Simultaneous Technologies and Demand and Supply Conditions in International Trade

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Abstract: If a country is not small enough to behave as a price taker in its export market, foreign demand conditions must be taken into account when estimating export supply functions. Also, when estimating demand or supply functions, it is desirable to use all prior theoretical knowledge and to estimate these functions jointly with the other demand and supply functions derived from the same technology. This calls for the simultaneous estimation of the technologies of all trading partners. For Canadian exports to the United States, we find that the simultaneous and joint estimation procedures bear heavily on the estimated price elasticities.

1. Introduction

In most of the empirical literature on international trade, the flow of traded goods is considered to be demand determined, with the quantity of imports determined by domestic variables and the quantity of exports determined by foreign variables, and with the price of traded goods exogenous in both cases. This approach, which usually invokes the small-open-economy hypothesis, seems somewhat paradoxical. If the home country is small, the price of its imports can indeed be taken as exogenous and it is then true that the quantity of imports is demand determined; the quantity of its exports, however, can be considered as demand determined only if one is willing to assume that it is the importing region (i.e. the rest of the world in many cases) that is now the small open economy. If the home country is truly small relative to its trading partners, the price of its tradeables is exogenous, but exogenous for the home country only, not for the rest of the world. The home country is then a price taker in its export markets as well as in its import markets, hence exports are supply determined. For the small open economy one should therefore be estimating import demand and export supply functions. This is the approach used in Kohli [1978] to estimate the structure of Canadian foreign trade.

Empirical evidence in Appelbaum/Kohli [1979] suggests, however, that the small-open-economy hypothesis does not hold for Canadian exports to the United States,
although the hypothesis cannot be rejected for Canadian imports from south of the border\(^3\). Estimating either a U.S. demand function for imports from Canada or a Canadian supply function of exports to the United States on their own is therefore likely to lead to a simultaneous equation bias\(^4\). The correct procedure would therefore be to estimate simultaneously a Canadian supply function and a U.S. demand function.

It is sometimes argued, since the demand for imports is determined simultaneously with the demand for domestic goods or factors, that import demand functions should be estimated jointly with the demand functions for the domestic goods or factors [see Burgess, for instance.] This is particularly important if one wants to make use of prior theoretical knowledge about demand systems (e.g. additivity or symmetry properties) or if one recognizes that these demand functions are mutually dependent. The same argument holds on the output side, hence the supply of exports should be estimated jointly with the supply functions of the remaining goods.

To sum up, we feel that the U.S. demand for Canadian exports, which should be estimated jointly with the demand functions for the other U.S. inputs, should also be estimated simultaneously with the Canadian supply function of exports to the United States, and that this last function itself should be estimated jointly with the other Canadian supply functions\(^5\). In short, both technologies should be estimated simultaneously.

The model is developed in section 2. The Canadian and the U.S. technologies are both treated symmetrically, and a separability assumption enables us to focus solely on the Canadian supply side and the U.S. demand side. Allowance is made for the possibility that Canada is not a price taker in rest-of-the-world export markets either. Section 3 discusses the functional form and alternative estimation techniques. Our empirical findings are presented in section 4, and section 5 provides a short conclusion.

2. The Model

The United States and Canada are treated symmetrically, so that the following developments hold for either country. We assume that import and export decisions are taken by profit maximizing firms which operate under perfect competition in all commodity and factor markets. Imports are thus treated as inputs to the production process, together with domestic factors\(^6\). Exports are produced jointly with domestic

\(^3\) Canada was found to have and to make use of some monopolistic power in its trade with the United States. These findings will not be explored any further here; however, they indicate that the small-open-economy hypothesis does not hold for Canadian exports to the United States.

\(^4\) This is the familiar Working [1927] identification problem. See Orcutt [1950].

\(^5\) In this paper, we assume, for simplicity, that both technologies are separable between inputs and outputs. In the more general case, when separability is not assumed, the import demand and the export supply equations should be estimated jointly, together with the other demand and supply equations derived from the technology.

\(^6\) We thus recognize that most internationally traded goods are intermediate products and that even finished imports are usually still subject to domestic handling, transportation and retail changes before they reach final demand.