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Friends, Enemies, and Factor Diversification: Implications for Protectionist Pressures

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Abstract

This paper examines the relationship between changes in commodity prices and changes in factor prices when individuals can diversify their factor ownership portfolios. In a closed economy, it is always possible to find a distribution of factor ownership which makes everyone indifferent to any small, exogenous price change and which satisfies the conditions for full employment of each factor. Such a distribution of factor ownership would dissipate interest in any price change since it would leave everyone's real income unchanged. In an open economy, it may not be possible to find such a distribution of factor ownership.

I. Introduction

The ubiquity of protection across both developed and developing countries presents an obstacle to the reconciliation of international trade theory with observed policy. In the absence of terms-of-trade effects and second best considerations, protection generally reduces real income, yet protec-

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tion is pervasive despite its pareto-inferior nature.

One explanation for the adoption of protectionist trade policies, which may be termed the "conflict perspective," describes the effects changes in commodity prices have on factor prices. The standard variable proportions trade model, described by Jones [1965], has been used quite extensively to identify the opponents and proponents of relative commodity-price changes. Interest in commodity-price changes centers on the effect such price changes have upon factor prices, and thus, is the focal point for analyzing the source of protectionist pressures. Previous work by Jones and Scheinkman [1977] showed that when the number of commodities equals the number of factors, every factor has a "natural enemy," a commodity whose price increase lowers the real return to that factor, but not necessarily a "natural friend," a commodity whose price increase raises the real return to that factor. Cassing [1981], however, showed that in the even case, it is always possible to make anyone better off through an increase in the price of some commodity when information about consumption is considered.[1] Both of these models are somewhat limiting in the sense that they assume individuals receive income from ownership of a single factor.

Because factor owners may not be able to diversify their factor ownership claims, they may suffer income losses if the terms of trade were to suddenly turn against them, hence, protection provides a form of social insurance when private insurance markets do not exist. It is then of interest to investigate whether the existence of a "securities" market – one in which individuals could trade ownership claims on factors – could serve as a form of insurance. Could factor ownership claims be diversified, or redistributed in such as fashion so that individuals could hedge against an unfavorable shift in the terms of trade? If so, tariffs would cease to provide a form of social insurance.

The purpose of this paper is to examine the real position of households who derive income from a factor ownership portfolio, rather than from ownership of a single factor.[2] In the even case, when factor ownership is diversified, it may not be possible to find a "natural friend" or a "natural enemy" for

1. Throughout this paper, the term "even" refers to the case where the number of goods equals the number of factors.
2. In this paper, individuals may not own foreign factors of production.

each household, even when consumption information is considered. Indeed, it may be possible to find a distribution of factor ownership such that any small, exogenous price change will leave the real position of everyone unaffected. Thus, such a distribution of factor ownership would insulate the economy from protectionist pressures. The possibility of each individual choosing the combination of factors which leaves their real position unaltered by any price change is nevertheless limited. In a closed economy, when production equals consumption, it is always possible to find a distribution of factor ownership which makes everyone indifferent to any small, exogenous price change, however, in an open economy, it may not always be possible.

Diversification which leaves individuals completely indifferent to relative price changes is not generally possible in an open economy because, in the aggregate, individuals consume goods which embody factors in proportions which differ from the factor composition of domestic production. The vector of goods consumed can be described in terms of the factors embodied in those goods, which Lloyd and Schweinberger [1988] refer to as the "implicit factor trade model." In an open economy, production will not equal consumption, so the country and some household is an implicit importer and exporter of some factors. If income equals expenditure, trade will be balanced and the economy will be an exporter of some goods and an importer of others. In this case, everyone is not on "the same side of the market" since there are net sellers of some factors (goods) and net buyers of others. It is then not generally possible to rearrange domestic factor ownership portfolios so that everyone could revert to a position of individual autarky, that is, neither a net importer or exporter of factors. As will be shown below, the factor ownership portfolio which leaves individuals indifferent to any small commodity-price change requires individuals to hold factors in proportion to their consumption bundle. For full employment, factors must be used in proportion to industry output levels. Thus, in an open economy, where consumption does not equal production, complete diversification is not possible.

