based on inequality and producer price variation. Using the change in prices between 2007 and 2008 will provide a better explanation for the poverty challenges observed between 2007 and 2008; this preliminary research was undertaken with 2004 data bases both for the Gini coefficient and for prices due to the unavailability of current data. Incorporation of 2005 prices for 2004 Gini data is considered to be less deterministic. Interpretation of micro-level income and consumption distributions and their relation to farm-level incomes can provide deep insights into the effect of primary staples-price differentials. This analysis provides room for interpretation of the effect on rural households that are more dependent on agriculture as a sector.

The effects of pricing also need to be disaggregated. The interpretation of price policy effect on income distribution for agriculture by Ellis (1996) is still important for considerations regarding poverty reduction via changing income distribution. The rise in staple prices coupled with the decline in supply is expected to affect rural population and the distribution of income in many aspects. It is essential to keep in mind that farmers are also rural households demanding agricultural products, and rising prices are mostly beneficent to farmers producing a food surplus, but reduce the income of landless workers and farmers producing a food deficit. The beneficent farmers producing a food surplus are the ones who are open to the market. This indicates commercialization of farming is essential in order to gain from price increases.

References
India (Narayan 2005). India’s progress in reducing tariff and non-tariff barriers on agricultural products seems to be negligible. Trade barriers can take a variety of forms, including strict limits for contaminants and pest-infestation tolerances. The results can mean potential obstacles to almond shipments and reduced demand. There is no simple quantitative assessment of the impact of phytosanitary barriers facing U.S. almonds. Beghin and Bureau (2001) presented several methodologies for modeling and quantifying non-tariff barriers (NTBs) to trade in the agricultural and food sectors. Several researchers have used price-weak-model methodologies to measure the cost of phytosanitary barriers. The methodology compares prices in two countries in order to provide a tariff equivalent and assign a residual to the cost of compliance with phytosanitary barriers. The method has several important limitations. First, the price-weak methodology assumes that the two goods compared are perfect substitutes. Second, it is possible to quantify the effect of NTBs present, but it is difficult to identify the precise nature of those NTBs. Third, for large-scale studies it is difficult to reflect differences in the quality of imported goods. Fourth, the cost of the SPS barrier is measured as a residual and not as an explicit function of the structure of the phytosanitary protocols.

Campbell and Gossett (1994) used a price-weak model for a large number of sectors. However, they made quality adjustments that generated homogeneous products. Calvin and Krissoff (1990) addressed the cost of Japanese phytosanitary barriers for U.S. apples by assuming perfect substitution. They estimated the technical-barrier tariff-equivalent method by comparing CIF (cost, insurance, and freight) prices of U.S. apples in the foreign country with wholesale prices in the foreign market. This basic price-weak methodology was extended by Calvin, Krissoff, and Foster (2008) by measuring the costs and trade effects of phytosanitary protocols of Japanese apple imports from the U.S. They addressed the phytosanitary problem by developing separate costs for fire-blight and codling-moth protocols and introduce uncertainty as to the outcome of participation in the export program. Yue, Beghin, and Jensen (2006) also extended the basic price-weak model by generalizing to the situation where goods are not perfect substitutes. Their investigation was limited to the situation where all phytosanitary protocols are removed.

Methodology

This analysis addresses the problem of how to develop costs and trade effects for phytosanitary protocols of Indian almond imports from the U.S. by measuring the actual cost of the phytosanitary barriers (Beghin and Bureau 2001; Calvin, Krissoff, and Foster 2008; Peterson and Orden 2006). We first develop a simple export model that directly links the cost of phytosanitary barriers to the requirements of the protocols and incorporates the U.S. almond-grower’s decision about whether to export to the Indian market. The analysis of the problem introduces uncertainty in net revenue in exporting almonds to India which adds to the economic cost above the accounting cost. To simplify the analysis, a perfect substitution is assumed. For example, if imports are a poor substitute for domestic goods, the percentage increase in price of an import good due to an imposed technical barrier will increase less in the domestic market because there will be differences in the price elasticity of demand and supply between domestic and imported goods. The price-weak method will also reflect rents rather than technical barriers if exporters are able to price discriminate (Beghin and Bureau 2001). We describe the export-trade models which provide estimates of the expected net revenues for different outcomes of a grower’s decision to export or sell in the domestic market (Calvin, Krissoff, and Foster 2008). These estimates provide the basis for investigating the trade effects of eliminating phytosanitary barriers.

