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Trade and factor returns: Empirical evidence from U.S. economy

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ABSTRACT

The purpose of this paper is to illustrate the usefulness of the specific factors model for calibrating the impact of various exogenous changes by simply estimating the elasticities of substitution for any number of sectors. Jones (1971) shows how with just a few parameters one can determine the impact of any price change in some sector on the wages of the mobile factor as well as all of the returns to the specific factors elsewhere in the economy. It is well-known that in the specific factors model, the increase in the price of any commodity will raise the wage of the mobile factor by a fraction of the percentage increase in the price, and that there will be a magnification effect on the specific factor used in that commodity and negative effects on all of the other specific factors in the economy. I estimate the elasticity of substitution by using CES production function and show how these estimates describe the general equilibrium of production with one mobile factor (labor) and nine industries of an open U.S. economy using data for 1979–2001. The results are consistent with the theory. I find that the value of the elasticity of substitution along with factor intensity between industries plays an important role in determining the impact of commodity prices on wage of mobile factor and rate of return to the specific capital.

1. Introduction

Economic theory allows for several competing models of the relationship between international trade and income distribution. During the past two decades, many studies have attempted to estimate the impact of trade on the distribution of wealth. Generally, the theoretical explanation for such a link has been based on the well-known Heckscher–Ohlin (H-O) model of trade. The relationship between trade and income distribution is embodied in the Stolper and Samuelson theorem (1941) and its generalizations that trade-induced commodity price changes have magnified effects on factor prices. [1] Abundant factors gain and scarce factors lose from trade.

On the empirical side, Leamer (1998) suggests the factor intensity approach is very simple and requires minimal data. Bowen, Leamer, and Sveikauskas (1987) concludes that the H-O model have performed poorly in empirical test[2]. According to Trefler (1993), "its predictions are always rejected empirically."As several studies have correctly emphasized, the factor intensity approach is based on the very restrictive assumption of complete factor mobility between industries. This assumption may not be well-suited to answering questions involving the impact of trade policy on income distribution, at least in the short run.[3] It is likely

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[1] See Lawrence and Slaughter (1993) and Leamer (1994) for critical discussions of the Stolper–Samuelson theorem and relative wages.

[2] According to Davis, Weinstein, Bradford, and Shimpo (1997), the H-O model performs more successfully between regions within countries. Davis and Weinstein (2001) also states that the model's predictions are more likely satisfied if the H-O model's assumptions of identical technologies, factor price equalization and identical and homothetic preference are relaxed.

[3] See Mayer (1974) and Mussa (1974) for analysis of the short-run specificity of capital.

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that some factors are sector specific and thus immobile (Grossman & Levinshon 1989)[4]. Scheve and Slaughter (2001) also state that trade's effect on factor income relies on the degree of intersectoral factor mobility.

The specific factor model, introduced by Jones (1971) and Samuelson (1971), has since been interpreted by Mayer (1974), Mussa (1974), and Neary (1978) as a short-run version of the H-O model.[5] The specific factor model assumes that labor is mobile between sectors with given supplies of specific factors. It offers a rich set of predictions for determining the effect of trade on factor returns.[6] The advantage of the specific factor model is that any number of sectors of the economy can be studied and so it is not necessary to confine oneself to some generalized change in the terms of trade. The most important problem with Stolper–Samuelson theorem is that it works with 2 goods and 2 factors. According to Redding (2008), the H-O theorem with many goods and factors of production are noticeably weaker than in the $2\times2\times2$ stylized version. If the number of factor surpasses the number of goods, the Stolper–Samuelson theorem, the Rybcznski theorem, and the factor price equalization fails to hold or become weaker in the specific factor model. The specific factor model is also effective to explain the effects of trade policy on the distribution of income. The main goal of the trade policy is to protect or improve the well-being of preferential groups. Mayer (1984) shows that the specific factors multi-sector model is more convenient for analyzing such industry specific distribution. Irwin (1996) concludes that 1923 British election favors the specific factor model for tariff protection.

In the real world, whether trade occurs or not, relative prices are going in different directions even in industries "intensive" in a given factor. One of the main differences between the two models is their technological characteristics. The Stolper–Samuelson theorem in the H-O model implies that factor intensity determines the impact of trade on income distribution. In the specific factor model with single mobile factor, the relative degree of flexibility in technology and the factor intensity ranking between sectors determine the effect on income redistribution as the terms of trade change. In the literature, Toledo (2011), Akay (2009), Malki, Thompson, and Yeboah (2009), Funda, Mikic, and Thompson (2006), Thompson and Toledo (2005a) and Thompson (1997), use the different empirical strategy in the specific factor model to predict output changes and income distributions in different countries.

The purpose of this paper is to illustrate the usefulness of the specific factors model for calibrating the impact of various exogenous changes by simply estimating the elasticities of substitution for any number of sectors. Ruffin and Jones (1977) showed the impact of a change in one commodity price on the wage of a single mobile factor and extend the model to many sectors. Jones and Ruffin (2008) argue the role of the elasticity of substitution in determining the impact of commodity price on the wage of a single mobile factor. It is well-known that in the specific factors model, the increase in the price of any commodity will raise the wage of mobile factor by a fraction of the percentage increase in the price, and that there will be a magnification effect on the specific factor in that commodity and negative effects on all of the other specific factors in the economy. I show how these estimates are sensitive to general equilibrium of production with one mobile factor (labor) and nine sectors of the U.S. economy using data for the 1979–2001. This article projects the income redistribution due to free trade using the U.S. economy. There are aggregation issues, but whether these are serious can only be determined by a more detail study.

Section 2 presents the theoretical background of the specific factors model. Data are described in Section 3. Section 4 describes the empirical strategy and results. Conclusion is presented in Section 5.

2. The theoretical framework

The model first described by Jones (1971) has commodities 1 and 2 produced with mobile labor L and two specific factors K_1 and K_2. Let w and r_i denote the nominal wage and rent in the ith sector, λ_i the proportion of labor used in industry i, a_{ij} the input-output coefficients, θ_{Li} the labor distributive share in industry I, and p_i the ith commodity price.[7] The equations of change of the Specific Factors model are:

$$\theta_{Li}\,\hat{w} + \theta_{Ki}\,\hat{r}_i = \hat{p}_i \text{ for } i = 1\ldots n. \tag{1}$$

$$\sum_{i=0}^{n} (\hat{a}_{Li} - \hat{a}_{Ki})\lambda_i = \hat{L}. \tag{2}$$

The first set of equations is the relative changes in factor prices as governed by the changes in international prices and the second equation represents the full employment constraints on the relative change in labor.

[4] Abrego and Whalley (2001) test the capital mobility assumption by using UK database for 1979 and 1995. They conclude that "the effects of assuming this capital is immobile are to slow considerably the movement of the mobile factors in response to price changes." Edwards and Whalley (2007) They find that some immobile factors expose adjustment costs from moving between sectors, due to search costs, transportation or removal costs, transaction costs, location preference and psychological costs.

[5] The model was introduced independently by Jones (1971) and Samuelson (1971). Samuelson (1971) labeled it Ricardo–Viner model. Jones (1971) named it the specific factor model.

[6] Rassekh and Thompson (1997) compare the performance of two models for each of nine industries using pooled data from 12 developed countries during the period 1970 to 1985. They conclude that the specific factor model produces relatively stronger outcomes.

[7] In Jones and Ruffin (2008) this analysis is conducted for two sectors but, it is generalizable in simple fashion to any number of sectors. Also Ruffin and Jones (1977) discussed the many sectors.