In autarky, the factor composition of production is the same as the factor composition of consumption, thus factor ownership portfolios can be rearranged to insulate everyone from any relative commodity-price change and maintain full employment for each factor. If income equals expenditure, "trade" will be balanced, since exports and imports of each factor (commodity) are zero. In this case, factors can be rearranged so that no one either favors or opposes any relative price change, since there are no net buyers and sellers of factors or goods internationally.

This result is significant because it shows that if factor ownership can be distributed in a particular fashion, then any small, exogenous price change will leave the real position of everyone unaffected. Thus, no one would have an incentive to lobby for protection. As Mussa [1974] has shown, factor specificity, factor mobility, and factor intensity are all important in determining the effect of changes in tariffs upon factor prices and the distribution of income. In addition to these, the distribution of factor ownership plays an important role in determining how changes in commodity prices affect an individual's real position, and thus, the interest of factor owners in tariff protection. As Lloyd [1987] notes, diversification of an individual's factor ownership portfolio is important because such diversification diminishes the increase in real income to an individual from an increase in the price of his "friendly commodity." In fact, a commodity may "cease to be a friend" as the share of an individual's income derived from some factor becomes smaller.

II. Basic Model

Using the standard variable proportions trade model for the case of n commodities and n factors, the solutions for each factor price in proportional change form are:

$$\hat{w} = (\theta^t)^{-1}\hat{p}$$

where $\hat{w}$ is the $(n \times 1)$ vector of proportional changes in factor prices, θ is the $(n \times n)$ matrix of factor cost shares in each industry, t denotes transpose, and $\hat{p}$ is the $(n \times 1)$ vector of proportional changes in commodity prices.[3] Jones and Scheinkman [1977] demonstrated that $(\theta^t)^{-1}$ is row stochastic, with each row having at least one negative element, but not necessarily a

3. A complete description of all notation used in this paper is contained in the appendix.

positive element greater than one. Thus, the conclusion that every factor has a "natural enemy" but not necessarily a "natural friend" readily follows.

When each individual derives income from ownership of only one factor of production, Cassing [1981] noted the real income effect from an exogenous change in the price of commodity j can be expressed as:

$$[\,(\theta^t)^{-1}_{ij} - \phi_{ij}\,]\,\hat{P}_j$$

where $(\theta^t)^{-1}_{ij}$ is the ij-th element of $(\theta^t)^{-1}$, and ϕ_{ij} is individual i's expenditure share on good j. Every row of $(\theta^t)^{-1}$ contains at least one negative element while the sum of $[(\theta^t)^{-1}_{ij} - \phi_{ij}]$ over all j is zero. Therefore, $[(\theta^t)^{-1}_{ij} - \phi_{ij}]$ must have at least one positive term in each row, otherwise each row sum could not be zero. Thus, as Cassing notes, it is in this sense that everyone has a "natural friend"; any individual can experience an increase in real income through an appropriate commodity-price increase.

In order to relax the assumption that each individual derives income from only one factor of production, specify a matrix H, with elements h_{ki} denoting the share of individual k's income derived from factor i. Pre-multiplying equation (1) by H gives:

$$H\hat{w} = H(\theta^t)^{-1}\hat{p} \qquad (3)$$

where each element of the vector $H\hat{w}$ represents the proportional change in individual k's income from any commodity-price change. Changes in each *individual's* income can now be related to changes in commodity prices through equation (3) when factor ownership is diversified. Note that the matrix H is row stochastic, since the shares of an individual's income derived from each factor he owns must sum to one: $\Sigma_i\, h_{ki} = 1$, for all k. Each element of the matrix Φ, ϕ_{kj}, is individual k's expenditure share on good j. Each row of the matrix Φ must sum to unity, since the income of each household must be exhausted over all commodities: $\Sigma_j \phi_{kj} = 1$, for all k.

