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# Does agricultural trade affect productivity? Evidence from Chilean farms

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ABSTRACT

This paper analyzes the relationship between trade and agricultural productivity in Chile, a middle-income country with a recent noticeable history of agricultural trade. This study uses an agricultural commodity trade exposure index in a cross-sectional analysis of more than 70,000 farms to study the relationship between the trade exposure of agricultural commodities and the yields reported by these farms in the 1997 Chilean agricultural census. In order to capture both import and export exposure we subdivide farms in two groups, according to the Chilean case: farms producing only importables such as grains (traditional crops), and farms producing both traditional crops and non-traditional agricultural commodities (products more related to export markets). We exclude from our analysis farms producing only non-traditional products because the census only reports yields for traditional crops. We employ a switching regression model to analyze the effects of trade exposure on traditional crop yields for both groups of farms. Results show that the trade exposure index is positively related to farm yields for both groups, but with a larger effect on farmers producing both traditional and non-traditional commodities. These results are important because they suggest that spillovers from both importables and exportables produce gains in the productivity of traditional crops.



## Introduction

The benefits and costs of globalization continue to be debated in the economic literature. Broadly speaking, two different views can be found in the literature: one holds that international trade is associated with productivity growth and improved economic performance; and the other is concerned about impacts on equity and local development (Carter et al., 1996; Estrades and Terra, 2012). This study contributes to this debate by analyzing whether, and to what extent, international trade (imports and exports) in agricultural commodities is related to agricultural productivity in Chile in the 1990s, a decade in which this country significantly increased its presence in international markets and underwent a transition from traditional to modern agriculture in many regions.

Several researchers have studied the impacts of trade liberalization on industrial and agricultural productivity in a wide range of countries. Using a cross-country sample (and generally relying on national productivity aggregates), Coe et al. (1997), Edwards (1998), and Badinger (2007) find that countries with fewer trade barriers experienced more rapid productivity growth. Using individual countries for analysis (generally relying on survey data at the firm level), Amiti and Konings (2007), Hay (2001), Ferreira and Rossi (2003), Jonsson and Subramanian (2001), Pavcnik (2002), and Tybout et al. (1991) also find a positive link between openness and productivity. The main channels giving rise to a positive trade/productivity relationship are generally hypothesized to be international spillovers as a result of trade (especially in R&D and best practices in production and supply chain management), gains in productivity due to product specialization as a result of trade, learning by doing through exporting, and pressures to raise productivity due to international competition.

However, some researchers argue that the response of productivity to trade liberalization is more ambiguous (Krishna and Mitra, 1998; Winters et al., 2004). On the import side, although firms may be stimulated to improve their productivity due to international competition, there may also be an exodus of assets (human and physical capital) from less competitive local firms. Under these circumstances productivity gains would only emerge if the irreversibility of investment in capital does not impede the exit of less productive plants (Pavcnik, 2002). On the export side, although firms are exposed to new markets through trade, local R&D and innovation might be reduced as firms utilize R&D carried out elsewhere.

In the literature on international trade in manufacturing, a consensus has emerged that only highly productive firms participate in the export market because of the presence of large fixed costs of exporting (Bernard et al., 2003; Melitz, 2003). Agriculture is different because trade in agricultural commodities is primarily

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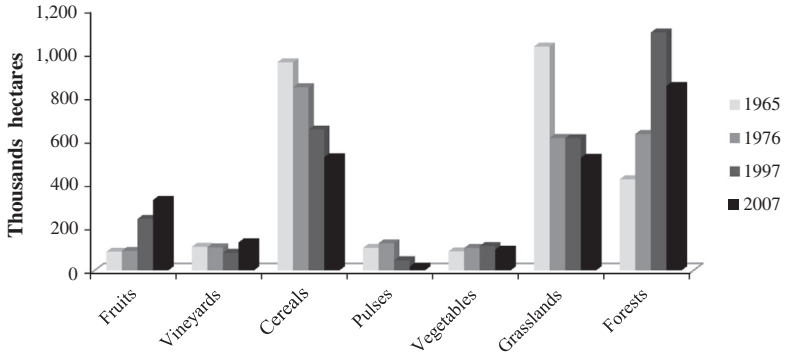


**Fig. 1.** Land use change in rural Chile, 1965–2007. *Source*: Portilla (2000) and Agricultural Census 2007 (http://www.censoagropecuario.cl).

carried out by specialized exporters or multinational enterprises such as Dole or Chiquita that generate export volume through contracts with large numbers of farms. Exporters sometimes enter into "resource provision" contracts with small farms in which they provide growers with specialized equipment, credit, technical assistance, and/or insurance (Reardon et al., 2009). Farms also often form cooperatives for input supply and domestic and international marketing. In this way, agricultural trade differs from manufacturing trade as firm (farm) heterogeneity does not necessarily exclude producers from the export market.

