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Global production sharing and the measurement of price elasticity in international trade

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HIGHLIGHTS

- Examine the effect of global production sharing on price elasticity of international trade.
- Use a new quarterly panel dataset for manufacturing imports of the USA at the 3-digit SITC level.
- The import demand function is estimated using the dynamic fixed effect estimator.
- Imports of parts and components are found to be insensitive to relative price changes.

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ABSTRACT

The implications of global production sharing for the measurement of price elasticity in international trade is examined using a unique dataset relating to manufacturing imports of the USA. There is strong evidence that parts and components, which account for a growing share of manufacturing trade, are remarkably less sensitive to changes in relative prices compared to final goods. This finding casts doubt on the conventional approach to trade flow modelling that treats parts and components and finals goods as a unified product.

1. Introduction

Global production sharing – the breakup of a production process into vertically separated stages carried out in two or more countries – has become one of the defining characteristics of world trade over the past few decades (Feenstra, 2010; Helpman, 2011). This has resulted in a steady rise of trade in parts and components within global production networks (Athukorala, 2014; Yeats, 2001). This purpose of this paper is to examine the implications of the growing dichotomy between trade in parts and components, and final goods for the measurement of price elasticities in manufacturing trade.

Our approach is to compare the results of estimating the standard import equation separately for total imports, parts and components and final goods using manufacturing import data of the USA. The USA is chosen for the study primarily based on data availability. Our foremost consideration here is the availability of genuine trade price (rather than unit value) indexes at a sufficiently disaggregated level, covering a reasonable period of time.[1] Unit value indexes have well-known limitations as price proxies, particularly for manufactured goods (Lipsey et al., 1991).

2. Analytical context

What are the implications of global production sharing for the sensitivity of trade flows to change in international prices relative

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[1] The US Bureau of Labour Statistics (BLS) compiles and disseminates import (and export) price indexes under its International Price Program launched in 1971. These indexes are based on actual transaction prices directly collected from foreign trade markets (BLS, 1997).

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to domestic prices? Two competing views have emerged in the recent literature.

One view holds that global production sharing increases the sensitivity of trade flows to relative price changes (Obstfeld, 2001). The global spread of production processes would induce firms to respond swiftly to changes in relative prices by switching between domestic and imported inputs, shifting tasks across borders, or changing procurement sources. Production networks not only open up greater opportunities for shifting production/procumbent sources in line with such price changes, but also act as swift purveyors of market information.

The alternative view, which takes a broader perspective of the nature and modalities of global production-sharing, holds that it could in fact weaken the link between international price changes and trade flows (Jones, 2000; Jones and Kierzkowski, 2001; Burstein et al., 2008). First, production units of the value chain located in different countries normally specialize in specific tasks which are not directly substitutable for tasks undertaken elsewhere. Substitutability of parts and components obtained from various sources is, therefore, rather limited. Second, setting up of overseas production bases and establishing the service links entail high fixed costs, making relative price/cost changes less important in business decision making. The canonical example of automobiles illustrates the intuition of this reasoning: consumers have more scope for substitution across finished cars than does a car manufacturer across specialized auto parts.

The above considerations suggest that the implication of global production sharing for estimating price elasticity is very much an empirical issue. To our knowledge, so far the only attempt to examine this issue is Arndt and Huemer (2007). In an analysis of the determinants of bilateral manufacturing trade between the US and Mexico, this study finds that trade in automotive parts and components between the two countries is insensitive to changes in the bilateral real exchange rate.

3. The model and data

The standard import demand equation in a panel datasetting takes the form:

$$M_{it} = \alpha + \beta_1 Y_t + \beta_2 RPM_{it} + \delta_i + \gamma_t + \varepsilon_{it} \tag{1}$$

where $i = 1, 2, \ldots, N$ is the product category, $t = 1, 2, \ldots, T$ is the time unit in quarters and, M is real imports, Y is domestic income (real GNP), $RPM = PM/PD$ is relative import price (import price/domestic producer price), δ_i is product specific effects, γ_t is time effects and ε_{it} is the disturbance term. The three key variables, M, Y, and RPM are measured in natural logarithms so that the coefficients of the latter two variables can be interpreted as income and price elasticities.