When factor ownership is diversified, the welfare effect of any small price change can be expressed by the matrix $[H(\theta^t)^{-1} - \Phi]$, which is analogous to equation (2). The row sums of $[H(\theta^t)^{-1} - \Phi]$ are zero since:

$$\Sigma_j[[H(\theta^t)^{-1}]_{kj} - \Phi_{kj}] = \Sigma_j[H(\theta^t)^{-1}]_{kj} - \Sigma_j \phi_{kj} = 1 - 1 = 0 \qquad (4)$$

for all k.[4] Now, $H(\theta^t)^{-1}$ is not guaranteed of having a negative entry in each row, unlike $(\theta^t)^{-1}$. Therefore, every individual is not guaranteed of having a natural enemy, using the definition of "enemy" in Jones and Scheinkman [1977]. Since each row of $H(\theta^t)^{-1}$ does not necessarily contain a negative element, it might be possible that each element of $H(\theta^t)^{-1}$ equals each corresponding element of the matrix Φ, which in this case would leave the matrix $[H(\theta^t)^{-1} - \Phi]$ consisting of all zeros. This leads to the following theorem:

Theorem 1: A individual has neither a "friend" nor an "enemy" in the "Cassing" sense if and only if $H(\theta^t)^{-1} = \Phi$.

If $H(\theta^t)^{-1} = \Phi$, then $[H(\theta^t)^{-1} - \Phi]$ is the zero matrix, and any individual neither benefits nor is harmed by any small, commodity-price change. If an individual does not possess a friend or an enemy, then $[H(\theta^t)^{-1} - \Phi]$ is the zero matrix, which requires $H(\theta^t)^{-1} = \Phi$. Therefore, an individual might not possess a "natural friend" or a "natural enemy" in the "Cassing" sense, that is, when consumption information is considered. See the appendix for a numerical example.

Of course, even when factor owners diversify, if an individual possesses a "friend," he must have an "enemy" in the "Cassing sense". If a row of $[H(\theta^t)^{-1} - \Phi]$ contains a negative element, which would be the case if that household has a "natural enemy", then the row must also have a positive element as well, a "natural friend", since the sum of the row's elements is zero. This result was established by Cassing [1981]. However, the new point to make here is that a household might not have a "natural friend" or a "natural enemy."

Finally, it is of interest to determine if factor ownership portfolios can always be arranged – as if there existed a perfect securities market – in such a fashion so that no one has an interest in advocating or opposing any small commodity-price change. Any small price change will leave the real

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4. In obtaining this result, use is made of the following theorem. If H is row stochastic, and $(\theta^t)^{-1}$ is row stochastic, then $H(\theta^t)^{-1}$ is also row stochastic. Proof: Let 1 be a column vector of ones (1's). Then $H{\cdot}1 = 1$ and $(\theta^t)^{-1}{\cdot}1 = 1$ since both H and $(\theta^t)^{-1}$ are row stochastic. Then, $H(\theta^t)^{-1}{\cdot}1 = H{\cdot}1 = 1$. Therefore, $H(\theta^t)^{-1}$ is row stochastic.

position of everyone unaffected if $H(\theta^t)^{-1} = \Phi$, therefore the required H matrix is: $H = \Phi(\theta^t)$, or each h_{ki} can be expressed:

$$h_{ki} = \Sigma_j \phi_{kj} \theta^t_{ij} \quad \text{for all } i, k \tag{5}$$

where θ^t_{ij} is the i-jth element of θ^t. Substituting for all the shares in (5) and cancelling terms gives:

$$v_{ki} = \Sigma_j z_{kj} a_{ij} = z_{k1} a_{i1} + z_{k2} a_{i2} + \ . \ . \ . \ + z_{kj} a_{ij} \quad \text{for all } i, k \tag{6}$$

where v_{ki} denotes the amount of factor i owned by individual k, z_{kj} is the amount of good j consumed by individual k, and a_{ij} is the amount of factor i required to produce a unit of j. Equation (6) reveals that the amount of factor i which would make individual k indifferent to any small price change is a positive weighted combination of his consumption bundle. Can everyone choose the v_{ki} given by equation (6) and still satisfy the condition for full employment of each factor? For this to be possible, $\Sigma_k v_{ki}$ must equal V_i, the endowment of domestic factor i. Summing over k:

$$\Sigma_k v_{ki} = \Sigma_k (\Sigma_j z_{kj} \cdot a_{ij}) \quad \text{or:}$$

$$= (\Sigma_k z_{k1}) \cdot a_{i1} + (\Sigma_k z_{k2}) \cdot a_{i2} + \ldots + (\Sigma_k z_{kj}) \cdot a_{ij} \quad \forall i. \tag{7}$$