In agriculture, Gopinath and Kennedy (2000) find a positive link between trade and productivity for US states. In developing countries or regions, estimation of the agricultural trade/productivity relationship is more complicated (especially at the farm level) because of difficulties in obtaining accurate measures of agricultural inputs and outputs (Martin and Mitra, 2001). Chile is an interesting exception, where data are consistently collected by local authorities, the national agricultural censuses being a clear example of this effort.[1]

In order to use international trade as explanatory variable in economic models, researchers have employed different approaches and methods to measure the importance of trade to an economy (Harrison, 1994). One widely used and tested trade variable is the trade dependency ratio, which is defined as the share of imports plus exports in the total GDP of a region (Harrison, 1994; Frankel and Romer, 1999; Jonsson and Subramanian, 2001). We use a similar methodology to calculate the exposure of producers to agricultural trade at a disaggregated level, on a per commodity basis. Thus, this study constructs a product-specific trade exposure index that measures the share of imports plus exports in the total production of an agricultural commodity in a particular year. Farm-level analyses are then carried out using the trade exposure index in a cross-sectional study of more than 70,000 farms located in the middle part of Chile.

### *Chilean agriculture in an open economy*

Chile was one of the first countries in Latin America to shift from import substitution to an open-economy model following the import substitution policies that were popular in the region during the 1960s and 1970s. This change led to several structural adjustments in macroeconomic policies and institutions, and one of the priorities given by authorities was to create an export-oriented strategy supported by a market-friendly regulatory system. This transformation included a strengthening of property rights that helped to improve access to land ownership, a reduction in public services and expenditures, the privatization of input and product markets, a gradual elimination of price controls,[2] and the liberalization of trade (non-tariff barriers were eliminated and tariffs on most imports were rapidly reduced) (Foster and Valdes, 2006). However, it was not until 1984, with the reversal of Chile's currency appreciation policy, that agricultural commodities became more competitive on global markets.[3] In response the agricultural sector started to receive major private investment and generate more income. For rural areas this new system led to dramatic changes in agriculture, land use and property rights. Fig. 1 shows the trends in land use during recent decades by type of product.

As can be observed in Fig. 1, the area devoted to fruits has shown significant growth since 1976, which clearly demonstrates the export boom produced by trade liberalization (the same phenomenon explains the boom in forest plantations). Thus, fruits became a new export-oriented product in Chilean agriculture. Following Barham et al. (1992) we refer to fruits and other products that were traditionally cultivated for local consumption but that started being exported in recent decades as "non-traditional" crops. Fig. 1 indicates that the area devoted to cereals and grains has fallen considerably over time, a trend explained by growth in imports. For these products we use the term "traditional" crops, since they were not part of the export boom in Chile, but rather commodities with positive net imports.

## Methods

In order to examine the effect of international trade on agricultural productivity, a detailed farm-level evaluation is undertaken through a cross-sectional analysis of crop yields on Chilean farms.Crop yields are not a perfect proxy for productivity but they are a commonly available measure and they do reflect productivity. Consider a single-output production function of the form $Y = AF(\mathbf{X}, L)$, where $Y$ is output, $A$ is total factor productivity, $L$ is land, and $\mathbf{X}$ is a vector of other inputs. If there are constant returns to scale, then we can rewrite the production function as $y = Af(\mathbf{x})$, where $y = Y/L$ is yield, $x = \mathbf{X}/L$ is other inputs per unit of land, and $f(\mathbf{x}) = F(\mathbf{X}/L, 1)$. If the farm's choices with respect to other inputs per unit of land depend on fixed or quasi-fixed farm-specific characteristics (e.g. infrastructure, human capital, soils), denoted by $\mathbf{k}$, the output price ($p$), the level of total factor productivity, and input prices ($\mathbf{w}$), we can write:

$$y = Ah(\mathbf{k}, p^*, \mathbf{w}), \tag{1}$$

where $p^* = p \cdot A$ is the effective output price and $h(\mathbf{k}, p^*, \mathbf{w}) = f(\mathbf{x}(\mathbf{k}, p^*, \mathbf{w}))$. An increase in total factor productivity affects in-

[1] Agricultural censuses are carried out every 10 years in Chile and collect data for practically every single farm in the country.

[2] Except for wheat, oilseeds and milk.

[3] However, price bands remained for wheat and oilseeds, and were added for sugar.