The model is estimated using a quarterly panel dataset put together from electronic databases of the US Trade Commission (data on imports) and the US Bureau of Labor Statistics (import price, domestic producer price and GNP). The import data at the 5-digit level of the Standard International Trade Classification (SITC) were separated into parts and components and final goods, and then aggregated at the 3-digit level. Domestic price indexes (available at the 4-digit US Industrial Classification and import price indexes (at the 4-digit level of the Harmonized System)) were matched with the SITC 3-digit import price series using standard commodity concordances obtained from the website of the UN Statistical Office.[2]

Details on the commodity/time coverage of the data, and the share of parts and components in each commodity are given in Table 1. The dataset covers 43 SITC 3-digit products, which accounted for nearly 62.5% of total US manufacturing imports (with parts and components accounting for 41.4% of these products) during 1990–2007. The time coverage of data for individual products varies depending on the availability of data on the price index. The import demand function is estimated using data for all 43 products and the sub-category of machinery and transport equipment, distinguishing between parts and components and final imports. The machinery and transport equipment category is treated separately for two reasons: production sharing is heavily concentrated in this product group and the identification of parts and components in the SITC system is much more comprehensive compared to the rest of manufacturing trade.

4. Estimation method

There are three methodological issues that we need to be mindful of in estimating Eq. (1). First, since the panel dataset has a long time span (t), estimation using the standard panel data techniques could yield spurious inferences if the data series are nonstationary (Baltagi, 2005). Second, import prices are potentially endogenous: given that the USA is a dominant player in world manufacturing trade (accounting for nearly a fourth) it is quite possible that M and RPM are jointly determined. Third, there is the issue of parameter heterogeneity: the possibility that elasticities might differ across product groups.

We tested for stationarity of the data series using the Fisher combination test of Maddala and Wu (1999), which is applicable to unbalanced panel data. The results indicate that all data series are non-stationary and can be transformed into stationary processes of order 1, or I(1). The model is therefore specified in ARDL form:

$$\begin{aligned} M_{it} &= \alpha_1 Y_t + \alpha_2 RPM_{it} + \alpha_3 M_{it-1} + \alpha_4 Y_{it-1} + \alpha_5 RPM_{it-1} \\ &\quad + \delta_i + \gamma_t + \varepsilon_{it}. \end{aligned} \tag{2}$$

The error-correction formulation of Eq. (2) is

$$\begin{aligned} \Delta M_{it} &= \lambda_1 \Delta Y_{it} + \lambda_2 \Delta RPM_{it} + \mu_i (M_{it-1} - \beta_1 Y_{it} - \beta_2 RPM_{it}) \\ &\quad + \delta_i + \gamma_t + \varepsilon_{it}. \end{aligned} \tag{3}$$

In Eq. (3), the λs are the short run and βs are the long run elasticities, and μ is the parameter of adjustment towards the long run equilibrium.[3] A negative and statistically significant estimate of μ is evidence of a long-run co-integrating relationship amongst the variables.

Importantly for our purpose, a key desirable property of the error-correction formulation of the model is that 'the second order or endogeneity bias in estimated coefficients is asymptotically negligible due to super consistency' (Banerjee et al., 1993, 176). In our case, asymptotic properties reasonably apply given the large number of observations (around 2500) used in estimation.

To investigate potential parameter heterogeneity we experimented with three alternative methods: the Dynamic Fixed Effects estimator (DFEE), the Pooled Mean Group estimator (PMGE), and the Mean Group estimator (MGE) (Pesaran et al., 1999; Blackburne and Frank, 2007). Based on a comparison using the standard Hausman test, the DFEE was selected as the preferred estimator on efficiency grounds.

[2] For details on the method of separating parts and components from the published trade data see Athukorala (2014). The complete dataset and the list of parts and components are available on request.

[3] Since we work with quarterly data with a large time span (t) relative to the number of products, a linear time trend, instead of time-specific fixed effects (γ_t), is included to capture the trend element in imports; quarterly dummies are included to capture seasonality in imports.