If the economy is closed, then production of good j must equal total consumption of good j, namely $(\Sigma_k z_{kj}) = X_j$. Substituting into (7):

$$\Sigma_k v_{ki} = a_{i1} \cdot X_1 + a_{i2} \cdot X_2 + \ldots + a_{ij} \cdot X_j \quad \forall i. \tag{8}$$

Equation (8) is just the full employment condition for factor i. For a price change to leave an individual's real income unaffected, he must hold factors in proportion to his consumption bundle, as given by equation (6). At the same time, full employment requires that the endowment of each factor equal a weighted sum of industry output levels. Clearly, the factor portfolio which leaves the individual indifferent to a price change is achievable only if production of a given commodity matches the consumption pattern. If the economy is closed, everyone may choose the v_{ki} which makes him indifferent to any small price change, because this choice will also satisfy the full employment condition for each factor. If the economy is open to trade, everyone may not choose the factor portfolio which leaves him indifferent to a price change because such a portfolio choice will not, in general, satisfy the aggregate full employment condition, since production does not equal consumption.

III. Conclusions

The purpose of this paper has been to generalize the notions of "natural friends" and "natural enemies" to the case where individuals may derive income from ownership of a portfolio of factors, rather than just one. When individuals can diversify, they may no longer have a "natural friend" or a "natural enemy," in the sense that Jones and Scheinkman [1977] used these terms or in the sense used by Cassing [1981]. Thus, it may be the case that no one will have an interest in any small commodity-price change, *i.e.* protection. Can individuals always choose the portfolio which will make them indifferent to a price change? It is always possible in a closed economy to find such a distribution of factor ownership, however, it may not always be possible in an open economy. The practical implication of this result is that even if there existed a perfect securities market in which individuals could trade claims on factor ownership, it is unlikely that these claims could be allocated in a fashion that would completely dissipate interest in any small relative commodity-price change. Thus, interest in any commodity-price change through protection cannot be eliminated completely, so tension among factor owners over trade policy is likely to persist in an open economy. On the other hand, since the world is a closed economy, it would then be possible to rearrange factor ownership portfolios so that everyone would be insulated from any small price change, provided it were possible to trade claims on factors across countries.

Appendix

This appendix provides a numerical example of the propositions asserted in the text. Consider the case of three households, three goods, and three factors:

$$H = \begin{bmatrix} .4 & .3 & .3 \\ .3 & .5 & .2 \\ .5 & .3 & .2 \end{bmatrix} \qquad (\theta^t)^{-1} = \begin{bmatrix} -.6 & .8 & .8 \\ .7 & -.4 & .7 \\ .8 & .8 & -.6 \end{bmatrix}$$

$$H(\theta^t)^{-1} = \begin{bmatrix} .21 & .44 & .35 \\ .33 & .20 & .47 \\ .07 & .44 & .49 \end{bmatrix} \quad \text{if} \quad \Phi = \begin{bmatrix} .21 & .44 & .35 \\ .33 & .20 & .47 \\ .07 & .44 & .49 \end{bmatrix}$$

then $[H(\theta^t)^{-1} - \Phi]$ is the zero matrix, and every household does not have a "natural friend," even when taking consumption information into account.

Notation:

i = number of factors of production, j = number of commodities, and k = number of individuals.
w_i = price of factor i.
p_j = price of commodity j.
θ_{ij} = cost share of factor i in a dollar's worth of good $j = (w_i\, a_{ij})/p_j$.
a_{ij} = amount of factor i required to produce a unit of good j.
X_j = output of commodity j.
z_{kj} = amount of commodity j consumed by individual k.
v_{ki} = amount of factor i owned by individual k.
ϕ_{kj} = share of individual k's income spent on good j.
h_{ki} = share of individual k's income derived from ownership of factor i.
V_i = total endowment of domestic factor i.

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