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Product variety, finite changes and wage inequality

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ABSTRACT

This paper presents a model with product variety to examine the effects of emigration and capital mobility between the North and the South on production reorganization and two-sided wage inequality. We obtain conditions under which the production patterns in both North and South undergo 'finite changes'. Overall, the production and trade patterns may be such that the South produces and exports a homogeneous good while the North, a commodity with varieties — the result driven not by technological changes, but by factor mobility. The results further suggest that the wage inequality rises in both countries in conformity with available empirical evidence.

1. Introduction

Over the last few decades the relationships between international trade and inequalities in factor returns have received critical attention. Several issues in this subject were explored and include studies that have dealt with factor-biased and sector-biased effects on factor returns (for example, Helpman, 2011; Kohler, 2004). Of these, wage inequality (both local and global) has been the subject of prime concern. In a recent study, Gustafsson and Segerstrom (2010) show that in models with one-sided product cycles and varieties produced exclusively in the North, the overall wage gap between the North and the South can be explained within admissible parameter values. Bastos and Straume (2010) on the other hand, show that if consumers love variety and product innovation is skill-intensive, greater intra-industry trade due to trade liberalization and greater import competition increase wage inequality. Presently, we are concerned with how factor mobility between the North and the South leads to finite changes in the industrial structures and its implications for two-sided wage inequality.

Available literature suggests that if policies to help the development of skills are adopted, it may lead to more innovations and expansion of firms (Leiponen, 2005) with a possible countervailing effect on wage inequality. Generally, however, it is accepted that increase in the relative price of exportable raises the skilled-to-unskilled wage in a skilled-labor abundant country with opposite impact for the unskilled labor. Newer findings on innovation in the North and immiserization in the South have emerged only recently (viz. Demmou, 2012) following the celebrated relationships between innovations and trade patterns *a' la* Krugman (1979). The issue of wage gap, nonetheless, has already been extensively dealt with in Acemoglu (2002, predominantly through skill-biased technological changes), Anwar (2006, 2008), Das (2002), Feenstra and Hanson (1997, 2003), Jones and Marjit (2003), Kar and Beladi (2004), Marjit et al. (2004), Chaudhuri and Yabuuchi (2007) and others. Welfare effects of emigration of skilled and unskilled workers have also been discussed in Marjit et al. (2013).

However, only a few among these explore the issue of *two-sided wage inequality* (for example, Das, 2003; Marjit and Acharyya, 2003) for the North and the South. In addition, little is known about the mechanism by which factor mobility affects the production reorganization in the North and the South. In a related context, Findlay and Jones (2000) offered a very distinct result earlier. It suggests that technical progress may alter factor price ratios in such a way that certain commodities are no longer produced in a country. This is coined as *finite change* in production. We explore if factor mobility between countries can alone, without recourse to the technological changes, bring about significant changes in factor prices causing two-sided wage inequality as well as finite changes in production for firms engaged in manufacturing of varieties.

Further, Marjit and Kar (2005) earlier showed that in spite of an absolute wage increase, unskilled labor emigration from a small open

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economy may worsen the existing wage-gap between skilled and unskilled workers, whereas, emigration of skilled workers can reduce wage inequality. Beladi et al. (2013) use a specific-factor model to show that regardless of the emigrating category – skilled or unskilled – return to capital declines following emigration and subsequently raises the return for workers of the non-emigrating type. Subsequently, Anwar (2006), Das (2003 for international trade and two sided inequality), Oladi and Beladi (2007), and others show that emigration leads to widening of skilled–unskilled wage gap whether through a presence of external economies or due to factor intensity conditions.

Note that, international trade could also be the driver of innovations and lead to obsolescence of technologies. The existing literature on product obsolescence identifies either the innovation of higher-quality products over lower-quality products (Aghion and Howitt, 1992; Grossman and Helpman, 1991, chp 4.; Segerstrom, 1991) or the expansion of product variety (Grossman and Helpman, 1991, ch. 3.; Romer, 1990) as the reason for gradually declining rents of firms from older products.[1] We obtain similar results where certain variety of a differentiated commodity, which was earlier produced in the South now becomes obsolete due to an outflow of a vital factor of production and not owing to innovations.

The skill shortage in a country like India often creates upward pressure on the wage demanded by the highly skilled workers. A compelling example is the recoil of many foreign software outsourcing units from India moving to even cheaper locations. The attrition rates and the worker turnover for such industry in India are quite high at 25–30% with significant cost implications for the employers. This might be a factor that can hurt production of certain varieties in the industry and shift the activity to other locations in the South or back to the source countries in the North.

