

Innovations, Product Variety and Trade Performance

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Summary. The purpose of this project is to examine the effects of technology innovations and product variety on imports and exports following the New Trade Theory and recent theories of endogenous economic growth. Indicators of technology competitiveness and the range of goods will be constructed for a long historical period for the OECD countries.

Projektbeskrivelse

Traditional models of foreign trade typically find large variations in estimated income elasticities in foreign trade across countries and that individual country import and export income elasticities differ significantly (see for a survey Marquez, 2002). Kaldor (1978) showed for a number of countries that market shares for exports and relative unit labour costs tended to move together so that countries gaining market share experienced a worsening of their price competitiveness – the so-called Kaldor paradox. Furthermore, Krugman (1989) showed that countries with the highest GDP growth had the highest ratio of export and import elasticities.

The literature has taken two directions in explaining these apparent paradoxes, although, these issues are strongly related. Kaldor (1978), on the one hand, points out the seriousness of omitting non-price competitiveness factors from trade models. Following the footsteps of Fagerberg (1988), several studies have addressed the Kaldor paradox by allowing for technology in trade equations (see, for references, Greenhalgh, 1990, Fagerberg, 1996). Most of these studies include real R&D expenditures directly in the import and export equations and test for statistical significance, and, therefore, estimate a supply effect but fail to test for technological competitiveness effects. A few studies have included R&D expenditures relative to competitors, however, these studies have only included a few major countries in their competitiveness index and, therefore, implicitly ruled out competition from small and medium-term size countries and assumed that all countries face the same competition from these major countries, as discussed further below.

Krugman (1980, 1989) and Helpman (1990), on the other hand, attribute the finding of a systematic relationship between relative income elasticities and relative GDP growth rates, to supply effects following the New Trade Theory, in which trade is largely an outcome of product variety. They argue that fast growing countries expand their share of world markets by expanding the range of goods that they produce as their economies grow. In other words, the income terms in estimates of imports and exports are capturing these supply effects and, therefore, explain why high growth countries have favourable income elasticities in exports relative to imports, and why the ratio of world trade to GDP has been steadily increasing since the early industrial revolution. This finding is consistent with the findings of Kim (1996), that trade balances are little affected by permanent changes in income.

Krugman (1989) finds a one-to-one relationship between the ratio of import and export elasticities and the ratio of the domestic and foreign GDP growth rate and that the relationship is statistically significant and calls the theory the 45-degree rule. Schatz (1989), however, argues that Krugman's finding is driven by three outliers, namely, Japan, the US and the UK. Removing these three countries from the sample reduces R^2 from 0.75 to 0.05. Using the same empirical method as Krugman but a larger country sample, Wu (2004) finds strong evidence for the 45-degree rule. Using potential income of exporters as a proxy for supply effects Gagnon (2003) also finds evidence for the 45-degree rule.

Common for all the tests of the 45-degree rule is that they are all indirect tests and, therefore, do not test the 45-degree rule in its own right using direct measures of product variety. A key assumption in these tests is that the trend GDP growth is a good proxy for the growth in number of the range of products. This stands in contrast to several models of economic growth where the trend per capita GDP growth is predominantly driven by technological progress. It cannot, therefore, be excluded that GDP growth at least to some extent, reflects the change in the technological sophistication of products.

The purpose of this project is to examine the effects of technology innovations and the range of goods on imports and exports of manufacturing products for the OECD countries, including Denmark. A multi-country sample is required, not only because it increases the efficiency of the estimates, but more importantly, because the construction of price, technological, and product

variety competitiveness indexes requires information about competing countries technology innovations and their range of products.

The plan is not to put different hypotheses sharply against each other, acknowledging that new technologies and product variety cannot be sharply distinguished, but to investigate the effects of the creation of new product designs, trade marks and new technologies on exports and imports.

More specifically the project distinguishes itself from previous studies in the following ways:

1. In contrast to previous studies a direct measure of the range of products is used. The range of goods will be measured as the number of trade marks and particularly new product designs, which are available from various sources far back in history. New trade marks and product designs are excellent measures of the change in the product variety and yet, to my knowledge, they have never been used in tests of trade theories. The data are available far back in history for most OECD countries from their statistical yearbooks and from the World Intellectual Property Organisation. Furthermore, I have excellent correspondence with several national patent offices.
2. A multilateral technology competitiveness index on export markets that accounts for technology competition from countries that sell to the export market and *not only* competition from domestic producers or a few major countries, will be adapted. Previous studies have assumed either 1) that there is no competition from abroad; or 2) that exporters only compete with domestic producers on their export markets and, hence, disregard competition from third countries. If competition from abroad is not allowed for it follows that supply effects are tested rather than the intentional effects from competition.
3. Patents are used along with R&D expenditures as alternative measures of technology advances. Almost all studies on trade and technology use R&D expenditures as measures of technology and the innovative activity. However, data for R&D are only available biannually and from 1970 or later for most OECD countries, which limits the scope for long-term analysis using R&D data. Furthermore, R&D expenditures have important limitations as measures of inputs to technological activities and are measured with a large

error (Patel and Pavitt, 1995). Statistics on patents, however, are measured with no error and go back far into history. Finally, R&D expenditures are directed towards both product and process innovations, whereas patents predominantly cover new products and are, therefore, the relevant measure of the technological content of exports and imports because process innovations are reflected in prices.

Patents will be used as a complement to new trade marks and new designs because they all stimulate exports. Points 1 and 3 should, therefore, be considered complements.

4. Supply and competitiveness effects are explicitly distinguished, where supply is the ability to produce an increasing range of goods and at a lower price. Supply effects account for the increase in the world trade-GDP ratio, whereas competitiveness effects are a zero-sum game.

Policy relevance

The project has important policy implications. In traditional macro and trade theory where trade is a function of income and price competitiveness only, policies need to target real exchange rates and domestic income to rectify current account disequilibria. Conversely, if trade is predominantly driven by supply factors, completely different policies are called for depending on whether the source of the supply effect is the innovative activity, the range of products, or a combination of the two. Furthermore, it is important to know the effectiveness of R&D and patents in influencing trade, since policies affect R&D and patenting differently. Finally, as a by-product of the study various time-series indicators of Denmark's international competitiveness within technology, product design and trade marks will be presented. These indicators will be excellent for tracking the time-series path of technology competitiveness and product varieties over a longer time span and will shed some light on the recent findings of Økonomi and Erhvervsministeriet (2003) that Denmark is a closed economy relative to its size and its proximity to foreign markets.

The project is expected to be finalised by the end of August 2004.

Budget

I attach a separate sheet summarizing the budget for the project.

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