To estimate the change in Indian almond imports, the analysis uses a static, partial-equilibrium trade model developed by Calvin, Krissoff, and Foster (2008) (see Equations 7, 8, and 9). The approach in this study is to estimate and separate the economic costs of the Indian phytosanitary barriers in order to concentrate on the effect of removing the protocol.

Model Specification

In this model analysis, we assume 1) the U.S. almond producer faces two options: export almonds to the Indian market, or sell almonds in the domestic market and export to international markets other than India; 2) the almond producer is risk-neutral and expects positive net revenue from exporting to the Indian market; 3) the grower has two types of almonds: high and low quality. The high-quality almonds can be sold in both the domestic and the Indian market, while the low-quality can be sold only in the domestic market; and 4) the distribution of quality is exogenous.

The expected net revenue of producing one pound of almonds, $N$, for the risk-neutral producer who decides to sell only to the domestic market depends on the quality of almonds, and production costs:

\[ N = -\alpha P_a + (1 - \alpha)C_a - C, \]

where $\alpha$ is the probability of producing high-quality almonds, $P_a$ is the expected price of high-quality almonds per pound in the domestic market, $C_a$ is the production cost of almonds per pound.

The expected net revenue, $E$, for the U.S. almond producer who exports to India must consider the probability that almonds produced will be of high quality ($\alpha$), suitable for Indian export. Assume that an almond producer would receive an expected price of $P$ per pound if the almonds were sold to India. Let $q$ represent the expected proportion of high-quality almonds shipped to India. Therefore the expected net revenue ($E$) for export to India will be achieved with the probability of having high-quality almonds and the proportion of expected shipment quantities ($\alpha$ and $q$):

\[ E = \alpha \left[ (1 + \alpha)P_a - C_a + qC_a \right]. \]

where $C_a$ is the cost of phosphine fumigation.

If the almonds produced are of low quality, a producer cannot export to India and does not incur any expense for post-harvest treatment. The expected net revenue, $L$, will be:

\[ L = -(1 - \alpha)C_a. \]

Equations 2 and 3 will give the expected net revenue, $N$, for exporting almonds to the Indian market.

\[ N = \alpha(P_a - P) + \alpha P_a + (1 - \alpha)C_a - qC_a. \]

For the risk-neutral producer to be enticed to export to India, the expected net revenue $N$ must at least equal the expected net revenue of selling in the domestic market $N$ after correction for transaction costs. Therefore a producer would export to India if the expected export price equals or exceeds the expected price of high-quality almonds for the domestic market, including expected costs of phosphine fumigation and other accounting costs:

\[ N_E - N = \alpha(q(P_a - P) + qC_a) \geq 0, \]

where $t$ represents transaction costs including insurance, freight, and other administrative costs.

To deliver the high-quality almonds to the India domestic wholesale market, wholesalers require the minimum price $P_m$, which accommodates $P_a$ and Indian tariff-rate equivalent $v$ after correction for internal transaction costs:

\[ P_m = P_a + C_m + v(t + v). \]

The Indian Government receives the tariff revenue, handlers and other institutions receive $t$. If the non-tariff barriers were removed, the minimum price ($P_m'$) of high-quality almonds produced under U.S. standard almond industry practices would equal the Indian domestic wholesale price $P_m$.

\[ P_m = P_a + C_m + v(t + v), \]

where $t$ is the total Indian imports from all sources including the U.S., $D$ is India's consumer demand, and $S$ is India's domestic supply. If the government of India removes its almond phytosanitary protocols and accepts the U.S. standard free from pest, the change in Indian imports of almonds can be determined by differentiating equations 7 and 8 (Calvin, Krissoff, and Foster 2008):

\[ d \epsilon = \frac{P_m}{P_m'C_m} - \frac{C_m}{P_m} \]

where $d\epsilon$ is the change in almond imports, $C_m$ and $C_m'$ are the price elasticities with respect to demand.
India (Narayan 2005). India's progress in reducing tariff and non-tariff barriers on agricultural products seems to be negligible. Trade barriers can take a variety of forms, including strict limits for contaminants and post-irradiation tolerances. The results can mean potential obstacles to almond shipments and reduced demand. There is no simple quantitative assessment of the impact of phytosanitary barriers facing U.S. almonds. Beghin and Bureau (2001) presented several methodologies for modeling and quantifying non-tariff barriers (NTBs) to trade in the agricultural and food sectors. Several researchers have used price-zege-wedge model methodology to measure the cost of phytosanitary barriers. The methodology compares prices in two countries in order to provide a tariff equivalent and assigns a residual to the cost of compliance with phytosanitary barriers. The method has several important limitations. First, the price-zege-wedge methodology assumes that the two goods compared are perfect substitutes. Second, it is possible to quantify the effect of NTBs present but is difficult to identify the precise nature of those NTBs. Third, for large-scale studies it is difficult to reflect differences in the quality of imported goods. Fourth, the cost of the SPS barrier is measured as a residual and not as an explicit function of the structure of the phytosanitary protocols.