We have used an oligopolistic production function with product variety (Krugman, 1981) to show that emigration of various skill types leads to *asymmetric finite changes* between the North and the South. Further, we show that a rise or fall in wage inequality depends on the capital intensity of the sector into which foreign capital flows. A mirror image is observed for the North. Section 2 describes the process of labor emigration from the South and Section 2.1 discusses capital inflow into the South, both with implications for the industrial reorganization and the wage inequality. Section 3 concludes.

2. The model

We consider two sectors. One sector produces a homogeneous good X and the other produces a differentiated good Y, in both the North (where, output, factors and prices are denoted by *) and the South. The consumers face a Cobb–Douglas utility function as in Das (2003) consuming both goods,

$$U = X^{a}\sum_{j=1}^{n} Y_j^{1-\alpha} \quad \alpha<1 \tag{1}$$

Let us define, M = total money income; p_X = price of good X; p_{Yj} = price of j-th variety of good Y.

The Lagrange equation is written as:

$$\pounds = X^{\alpha}\sum_{j=1}^{n} Y_j^{1-\alpha} + \lambda\left[M - p_x X - p_{Yj} Y_j\right] \tag{2}$$

Standard first order conditions lead to:

$$\frac{\alpha}{1-\alpha}\frac{X^{\alpha-1}}{X^{\alpha}}\frac{\sum_{j=1}^{n} Y_j^{1-\alpha}}{\sum_{j=1}^{n} Y_j^{-\alpha}} = \frac{p_X}{p_{Yj}} \tag{3}$$

$$\text{such that,} \frac{\alpha}{1-\alpha} = \frac{p_X/p_{Yj}}{\sum_{j=1}^{n} Y_j/X} \tag{4}$$

Thus, the elasticity of substitution (σ) between X and all varieties of Y is a constant.

Rearranging (4) we have:

$$X = \frac{\alpha}{1-\alpha}\sum_{j=1}^{n} Y_j\frac{p_{Yj}}{p_X} \tag{5}$$

$$\text{and,} \sum_{j=1}^{n} Y_j = \frac{1-\alpha}{\alpha}X\frac{p_X}{p_{Yj}} \tag{6}$$

Substituting (5) and (6) in $\frac{\delta\pounds}{\delta\lambda} = 0$ we get,

$$M = \frac{\alpha}{1-\alpha}p_{Yj}\sum_{j=1}^{n} Y_j + \frac{1-\alpha}{\alpha}Xp_X \tag{7}$$

Using (5), (6) and (7), we get the inverse *demand* functions for X and Y_j, respectively,

$$p_X = \frac{\alpha M}{(1-\alpha)M} - \frac{\alpha^2}{(1-\alpha)^2}p_{Yj}\frac{\sum_{j=1}^{n} Y_j}{X} \tag{8}$$

$$\text{and,} p_{Yj} = \frac{(1-\alpha)}{\alpha}\frac{M}{\sum_{j=1}^{n} Y_j} - \frac{(1-\alpha)^2}{\alpha^2}\frac{X}{\sum_{j=1}^{n} Y_j}p_X \tag{9}$$

The production functions on the other hand are given by, $X = X(L, K)$ and, $Y_j = Y_j(S,L,K)$ where, L denotes the unskilled labor, S is the skilled labor and K denotes the capital. Following Krugman (1981), we consider that physical amount of the inputs constitute the cost functions. Let θY_j amount of unskilled labor be used as fixed cost in Y_j along with the variable costs. Amount of skilled labor, unskilled labor and capital used as variable costs in Y_j are (β_S), (β_L) and (γ_Y) respectively. The presence of fixed cost ensures that the average fixed cost in Y_j is falling. As a result, the producer of each variety will not share its market and only one firm will produce the j-th variety as in case of particular brands — a well-known feature of Chamberlinian monopolistic competition. However, there is no fixed cost of production in X, where (β_L) and (γ_X) in physical terms of the inputs constitute the variable cost.[2] There is no exogenous entry barrier for new firms either in X or in Y. Total factor endowments are given by,

$$\bar{L} = \beta_L X + \theta Y_j \tag{10}$$

$$\bar{S} = \sum_{j=1}^{n}\beta_S Y_j \tag{11}$$

[1] Obsolescence of technology has also been discussed in Marjit (1994) with reference to use of specific factors of production.

[2] To calculate nominal cost we multiply physical input requirements by individual factor returns.