits). In this way, this study contributes to the economics literature.

For future research, it may be worthwhile examining how differences in consumer demand impact wage inequality in comparative-advantage based models of international trade. Additionally, from an empirical standpoint, it may be beneficial to examine the relationship between different types of trade, consumer characteristics (e.g. age, savings behavior, etc.) and wage-inequality.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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