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Model Specification

In this model analysis, we assume 1) the U.S. almond producer faces two options: export almonds to the Indian market, or sell almonds in the domestic market and export to international markets other than India; 2) the almond producer is risk-neutral and expects positive net revenue from exporting to the Indian market; 3) the grower has two types of almonds: high and low quality. The high-quality almonds can be sold in both the domestic and the Indian market, while the low-quality can be sold only in the domestic market; and 4) the distribution of quality is exogenous.

The expected net revenue of producing one pound of almonds, $N_i$, for the risk-neutral producer who decides to sell only to the domestic market depends on domestic prices, the quality of almonds, and production costs:

$$N_i = aP_i + (1 - \alpha)P_i - C,$$

where $\alpha$ is the probability of producing high-quality almonds, $P_i$ is the expected price of high-quality almonds per pound in the domestic market, $P_i$ is the expected price per pound of low-quality almonds in the domestic market, and $C$ is the production cost of almonds per pound.

The expected net revenue, $E_i$, for the U.S. almond producer who exports to India must consider the probability that almonds produced will be of high quality ($\alpha$), suitable for Indian export. Assume that an almond producer would receive an expected price of $P_i$ per pound if the almonds were sold to India. Let $q$ represent the expected proportion of high-quality almonds shipped to India. Therefore the expected net revenue ($E_i$) to export to India will be achieved with the probability of having high-quality almonds and the proportion of expected shipment quantities ($a$ and $q$):

$$E_i = a[(qP_i + (1 - q)P_i) - (C + qC_H)],$$

where $C_H$ is the cost of phosphine fumigation.

If the almonds produced are of low quality, a producer cannot export to India and does not incur any expense for post-harvest treatment. The expected net revenue $L_i$ will be

$$L_i = (1 - \alpha)P_i - C.$$

Equations 2 and 3 will give the expected net revenue $N_i$ for exporting almonds to Indian market.

$$N_i = aP_i(1 - q) + aP_i(1 - \alpha) + (1 - \alpha)P_i(1 + q)C_H.$$

For the risk-neutral producer to be enticed to export to India, the expected net revenue $N_i$ must at least equal the expected net revenue of selling in the domestic market, $N_i$ after correction for transaction costs. Therefore a producer would export to India if the expected export price equals or exceeds the expected price of high-quality almonds for the domestic market, including expected costs of phosphine fumigation and other accounting costs:

$$(5) \quad N_i = N_i = \alpha qP_i(1 - q) + \alpha qP_i(1 - \alpha) + (1 - \alpha)P_i(1 + q)C_H \geq 0,$$

where $t$ represents transaction costs including insurance, freight, and other administrative costs.

To deliver the high-quality almonds to the Indian domestic wholesale market, wholesalers require the minimum price $P_K$, which accommodates $P_i$ and Indian tariff-rate equivalent $t$ after correction for internal transaction costs:

$$(6) \quad P_K = P_i + C_H + t(1 + v).$$

The Indian Government receives the tariff revenue, handlers and other entities receive $t$ if the non-tariff barriers were removed, the minimum price $P_K$ of high-quality almonds produced under U.S. standard almond industry practices would equal the Indian domestic wholesale price $P_K$ and trade would increase.

$$(7) \quad P_K = P_i + q(1 + v) + C_H + t(1 + v), \quad \text{then there is no trade (} T = 0 \text{)},$$

$$(8) \quad I = D(P_K) - S(F_K),$$

where $I$ is the total Indian imports from all sources including the U.S., $D$ is India's consumer demand, and $S$ is India's domestic supply. If the government of India removes its almond phytosanitary protocols and accepts the U.S. standard free from pest, the change in Indian imports of almonds can be determined by differentiating equations 7 and 8 (Calvini, Krissoff, and Foster 2008):
and supply, and \((1 + \gamma)AC_p\) is the change in the \(P_{lm}\) with changes in poyhsanitary protocols. When the poyhsanitary protocols are removed, the domestic wholesale price (\(P_{wh}\)) in India falls to the minimum price (\(P\)) plus the tariff. In this case consumers gain, producers lose, and the government continues to receive the tariff revenue.

**Data**

The average estimated cost of phosphine fumigation in the U.S. is $0.0027 per pound (Aegerter and Folwell 2001). The average annual CIF (cost, insurance, and freight), a proxy for the world almond price, was estimated from the invoice prices paid by the domestic importers to the U.S. exporters, exclusive of tariffs. The average value of the CIF at the port of India for almonds produced in the U.S. was calculated at $1.30 per pound. The Indian average wholesale market price (Delhi Market) is $2.19 per pound (ERS 2007a; FAS 2007). The applicable tariff value for almond in India is $0.67 per pound (Singh 2002–2007). The average tariff-rate of poyhsanitary protocol is 51.8, which is the residual when the price difference is corrected for tariff, handling, and transportation costs to domestic wholesale markets. Due to data limitations, the internal transaction costs to move almonds to domestic wholesale markets were assumed to be $0.22 per pound. For this study, price elasticities of demand and supply were calculated because estimated data from previous studies were not available (Table 1). They are generally inelastic except the price elasticity of demand for the marketing year of 2006/07.

The expected export shipment was based on the relationship of production and export quantities (Almond Board of California 2007a, 2007b). The average proportion of almond shipments (\(q\)) to India was estimated at 0.69. The quantity suitable for the export market (\(s\)) was based on inspection reports in the U.S. (Almond Board of California 2007a, 2007b).

**Empirical Results**

The almond trade is estimated in the absence of the poyhsanitary protocol, so that its cost is assumed to be zero. This empirical model looks at the effect of eliminating poyhsanitary protocols in the almond trade from marketing years 2003/04 through 2006/07. The technical barrier (TB) tariff-rate equivalent varies between years and the average over several years was estimated at 51.8 (Table 1). The TB tariff-rate equivalents were slightly higher in the earlier years. Table 1 shows the quantity and value of trade that would have increased if poyhsanitary protocols were eliminated. In this case, India could import almonds at the world price minus the poyhsanitary costs.

The range of annual and average quantities and values for the short-run effect of eliminating the poyhsanitary protocols are shown in Table 1. The average quantity of almonds imported would increase by 9,219 metric tons, with a value of $51.1 million. India’s consumption of almonds is almost entirely met through imports, with the U.S. typically enjoying an 80–85% share of the Indian almond import market (ERS 2007a, 2007b). As the increased trade is the estimate of the total Indian imports from all sources, we assume that the larger share of the increased imports would accrue to the U.S. producers.

The Indian price elasticities of demand and supply were inelastic for the first three marketing years but elastic for the fourth marketing year. As trade would be increased with the elimination of poyhsanitary protocols, almond consumers in India would gain at the expense of producers. While the increased imports would allow Indian producers to change their production plans in response to new economic conditions, the producer supply curve might shift when faced with new competition. As these changes take place, the Indian almond industry would have incentive to improve production technology and reduce production costs, which would increase producer surplus.

**Conclusion**

This study focuses on the trade effects of poyhsanitary protocols on the U.S. producers for the Indian market and U.S. almond sales to India. This analysis is critical for understanding the impact of poyhsanitary protocols on U.S. almond producers. The model provides explicit derivation of the cost in terms of poyhsanitary protocols. With the elimination of poyhsanitary protocols, almond trade increased. The U.S. is assumed to accrue a larger share of this increased import since it is the dominant exporter of the Indian market.

While measuring TB tariff-rate equivalents is a simple concept, the results are highly dependent on a number of assumptions, some of which may lead to overestimation or underestimation of TB tariff-rate equivalents and trade effects. We may have overestimated or underestimated the price differentials because almond quality differences were not reflected in this study. The model relies strongly on the assumption of perfect substitution. In addition, the price-weighed calculations did not reflect the actual internal transaction costs of moving U.S. almonds from the Indian port of entry to wholesale markets. This export model of the U.S.-India almond trade also can be used for estimating the trade effects of other poyhsanitary measures.

**Table 1. Short-Run Changes in India’s Almond Imports with the Elimination of Poyhsanitary Protocols.**

<table>
<thead>
<tr>
<th>Year</th>
<th>2003/04</th>
<th>2004/05</th>
<th>2005/06</th>
<th>2006/07</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB tariff-rate (%)</td>
<td>60.8</td>
<td>51.1</td>
<td>53.1</td>
<td>42.4</td>
<td>51.8</td>
</tr>
<tr>
<td>Demand</td>
<td>-0.075</td>
<td>0.135</td>
<td>-0.897</td>
<td>-1.383</td>
<td>-1.383</td>
</tr>
<tr>
<td>Supply</td>
<td>-0.041</td>
<td>0.268</td>
<td>0.268</td>
<td>-0.289</td>
<td>-0.289</td>
</tr>
<tr>
<td>Quantity (MT)</td>
<td>1,305</td>
<td>2,149</td>
<td>10,508</td>
<td>22,913</td>
<td>9,219</td>
</tr>
<tr>
<td>Value ($)</td>
<td>5,106,401</td>
<td>11,55,533</td>
<td>65,280,117</td>
<td>122,649,582</td>
<td>51,14,658</td>
</tr>
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**References**


and supply, and \((1 + \gamma)\Delta C_P\) is the change in the \(P_P\) with changes in phytosanitary protocols. When the phytosanitary protocols are removed, the domestic wholesale price \((P_P)\) in India falls to the minimum price \((P^\beta)\) plus the tariff. In this case consumers gain, producers lose, and the government continues to receive the tariff revenue.

**Data**

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The expected export shipment was based on the relationship of production and export quantities (Almond Board of California 2007a; 2007b). The average proportion of almond shipments \((a)\) to India was estimated at 0.69. The quantity suitable for the export market \((a)\) was based on inspections reports in the U.S. (Almond Board of California 2007a, 2007b). This quality parameter was estimated at 0.98.

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**References**


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Sectoral Growth Interdependencies and the Role of Agriculture in Poland and Romania

Y. Subramanian, S. Sahaian, L. Maynard, and M. Reed

The economic transition processes in the Central and Eastern European Countries were not as smooth as some expected. The length and the effects of transition varied among countries. Some policies worked well for one country but not for others. Many economists and policymakers wonder why some countries have experienced better success in the transition process than others. One way to solve the mystery is to understand the existence of inter-sectoral linkages among major economic sectors.

Once the complex linkages have been identified, the information can be used to determine the effects of various policies. The information also could be used to identify the optimal policy by measuring the effects of various policy alternatives on different sectors in the economy. Therefore determining the inter-sectoral relationship using appropriate econometric models should play a dominant role in the future growth literature.

This paper identifies the pattern of changes in sectoral composition that characterizes the economic dynamics of two transition countries (Poland and Romania) by applying a multi-sectoral endogenous growth framework. This study employs the Johansen procedure of cointegration analysis to identify the existence of long-run and dynamic short-run inter-sectoral linkages among different sectors in the economies. The study is significant because Poland and Romania are the two largest countries in the Central and Eastern European region, and recently became members of the expanded European Union. After 20 years of the liberalization process, the countries are at different levels of transition, so understanding the inter-sectoral linkages could shed important insights on the transition process, and such information should assist policymakers in identifying the optimal policies to continue further economic growth.

This study determines the linkages between the agricultural sector and the rest of the economies, investigates the existence of long-run growth relationships among different sectors in the economies, and determines the effects of the transition on agriculture and other sectors in the economy.

Conceptual Framework

Agriculture played an important role in the early growth theories. The manufacturing and service sectors could have been detrimental to growth in the agricultural sector as a result of changes in productivity and differences in the income elasticities. Economies in industrialized countries show that there is positive relationship between the price of services and income. This means that as the economy grows, the share of the service sector will increase and more of the labor force will be attracted to less-efficient sectors such as agriculture to service sectors. Such inter-sectoral relationships suggest that during the transition period different sectors in the economy may establish unique inter-sectoral linkages, and such linkages play an important role in future economic growth.

In analyzing the inter-sectoral linkages we focus on the question of whether the agriculture, manufacturing, service, and trade sectors evolve independently. In order to identify the inter-sectoral linkages, we constructed the following model:

\[ G_j = g(G_a, G_{ap}, G_{ap}, G_p) \]

where \( G_j \) represents the economic growth of sector \( j \) and subscripts \( A, M, S, \) and \( T \) denote the agricultural, manufacturing, service, and trade sectors, respectively. In each case, growth is measured using real prices with a 1990 basis. Annual data from 1989–2006 for Poland and Romania were collected from http://data.un.org.